National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

VOLUME I of III

SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT

Advanced Technology Solar Telescope
Haleakalā, Maui, Hawai‘i

May 2009

NOTE TO REVIEWER

The attached Supplemental Draft Environmental Impact Statement (SDEIS) for the proposed Advanced Technology Solar Telescope (ATST) was prepared in response to public and agency comments of the Draft Environmental Impact Statement (DEIS) published in September 2006. In a number of respects, the SDEIS is considerably revised from the DEIS; comments received warranted additional surveys and studies, which were completed after the DEIS was published. In particular, the following areas of the SDEIS that are listed below are substantially changed from the DEIS:

1. More details of the site selection process have been added to Section 2. The ATST Site Survey Working Group Final Report from October 2004, which further explains the scientific and technical details of the site selection process, has been appended to the SDEIS.
2. New and more detail was added to the SDEIS describing the proposed ATST Project's equipment and infrastructure and these additions are discussed in Section 2.
3. The Haleakalā National Park (HALE) road corridor and its resources were included in NSF's National Environmental Policy Act (NEPA) review of the proposed ATST Project in response to comments from the National Park Service (NPS) and others. Park resources along the road corridor are part of the affected environment in the SDEIS Section 3 and have been evaluated for both environmental and cultural/historic impacts in Section 4.
4. Additional arthropod sampling for the proposed ATST project was conducted in March 2007, and the additional data on arthropod occurrence is also discussed in Section 3.
5. A more definitive impact characterization vocabulary was employed to evaluate potential impacts on resources within HO and HALE in Section 4.
6. A Supplemental Cultural Impact Assessment to further identify cultural resources issues was conducted in May 2007, and the results are analyzed in Section 4.
7. The results of Endangered Species Act Section 7 consultations with the U.S. Fish & Wildlife Service (USFWS) are presented as part of the biological impact assessment for the proposed ATST Project. The Informal Consultation Document prepared by USFWS for NSF is appended to the SDEIS.
8. A commercial Haleakalā visitor survey was completed in November 2007, and the opinions obtained from that survey and from NPS visitor surveys have been applied to the assessment of potential impacts to the HALE visitor experience in Section 4.
9. A Federal Highway Administration Report for the HALE Park road, entitled, "Pavement/Drainage Condition Investigation and Recommendations" was completed in March 2009 and the results of that study were used to help determine and analyze potential impacts to the resources along the Park road corridor that would result from the proposed ATST Project.
10. Individual and agency comments and responses from four additional formal Section 106 meetings and informal consultations with the Native Hawaiian community and other members of the public since 2006 have been added to the SDEIS.
11. Section 4 has been revised to reflect new terminology used to evaluate the impacts of the "action" and "no-action alternative". Specifically, the document no longer classifies impacts as "significant" or "insignificant"; rather, impacts are evaluated as to whether they are "negligible", "minimal", "moderate", "major", "short-term" and/or "long-term".

A 45-day public comment period on the SDEIS will be held from May 8, 2009 through June 22, 2009. Additional NEPA hearings will be held on June 3 and 4, 2009; and consultation meetings under Section 106 of the National Historic Preservation Act (NHPA) will be held on June 8 through 10, 2009.

Responses to comments on both the DEIS and the SDEIS will be included in the final EIS.

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SUPPLEMENTAL DRAFT
ENVIRONMENTAL IMPACT STATEMENT

Advanced Technology Solar Telescope

This Supplemental Draft Environmental Impact Statement addresses the proposed development of the Advanced Technology Solar Telescope ("proposed ATST Project") within the 18.166-acre University of Hawai‘i Institute for Astronomy Haleakalā High Altitude Observatory site at the summit of Haleakalā, Maui, Hawai‘i. The proposed ATST Project is a project of the National Solar Observatory that is being considered for funding by the National Science Foundation.

This Supplemental Draft Environmental Impact Statement is also being prepared to evaluate the potential environmental effects associated with issuing a National Park Service Special Use Permit, pursuant to 36 Code of Federal Regulations §5.6 to operate commercial vehicles on the Haleakalā National Park Road during the construction and operation of the proposed ATST Project.

This Supplemental Draft Environmental Impact Statement is a joint Federal and State of Hawai‘i document prepared in compliance with the National Environmental Policy Act, Council on Environmental Quality NEPA Implementing Regulations, the National Science Foundation's NEPA-implementing regulations, the National Park Service Director's Order 12 Conservation Planning, Environmental Impact Analysis and Decision Making, and the State of Hawai‘i Chapter 343 Hawai‘i Revised Statutes, and Title 11, Chapter 200 Hawai‘i Administrative Rules, and Hawai‘i Administrative Rules 13-5-31.

As the responsible official of the applicant agency, I hereby acknowledge that this Supplemental Draft Environmental Impact Statement for the proposed ATST Project and all ancillary documents were prepared under my direction or supervision and the information submitted, to the best of my knowledge, fully addresses document content requirements.

Craig B Foltz

May 1, 2009

Dr. Craig Foltz, Ph.D.
ATST Program Director
Acting Director, Division of Astronomical Sciences
National Science Foundation,
4201 Wilson Boulevard, Room 1045
Arlington, VA 22230
Telephone: 703-292-4909, Fax: 703-292-9034

Date

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ENVIRONMENTAL IMPACT STATEMENT ORGANIZATION

VOLUME I - ENVIRONMENTAL IMPACT STATEMENT

EXECUTIVE SUMMARY: Briefly describes the proposed ATST Project, environmental and socioeconomic consequences, and mitigation measures.

SECTION 1.0: INTRODUCTION
Describes the project description, project location, and compliance with Federal, State and County agencies.

SECTION 2.0: PROJECT DESCRIPTION AND ALTERNATIVES
Describes the proposed ATST Project at both the primary and alternative sites and the No-action Alternative.

SECTION 3.0: DESCRIPTION OF AFFECTED ENVIRONMENT
Describes the existing environment at and near the Haleakalā High Altitude Observatories site.

SECTION 4.0: SUMMARY OF ENVIRONMENTAL CONSEQUENCES, CUMULATIVE EFFECTS, AND MITIGATION
Summarizes the environmental consequences of the proposed ATST Project based on the findings of Section 3.0, the cumulative environmental effects, and mitigation. The summaries take into consideration past, present, and reasonably foreseeable future actions within or near the proposed ATST Project.

SECTION 5.0: NOTIFICATION, PUBLIC INVOLVEMENT, AND CONSULTED PARTIES
Describes details of all notifications, public involvement, and consulted parties for the proposed ATST Project conducted during the pre-assessment period, public scoping meetings, Federal, State and County agency meetings, and meetings with local and Native Hawaiian organizations and other interested individuals. Section 106 notification, public involvement, and consultation are also described in this section. Copies of public comments during the scoping process prior to publication of the DEIS can be found in Vol. III, Appendix A-Pre-DEIS Public Comments. Formal public meetings were recorded, and to accommodate requests from the public, can be found in Vol. III, Appendices C through D-Meeting Transcripts.

SECTION 6.0: UNRESOLVED ISSUES
Discusses three unresolved issues that are in a significant stage of development.

SECTION 7.0 REFERENCES
Lists all references used in this Environmental Impact Statement.

SECTION 8.0: ACRONYMS, ABBREVIATIONS AND TERMINOLOGY
Lists the definition of acronyms, abbreviations, and terminology used throughout this Environmental Impact Statement.

SECTION 9.0: LIST OF PREPARERS
Lists all persons, firms, or agencies who participated in preparing this Environmental Impact Statement.

ENVIRONMENTAL IMPACT STATEMENT ORGANIZATION

VOLUME II - SURVEY AND ASSESSMENT REPORTS

Volume II contains survey and assessment reports that were conducted in the surrounding environment at and near HO, which provide detailed and/or focused information relative to key environmental effects and topics addressed in Volume I and other relevant documentation used in producing this EIS.

Appendix A: Archaeological Field Inspection, January 2006

Appendix B: Archaeological Recovery Plans:
- (1) Data Recovery Plan for Site 50-50-11-5443 (Reber Circle), December 2005
- (2) "Science City" Preservation Plan, March 2006

Appendix C:
- (1) Updated Arthropod Inventory and Assessment, December 2005
- (2) Supplemental Arthropod Sampling, March 2007

Appendix D: ATST Hazardous Materials and Hazardous Waste Management Program, April 2006

Appendix E: Botanical Survey, December 2005

Appendix F:
- (1) Cultural and Historical Compilation of Resources Evaluation and Traditional Practices Assessment, January 2006
- (2) Supplemental Cultural Impact Assessment, May 2007

Appendix G: Geological Setting at Primary and Alternative Advanced Technology Solar Telescope Sites, Haleakalā High Altitude Observatories, November 2005

Appendix H: Movement of Hawaiian Petrels Near USAF Facilities Near the Summit of Haleakalā, Maui Island, Fall 2004 and Spring 2005

Appendix I: Petrel Monitoring Plan, 2006

Appendix J: Proposed ATST Project and Alternatives Supplementary Documentation:
- (1) Sites Evaluated for Science Criteria
- (2) Supplemental Discussion of the Constraints of Solar Science Development
- (3) Haleakalā vs. La Palma Dust Comparison
- (4) Supplemental Description of ATST Equipment and Infrastructure

Appendix K: Soils Investigation Report, May 2005

Appendix L: Stormwater Master Plan for Haleakalā High Altitude Observatories, March 2006

Appendix M: U. S. Fish and Wildlife Service, Section 7, Informal Consultation Document, March 2007

Appendix N: Haleakalā Visitor Survey, November 2007

Appendix O: ATST Site Survey Working Group Final Report, October 6, 2004

Appendix P: Federal Highway Administration, Haleakalā Highway, Haleakalā National Park, Pavement Drainage Condition Investigation, Distress Identification and Recommendations Report #HALA 3-2-2009. Rev. April 2009.

ENVIRONMENTAL IMPACT STATEMENT ORGANIZATION

VOLUME III – Pre-DEIS PUBLIC COMMENTS AND MEETING TRANSCRIPTS

Volume III contains public comments received during the scoping process that were also included in the Draft Environmental Impact Statement published September 2006. Comments and responses to the Draft EIS and Supplemental Draft EIS will be included in the final EIS.

Also in Volume III are meeting transcripts from the Public Scoping Meetings, Section 106 Formal Consultation Meetings, and the DEIS Public Comment Meetings. Meeting Transcripts were requested by the public at various meetings and from comments received during the EIS process.

The Appendices in Volume III is listed below:

Appendix A: Pre-DEIS Public Comments

Appendix B: Transcripts – Public Scoping Meetings
(1) Cameron Center, July 12, 2005
(2) Kula Community Center, July 13, 2005
(3) Pukalani Community Center, July 14, 2005

Appendix C: Transcripts – Section 106 Formal Consultations
(1) Pukalani Community Center, March 28, 2006
(2) Paukūkalo Community Center, May 1, 2006
(3) University of Hawaiʻi Institute for Astronomy, June 16, 2008
(4) University of Hawaiʻi Institute for Astronomy, June 17, 2008
(5) University of Hawaiʻi Institute for Astronomy, August 27, 2008**,** Afternoon Session
(6) University of Hawaiʻi Institute for Astronomy, August 27, 2008**,** Evening Session

Appendix D: Transcripts – DEIS Public Comment Meetings
(1) Cameron Center, September 27, 2006
(2) Pukalani Community Center, September 28, 2006
(3) Kula Community Center, September 29, 2006

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EXECUTIVE SUMMARY

ES-1.0 INTRODUCTION

The proposed ATST Project is an applicant action by the National Science Foundation (NSF) for the development of the Advanced Technology Solar Telescope (ATST) within the 18.166-acre University of Hawaiʻi (UH) Institute for Astronomy (IfA) Haleakalā High Altitude Observatories (HO) site at the summit of Haleakalā, County of Maui, Hawaiʻi.

The primary goals of the proposed ATST Project are to understand solar magnetic activities and variability, both because the Sun serves as a key resource for understanding the underpinnings of astrophysics and our understanding of magnetic plasmas, and because activity on the Sun drives space weather. Space weather creates hazards for communications to and from satellites, as well as for astronauts and air travelers. Furthermore, and perhaps most importantly, the variability in solar energy induced by solar activity affects the Earth's climate.

This Supplemental Draft Environmental Impact Statement (SDEIS) is a joint Federal and State of Hawaiʻi document prepared in compliance with Federal National Environmental Policy Act (NEPA) regulations and guidelines. The Federal NEPA process is separate and distinct from the State of Hawaiʻi environmental process to be completed by the University of Hawaiʻi (UH) in accordance with applicable State of Hawaiʻi statutes and regulations. No final action will be taken by the NSF pertinent to funding the on-site construction, installation, and operation of the proposed ATST Project until the decision-making process under NEPA has been completed.

This SDEIS is also being prepared to evaluate the potential environmental effects associated with the issuance of a Special Use Permit (SUP) by the National Park Service (NPS) pursuant to 36 Code of Federal Regulations (CFR) § 5.6 to operate commercial vehicles on the Haleakalā National Park (HALE) road during the construction and operation phases of the proposed ATST Project. In 2006, NSF issued a Draft Environmental Impact Statement (DEIS) that did not include an analysis of effects to the Park road corridor. It is for this reason and because additional studies were prepared in response to comments on the DEIS that NSF decided to prepare this SDEIS.

ES-1.1 Proposed ATST Project Location

The proposed ATST Project would be located on State of Hawaiʻi land within the Conservation District on Puʻu (hill) Kolekole, near the summit of Haleakalā. Puʻu Kolekole is about 0.3 mile from the highest point, Puʻu Ulaʻula (Red Hill) Overlook, which is in HALE. At an elevation of 10,023 feet, Haleakalā is one of the prime sites in the world for astronomical and space surveillance activities. The proposed ATST Project would be located within the 18.166-acre HO site at the summit of Haleakalā, County of Maui, Hawaiʻi, on approximately 0.86 acres of undeveloped land. The 0.86 acres includes the leveling area, buildings, and paved pads. The preferred site is east of the existing C. E. Kenneth Mees Solar Observatory (MSO) and will be referred to in the SDEIS as the Mees site. The alternative site would be a currently unutilized site within HO known as Reber Circle and will be referred to in the SDEIS as the Reber Circle site. A No-Action Alternative has also been considered. These alternatives are further defined in Section 2.0-Proposed ATST Project and Alternatives.

ES-1.2 Land Ownership

In 1961, an Executive Order (EO) by Governor Quinn set aside 18.166 acres of land on the summit of Haleakalā in a place known as Kolekole to be under the control and management of the UH Institute for Astronomy (IfA) for scientific purposes. The site is known as HO and it is the only such property on Haleakalā specifically designated for such purposes. UH is the recorded fee owner of the parcel identified as Tax Map Key (TMK) (2) 2-2-07-008.

The Park road corridor is owned and managed by HALE, a unit of the National Park System. The Park road corridor — specifically, a 50-foot corridor along the Park road measured from the mid-point of the road extending out 25 feet on each side — includes the roadway itself and the historic bridge and multiple culverts. The Park road corridor is included because a SUP is required by HALE to operate commercial vehicles within the Park.

ES-1.3 Identification of Agencies Proposing the Action

NSF serves as the lead Federal agency for review under NEPA. NSF would fund the construction of the proposed ATST Project if it were to be approved. The NSF is an independent Federal agency, which was created by Congress in 1950. The NSF's Statutory Mission is "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense."

The Association of Universities for Research in Astronomy (AURA) is a consortium of universities, and educational and other non-profit institutions that operates world-class astronomical observatories, termed "centers". Its members are comprised of 33 U.S. institutions and 7 international affiliates. AURA acts on behalf of the science communities that are served by its centers and as trustees and advocates for the centers' missions.

AURA operates the National Solar Observatory (NSO) under a cooperative agreement with NSF. The proposed ATST Project is a proposal of the NSO that is being considered for funding by the NSF. The IfA is one of several partners collaborating on the proposed ATST Project and, therefore, it is cooperating in the Federal NEPA process, as well as leading the parallel State of Hawaiʻi EIS process.

The accepting authority for the proposed ATST Project would be the NSF, which is also the agency primarily responsible for the proposed ATST Project. It assumes responsibility for preparing the EIS in accordance with NEPA, the Council on Environmental Quality (CEQ) NEPA-Implementing Regulations (40 CFR Parts 1500-1508), and the NSF's NEPA-implementing regulations (45 CFR Part 640). While the NSF is the agency primarily responsible for the proposed ATST Project and assumes responsibility for the EIS in accordance with (Hawaiʻi Administrative Rules) HAR Title 11 Chapter 200-4(a), the accepting authority for the proposed ATST Project, pursuant to the relevant State of Hawai'i authorities, would be UH IfA.

ES-1.4 Project Summary

Need for the Project. Since George Ellery Hale's 1908 discovery that sunspots coincide with strong magnetic fields, astronomers have become increasingly aware of the Sun's magnetic field as a complex and subtle system. The familiar 11-year sunspot cycle is just the most obvious of its many manifestations. Recent advances in ground-based instrumentation have shown that sunspots and other large-scale phenomena that affect life on Earth are intricately related to small-scale magnetic processes whose inner workings happen on scales that are too small to be observed with current ground- and space-based telescopes.

At the same time, using advances in computer science and technology, scientists have developed intriguing new theories about those small-scale processes, but they lack empirical observational data to verify the validity of their models. Scientists are positioned for a new era of discovery about the Sun and how it affects life on Earth, how distant stars work, and how to possibly control plasmas in laboratories.

To meet this challenge, a team led by the NSO is developing the ATST as the world's largest optical solar telescope. An unobstructed 4-meter (13-foot) diameter primary mirror combined with the latest in computer and optical technologies would give ATST sharper views of solar activities than any telescope on the ground, in space, or in the planning stages. After a careful two-year study that began with more than 70 possible worldwide observatory sites, the NSO team, in collaboration with representatives from the solar physics scientific community, demonstrated that Haleakalā is the only site satisfying the ATST science goals.

A primary goal of the proposed ATST Project would be to help scientists understand the solar magnetic activities and variability that drive space weather and the hazards it creates for astronauts and air travelers, and for communications to and from satellites.

From a site on Haleakalā, the proposed ATST Project would have unprecedented sensitivity for measuring the Sun's outer atmosphere and it would be able to see the finest details on the disk of the Sun. The proposed ATST Project would be unique in its ability to resolve fundamental length and time scales of the basic physical processes governing variations in solar activity. Just as fundamental problems in atomic, nuclear, and gravitational physics were revealed through earlier studies in solar physics, the proposed ATST Project would have a broad effect on astronomy and astrophysics, plasma physics for potential future power systems, solar-terrestrial relations and climatology and ultimately, prediction of solar activity.

Another primary objective for the proposed ATST Project would be to resolve fundamental length and time scales of the basic physical processes governing variations in solar activity associated with climate changes on Earth.

To meet this challenge, a team led by the NSO is developing the proposed ATST Project as the world's largest optical solar telescope. An unobstructed 4-meter (13-foot) diameter primary mirror combined with the latest in computer and optical technologies would give the proposed ATST Project sharper views of solar activities than any telescope on the ground, in space, or in the planning stages.

Purpose of the Proposed ATST Project. At the onset of the 21st century, fundamental physical processes that govern the behavior of the Sun and many other astrophysical objectives remain elusive. The Sun provides the laboratory and unique opportunity to probe cosmic magnetic fields with unprecedented resolution in space and time and to test theories of their generation, structure, and dynamics. The field of solar physics has developed rapidly during the last decade, to a point where sophisticated theories and models await critical observational tests. However, existing instrumental capabilities no longer are sufficient to meet this challenge. Recent incorporation of practical adaptive optics systems in astronomical telescopes, coupled with other advances in unique and powerful instrumental techniques, now promises a major advance in solar observing capabilities.

To achieve observational progress in solar astronomy, a solar telescope would have to have the capability to obtain the sharpest visual image possible using a telescope with optics sufficiently refined to produce that level of detail. Secondly, it would also need the capability of collecting as much "useful" solar radiation as possible and delivering it to the telescope's instruments. Third, it would need to be capable of observing the widest spectrum of solar light to observe atmospheric properties from the various structures on the Sun. Neither the current MSO facility on Haleakalā nor any other current or planned ground-based or space-based solar telescope in the world has these capabilities.

There are three primary objectives for the ATST telescope that must be met:

Objective 1: The ability to efficiently observe the solar atmosphere at or near the diffraction limit of the telescope (in other words, when turbulence in the atmosphere is minimal);

Objective 2: The ability to efficiently observe the faintest outer layers of the solar atmosphere, the corona, adjacent to the very bright photosphere; and,

Objective 3: The ability to observe the solar atmosphere at wavelengths from visible through mid-infrared wavelengths.

The ability to address these scientific objectives defines NSF's purpose and need for the proposed ATST Project. In considering the potential funding of the proposed ATST Project, NSF has relied on the opinions of a large number of experts in the fields of astronomy, solar and space physics, as well as experienced telescope engineers and builders. In their consideration of the proposed ATST Project, these experts scrutinized the ability of the ATST design to meet the three primary science objectives in the context of an assumed satisfactory site.

ATST Education and Public Outreach. The ATST consortium provides education and outreach (E&O) on several fronts that leverage and expand existing programs within the partnering groups and create unique opportunities offered by the ATST during both its development and operation. An Educational and Outreach Officer has been appointed to coordinate the efforts of the ATST partnering organizations.

A goal is to establish several graduate student positions at the partnering universities, including UH. Thesis topics would encompass a range of innovative engineering and solar science applications relating to the proposed ATST Project. Well-established, ongoing E&O activities complement the goals of the proposed ATST Project.

Some preliminary plans for the E&O Program include internships, post-doctoral fellowships, and student programs. NSO would develop a program for internships with college students from Hawaiʻi, the NSO would provide opportunities for Post-doctoral candidates to participate in analysis, modeling, simulation and instrumentation efforts related to the science and engineering objectives of the proposed ATST Project and develop educational modules designed to take advantage of the new observations and insights that would be derived from science operation of the proposed ATST Project.

The proposed ATST Project would encompass materials and in-service training for a range of hands-on and computer activities in conventional school and teacher in-service settings or as informal science education offerings at science camps, museum lectures, and other venues.

ES-1.5 Current Environmental Setting for Proposed ATST Project

HO is wholly contained within Puʻu Kolekole. Geologic studies describe the HO property as an asymmetric volcanic cone whose slopes are steeper at the western and northwestern sides, while the eastern and southern slopes are gentler. Much of the northern slope — most of which is occupied by the Air Force Maui Space Surveillance Complex (MSSC) — is flattened and has been disturbed. The central crater of Kolekole is described as a flattened bowl of ponded ankaramite lava, spatter and pyroclastic ejecta.

In addition to the facilities located at HO, two ahu (altar or shrine) are also located within the HO property. A Native Hawaiian master dry-stack mason constructed an east- and a west-facing ahu in 2005, signifying sacred ceremonial sites. The east ahu was dedicated as Pā ele Kū Ai I Ka Moku and the west ahu was dedicated as Hinalaʻanui. Native Hawaiians practicing cultural traditions are welcome to utilize the existing ahu sites.

In 1961, the 18.166 acres of land were designated and assigned to the IfA for scientific purposes, under EO 1987 by then Governor Quinn. UH IfA is responsible for managing and developing the land. Other agencies established adjacent facilities through EO during the same period. The history of scientific events begins in the spring of 1951 when Grote Reber conducted radio astronomy experiments at Haleakalā and extends to the most recent notable milestone; dedication of the University of Hawaii's newest telescope, the PS-1, in July 2006.

Existing uses of HO include astronomical research facilities for advanced studies of astronomy and atmospheric sciences. There are eight facilities with different primary functions at HO. These range from space surveillance to asteroid hunting to amateur astronomy.

Within the broader Maui region, there are science programs and activities sponsored by various local, State, and Federal organizations that include opportunities to conduct research in astronomy, engineering, adaptive optics, computer sciences, geology, meteorology, oceanography, physics, social sciences, and the life sciences, as well as participate in internships, work with a mentor, conduct astronomical measurements, and attend scientific talks.

Reference to Related Existing or Planned Projects in Region. Currently there are no existing projects at HO or within the areas directly adjacent to HO. Two recently completed existing projects were: 1) the U.S. Army Corps of Engineers construction of an addition to the Advanced Electro-Optical System (AEOS) structure that houses a Mirror Coating Facility (MCF) for the AEOS primary mirror. This project was completed in 2007 on behalf of the Air Force Research Laboratory (AFRL); and, 2) the Maui Television Broadcast site on Pu'u Kolekole, located near the entrance to HO, was decommissioned after the relocation of broadcast towers to the ʻUlupalakua Ranch site. The site was cleaned up of structures and returned to a natural state. This project was completed in February 2009. No public or private projects are known to be planned for the region in which the proposed ATST Project would be constructed. The existing State Land Use District for the proposed ATST Project is designated as Conservation District, General Subzone. The 18.166 acres of HO land are within the Conservation District lands; therefore, no private projects are planned in the existing areas that constitute the General Subzone of conservation lands around the summit of Haleakalā.

ES-1.6 Compliance with Government Agencies

This EIS is prepared pursuant to the NEPA of 1969, as amended, Title 42, United States Code §4321 *et seq*., the implementing regulations of the CEQ (40 CFR Parts 1500-1508). It is also prepared pursuant to the State of Hawaiʻi Chapter 343 HRS, State Environmental Review Law, and Title 11, Chapter 200 HAR, EIS Rules, in that the proposed ATST Project may potentially meet one or more of the significance criteria for effects on Conservation District Land. HAR 13-5-31(1) (Permit and Applications) requires an EIS to accompany the required Conservation District Use Application (CDUA). A copy of the EIS would be submitted with the CDUA. A copy of the IfA's Long Range Development Plan (LRDP) will also be submitted with the CDUA per the request made by the State of Hawaiʻi Department of Land and Natural Resources (DLNR) Office of Conservation and Coastal Lands (OCCL).

The proposed ATST Project would require a number of State and Federal permits and approvals prior to construction, if approved. Most of those permit and approval applications that historically have needed iterative consultations, agency review, or formal concurrence, have already been initiated. However, the Conservation District Use Permit (CDUP) application requires an appended Final EIS. In addition, a SUP from HALE to operate commercial vehicles on the Park road during construction and operation of the proposed ATST Project is required.

ES-1.7 State of Hawaiʻi Land Use Conformity

The existing State Land Use District for the proposed ATST Project is designated as Conservation District, General Subzone. The objective of the General Subzone is to designate open space where specific conservation uses may not be defined, but where urban use would be premature. During the past few years, the OCCL within the DLNR has administered CDUPs for numerous potential uses, among them astronomical facilities on Haleakalā. The proposed ATST Project would be located in the area of the Conservation District that has been set aside for astronomical research.

The Coastal Zone Management Area (CZMA) as defined in Chapter 205A, HRS, includes all the lands of the State. The subject parcel is not within the Special Management Area, pursuant to the County of Maui Planning Department map entitled Island of Maui Showing Special Management Area.

The Hawaiʻi State Plan, Chapter 226, HRS establishes a set of goals, objectives and policies that serve as long-range guidelines for the growth and development of the State. The Plan is divided into three parts, only one of which is appropriate to the proposed ATST Project: Part I-Overall Theme, Goals, Objectives and Policies. The sections of the Hawaiʻi State Plan Part I directly applicable to the proposed ATST Project are listed below and are discussed in Sections 2.0, 3.0, and 4.0 of this SDEIS.

State of Hawaiʻi law requires that the government give systematic consideration to the environmental, social, and economic consequences of proposed development projects prior to allowing construction to begin. The law also assures the public the right to participate in planning projects that may affect their community. As mentioned above, the preparation of environmental documentation for the proposed ATST Project jointly serves both the Federal and State processes. The NSF will provide documents for review and comment through a public comment period and public hearing. In addition, publication through the State Office of Environmental Quality Control's (OEQC) "The Environmental Notice" bulletin of an acceptance or non-acceptance determination by the Accepting Authority would delineate a 60-day legal challenge period for the proposed ATST Project.

The DLNR is an integral part of the environmental review process for the proposed ATST Project. Since HO is on Conservation District lands, the proposed ATST Project will be subject to a permit for non-conforming use of conservation lands. The permit application process will require extensive environmental, biological**,** cultural, and historic review by various State agencies, followed by public hearings and the Board of Land and Natural Resources (BLNR) approval.

ES-1.8 County of Maui Community Plan

The Makawao-Pukalani-Kula Community Plan includes a policy that states: "Encourage Federal, State and County cooperation in the preparation of a comprehensive Haleakalā summit master plan to promote orderly and sensitive development which is compatible with the natural and native Hawaiian cultural environment of Haleakalā National Park."

The proposed ATST Project conforms to the IfA's LRDP for HO, which is the UH contribution to any summit master plan. There are more than twenty-five separate agencies with interests and facilities in the summit area of Haleakalā. IfA has taken the lead at the summit in preparing a LRDP for the coming decade, and the proposed ATST Project was an integral part of the IfA plan. The LRDP has specific protocols and measures that ensure orderly and sensitive development that is designed to be compatible with the intended land-use and purposes for the 18.166 acres of land under the auspices of IfA.

ES-1.9 Agency Notification and Collaboration

The NSF and its collaborating agencies began the process of informal consultation with Federal and State agencies in May 2005, along with State of Hawaiʻi elected officials, island community groups, and relevant commercial interests. Details about agency collaboration and consultation throughout the EIS process can be found in Section 5.0-Notification, Public Involvement, and Consulted Parties. Numerous formal and informal consultations took place with these entities and groups to ensure full disclosure and information.

ES-2.0 PROPOSED ATST PROJECT AND ALTERNATIVES

A detailed description of the proposed ATST Project and Alternatives is found in Section 2.0.

ES-2.1 Introduction

The proposed ATST Project includes construction, installation, and operation at HO on the island of Maui, Hawaiʻi. The proposed ATST Project also involves obtaining a SUP from HALE to operate commercial vehicles on the Park road. This section describes the preferred site and one alternative site, as well as a No-Action Alternative. The proposed ATST Project would construct the ATST at one of two currently unutilized sites within HO. The preferred site is near the existing MSO facility and is referred to in the EIS as the Mees site**.** The alternative site would be at an identified and currently unutilized site within the HO boundary large enough to accommodate the telescope. This site is the previous location of a radio astronomy experiment, referred to at HO as Reber Circle and will be referred to in the EIS as the Reber Circle site.

This section describes the development of the alternatives and process for identifying scientifically viable sites, construction activities and schedule, the final form the proposed ATST and its supporting facilities would take, and ATST operations. Furthermore, this section includes a discussion of sites considered but not carried forward for full analysis and evaluation, due to their failure to meet the purpose and need of the proposed ATST Project.

ES-2.2 Site Selection

The existing ground-based solar telescope facilities operated by the NSF were built over a generation ago. The proposed ATST Project represents an opportunity to implement a unique astronomical resource that is expected to be useful and innovative for several decades to come. As such, the selection of the site is critically important. Thus, the site selection process was carried out with substantial solar research community oversight and input. A detailed chronology is presented for site selection.

ES-2.3 Alternatives Eliminated from Further Consideration

In order to determine which sites would meet the purpose and need of the proposed ATST Project, the Site Survey Working Group was formed. A detailed discussion of the site selection process by this group is presented, including the objective criteria and analyses that ultimately reduced the 72 candidate sites to 6 then 3 and finally to Haleakalā as the only one that would meet the scientific objects for the proposed ATST Project

ES-2.4 Description of the Proposed ATST Project at the Mees Site

The proposed ATST Project would construct and operate a reflecting Gregorian-type telescope that would deliver images of the sun and the solar corona to instrument stations mounted on the telescope and on a rotating platform located below the telescope. The facilities would include:

1. The observatory facility, which includes the telescope, its pier, and the rotating instrument platform,
2. The telescope enclosure,
3. The Support and Operations Building (S&O Building) adjacent to the observatory,
4. A utilities building attached to the S&O Building by an underground utility chase,
5. Parking for the facility as a whole; and,
6. Modifications to the existing MSO facility.

The entire facility would include approximately 43,980 square feet of new building space, within a site footprint of 0.74 acres.

ES-2.4.1 Features of Infrastructural Design

This section discusses the design features of the proposed infrastructure. Supplemental information is provided in Vol. II, Appendix J(4)-Supplemental Description of ATST Equipment and Infrastructure.

The distance between the primary mirror (M1) and the secondary mirror (M2) together with the M1 diameter and off-axis mounting, effectively establishes the swing radius and the required dimensional clearance of the telescope (in altitude and azimuth) and the size of the enclosure required to protect it. Following the identification of the Haleakalā site and the consideration of the typical variation of turbulence with height above the ground, the proposed height of the telescope — defined as the distance from ground level to the rotational center of the telescope — was established to be 28 meters (92 feet).

The S&O Building would be a multi-story structure attached to the lower enclosure, which accommodates observing-related activities that necessitate direct adjacency to the telescope. It would contain a large docking bay with a 20-ton crane, equipment and equipment storage, telescope maintenance facilities, offices and workrooms, laboratories, control room for the telescope, and the large-scale platform lift (elevator) needed to move telescope parts between levels. The Utility Building would be a rectangular, steel-framed, metal structure that would provide space for mechanical and electrical equipment that requires complete thermal and vibration isolation from the telescope. The Utility Building would be connected to the S&O Building by an underground utility chase. Additional facilities associated with the telescope facility are discussed in this section.

With the exception of the Utility Building, the rest of the proposed ATST facility would be white in order to reduce heat absorption, thus decreasing air turbulence that would degrade the seeing.

Additional facilities associated with the telescope facility would include a grounding field consisting of a series of shallow trenches around the facility and fanning out to the south of the S&O Building, a wastewater treatment plant with a capacity of 1,000 gallons/day and an associated infiltration well, a stormwater management system including gutters, catchment drains, an underground tank and pipes connecting it to the cistern at the MSO facility, a new electrical transformer next to the Utility Building; and a diesel generator for use in case of power outages.

ES-2.4.2 Potential Use of the Mees Solar Observatory Facility

The existing MSO facility is a 45-year-old concrete block structure of approximately 5,440 square feet. The building currently houses a telescope and connecting instrument rooms as well as offices, labs, a shop, kitchen, and restrooms. Early in the feasibility investigation for the proposed ATST Project, it was suggested that utilizing some of the facilities in the existing MSO would help reduce the need to construct new building space to support some of the construction and operational requirements. The IfA, the owner of the MSO facility, agreed to this potential shared use of building space with the specific terms to be negotiated as the needs arise. This has allowed the ATST Project to reduce the construction of new enclosed building space, with commensurate reduction in the scope, duration, material delivery, site coverage and other parameters of the project that are inherently related to its overall scope.

ES-2.4.3 Construction Activities

The proposed ATST Project construction would involve land clearing, demolition, grading/leveling, excavation, soil retention and placement, construction, remodeling of the MSO facility, paving, and other site improvements.

Land Clearing. Land clearing using bulldozers and other heavy machinery would be required. Existing vegetation is very sparse and no Federally-threatened Haleakalā silverswords (‘ahinahina, or *Argyroxiphium sandwicense*) or other protected species have been identified on the site (see Section 3.0-Description of Affected Environment).

Demolition. Minimal removal of vegetation would be necessary to clear the primary site for the proposed ATST Project. Facilities to be demolished or removed at the MSO facility include the ATST test tower and foundations, tower and weather station, driveway, parking area, rock wall borders, generator and other selective demolition at the shop/utility area; and, a facility underground cesspool. Demolition would be staged, beginning with the removal of on-site structures and continuing later with the interior work in the MSO facility after the proposed ATST structure is nearly complete. The total duration of demolition activities conducted at different times during the course of the project would be approximately two months.

Grading/Leveling. The construction of the proposed ATST Project would require grading to create a level pad at least 20 feet wider in all directions than the base level footprint of the enclosure and the S&O Building. The critical nature of the structural bearing condition requires that the level area be achieved primarily by cutting or excavating rather than by a cut and fill approach. An estimated 2,500 cubic yards of soil and rock would be removed for leveling in order to prepare the site for construction. The duration of this activity would be approximately one month.

Excavation. Excavation would include removal of rock and soil to accommodate the foundation systems of the telescope pier, the telescope enclosure, the S&O Building, the elevator and platform lift, the utility building, and the utility chase. Additional excavation would be needed in order to trench for utility lines, all of which would be installed underground. The major structural excavation is expected to follow the leveling work and is anticipated to take approximately two months to complete.

Soil Retention or Repair Measures. Soil retention would be achieved using on-site native rock to form a sloped rip-rap embankment. In some places, there is an expected requirement for over-excavation, fill, and re-compaction. Every effort would be made to utilize existing on-site soil. Any required importation of outside fill would comply with sterilization procedures and other required precautions against unintentional importation of invasive biological species.

Placement of Excess Soil and Rock. At an average volume of 20 cubic yards per truckload, approximately 250 truck trips would be necessary to relocate excess rock and soil. Native soils and rock would be spread on the hillside along the Main Observatory Road, approximately 328 feet west of the existing MSO facility. All native rock and soil removed from the site would be placed at locations within HO boundaries under supervision of a cultural monitor.

Primary Soil Placement Area: Open area southwest of the Faulkes Telescope. Prior to utilizing the open area southwest of the Faulkes Telescope Facility (FTF) for staging, the material removed in the initial site leveling and structural excavation for the proposed ATST Project would be deposited in this location to a maximum thickness of about 6 feet at the east end, tapering down to level with the existing site at the west end near the Federal Aviation Administration (FAA) facility. This new fill would be configured to maintain the established stormwater management flow paths for HO

Alternate Soil and Rock Placement Strategies. A significant percentage of the material that would be excavated from the site is expected to be in the form of large intact pieces of rock. Subject to approval by IfA, other HO tenants, and the Cultural Monitor, these large rocks may be placed at locations around the HO property. As an additional strategy for beneficial use of on-site soil material, sand and silt may be taken from the infiltration basin area to be utilized for backfill around the proposed ATST structures. This could potentially eliminate the need for imported backfill material and would also augment periodic removal of sand and silt that must be done to maintain the capacity and percolation of the infiltration basin to help reduce potential erosion.

Construction. To determine the extent of excavation and underground work required for the proposed ATST Project, a preliminary design for the telescope and enclosure foundations has been established. After presenting the overall design in public meetings and publication of the DEIS, it is evident from subsequent descriptions of the foundations by concerned members of the community, that this aspect of the proposed ATST Project has not been well understood. Therefore, this section of the SDEIS provides a detailed description of the foundation in order to clarify the nature and dimensions of the proposed foundations.

The buildings would be constructed of steel, concrete, manufactured siding and roofing panels, insulation, standard utility materials, and standard interior finish materials. The foundations of the telescope and enclosure would be constructed concurrently with the excavation and concrete work required for the support facilities.

The foundations of the telescope and enclosure would be constructed concurrently with the excavation and concrete work required for the support facilities. The telescope pier would also likely be included in that early phase of work. The lower enclosure would be constructed concurrently with the steel erection and exterior construction work on the S&O Building. Following substantial completion of these activities, the on-site erection of the rotating upper enclosure would begin and would be completed over a period of approximately one year. Following this, the telescope mount would be erected, which is also anticipated to take approximately another year.

Staging. Contingent on agreement by the FAA property owner, the proposed primary staging area for the storage of construction materials would be the open area southwest of the FTF, which is approximately 0.9 acres. The majority of on-site construction materials and temporary facilities would be confined to this area. Contractors' trailers and storage containers, parking for large construction equipment and vehicles, lunch/break area for workers, roll-off dumpsters and other trash receptacles, portable toilets, and other temporary facilities typically needed for construction sites would be accommodated at this location. A large open area would be reserved for lay down and pre-assembly of large structural pieces or other staging activities that can be done away from the main site.

Construction Traffic. As a result of the public comment period that followed the publication of the DEIS and meetings with HALE, NSF agreed to assess the extent of construction traffic traversing through HALE. Early in the assessment process, HALE contracted with the Federal Highway Administration (FHWA) for field investigation and preparation of a study defining the current condition of the road and the extent of potential increased wear from construction traffic related to the proposed ATST Project. As a follow-up to that initial study, the FHWA recommended and later performed an additional road condition investigation, which included borings of the existing pavement, Falling-weight Deflectometer testing, and more thorough assessment of the drainage structures along the Park road.

In cooperation with those studies, ATST project engineers estimated the required use of the road by large vehicles (defined by the FHWA as Class 5 or larger) during the course of construction. This information was provided to HALE and FHWA for their reference in assessing potential effects. ATST project engineers have continued to refine that estimate based on logistical planning and discussions with contractors. The number of truck and automobile trips that are anticipated to be required over the 7-year construction, integration, and commissioning phases of the proposed ATST Project is approximately 25,000. Less than 800 of the anticipated vehicle-trips would be by large trucks (FHWA class 5 and larger). The majority of the anticipated trips would be by small pick-up trucks, vans and passenger vehicles, as required for the commuting of workers, small equipment or material deliveries, and passenger car traffic for inspection and supervision.

The FHWA report also includes detailed information about the condition and anticipated future maintenance requirements of the sections of the Park road, including the roadway, culverts, and bridge. The details of these conditions are described in this section. Tables are presented describing the major use of the Haleakalā Highway for construction of the proposed ATST project. If the proposed ATST Project is approved, the SUP to be issued by HALE would address any mitigation measures related to construction traffic, including any contribution to road maintenance and repair necessary. NSO is developing a management plan to ensure implementation of mitigation measures associated with the proposed ATST Project.

ATST Project Engineers estimated the required use of the Park road by large vehicles (defined by the FHWA as Class 5 or larger) during the course of construction. This information was provided to HALE and FHWA for reference in assessing any potential effects. ATST Project Engineers have continued to refine that estimate based on logistical planning and discussions with contractors. The number of truck trips anticipated to be required over the 5-year construction phase of the proposed ATST Project is also listed and described in this section.

HALE Entrance Station Clearance. During the investigation of potential road and traffic issues, the current configuration of the existing entrance station for HALE was identified as a restriction to wide truck loads. The conveyance of large unitary pieces of the ATST telescope, the primary mirror in its protective crate, and other constituent elements of the proposed ATST Project would require truck loads of up to 32 feet 10 inches in width. The HALE entrance station currently provides one paved driving lane approximately 12 feet wide on both the entrance and exiting sides. Development by ATST engineers of alternative proposals for wider clearance, and subsequent consideration by HALE staff identified a mutually preferred option to widen and improve the shoulder on the entry (uphill side) of the entrance station. This would be done by installing compacted fill and a gravel driving surface out to a maximum distance of approximately 12 feet beyond the existing paved roadway at the widest point, and tapering back to the roadway on each end, so as to provide a widened, drivable lane capable of supporting the widest and heaviest of the anticipated ATST loads. Other requirements of this project would include protecting underground utilities, relocating an existing light pole, upgrading utility pull boxes to withstand the anticipated loads, and other related work.

Best Management Practices. A variety of best management practices (BMPs) (required practices established in the LRDP and policies reflecting public consultation during the EIS process) would be implemented during construction, in order to prevent damage to the natural environment.

Proposed Construction Schedule. The earliest possible construction start would be during fiscal year 2010. Excavation and construction of the foundations and pier would take place in the first year of construction (2010) and erection of the enclosure and building structures would follow in the second, third, and fourth years (2011 to 2013). Once the enclosure is positioned, the telescope mount would be installed and the majority of the remaining work would be inside the buildings and enclosure. The optics, control systems, and instrumentation would progress toward the end of construction and into integration, testing, and commissioning of the various systems and instruments. The final phase of construction would be the verification of the science and the transition into a fully operational system by 2017). A graphic timeline is included which notes that tasks that have the potential for noise or vibration would be curtailed or restricted during ‘u‘au nesting and egg-incubation periods, as required by the mitigations defined by the U.S. Fish and Wildlife Service (USFWS).

ES-2.4.4 Telescope Operation Activities

During the final stages of construction, initial operation of the ATST would begin. The first scientific use of the facility would mark a shift in priorities from telescope commissioning activities to early scientific observational priorities. A ramp-up of full operational support would begin during telescope integration and continue through final commissioning of the first major science instrument. As the facility is staffed for telescope operations, construction staff on site would begin to decrease. Additionally, as new instruments become operational, more facility staff would be hired to conduct operations. As with other observatories at HO, the operations staff would be drawn from available local Maui personnel to the fullest extent possible.

Shift Schedule. The proposed daily schedule for operations would be dictated by solar observing hours from sunrise to sunset. Preparing the dome and telescope for observing would begin approximately one hour before sunrise and shutdown procedures would continue until approximately one hour after sunset. Off-site staffing would work on Maui or at the NSO offices which are currently sited in Sunspot, New Mexico and Tucson, Arizona.

Transportation. During operation, ATST-related road traffic to the summit of Haleakalā is expected to be relatively minimal. There would be a van shuttle for observatory employees scheduled between the base facility in the Kula/Waiakoa area and the facility at HO, separate passenger cars driven by staff or visiting observers making a round trip to HO and back, and commercial service-vehicle traffic to support the operation of ATST of vehicles up to Class 5 size. Larger commercial vehicles, Class 6 and above, would be used primarily for delivery of water, liquid nitrogen and other utility commodities.

Hazardous Materials. Operations at HO facilities sometimes require the use, handling, storage, and disposal of hazardous materials (HAZMAT) performed in compliance with 40 CFR §260-299, Solid Wastes, and the Resource Conservation and Recovery Act. A HAZMAT management plan specific to the proposed ATST Project has been prepared and is included as Vol. II, Appendix D-ATST Hazardous Materials Management Program. Hazardous materials that would be used at the proposed facility and their uses are also shown in this Section. The transportation of HAZMAT for the proposed ATST Project would be fully consistent with Title 49 CFR Parts 100-185 Hazardous Materials Regulations – Hazmat Transportation as prescribed by the Federal Department of Transportation. Only properly licensed companies and individuals would be contracted to transport HAZMAT.

Transportation of the mirror stripping, cleaning and recoating materials and the effluent from this process would occur approximately once every two years. Transportation of the heat transfer fluid concentrate would occur as needed for replenishment of the system, approximately once per year. None of the mirror coating materials or heat transfer fluids is defined as hazardous under Title 49 CFR Federal Department of Transportation. Liquid nitrogen and helium would be transported to the ATST facility on a periodic basis approximately four times per year. A table of HAZMAT that would be used is presented.

Utilities. Stormwater Management - Rainwater around the enclosure would be collected and utilized as a source of domestic water for observatory operations. The combined capacity of the underground holding tank and cistern (104,000 gallons total) would be adequate to capture all the rainwater flowing off of the roof and building surfaces of the existing Mees facility and the proposed ATST Project during the maximum defined 5-year rainfall event (8 inches in 24 hours). Additional rainwater would be allowed to overtop the cistern and would be distributed over a broad area of the natural cinders to maximize percolation and minimize erosion-causing run-off. An assessment of and a management plan for the existing HO surface drainage system and the infiltration basin is in Vol. II, Appendix L-Stormwater Master Plan for HO.

Wastewater Management - An individual treatment plant adequate to process the domestic wastewater from both the proposed ATST Project and the MSO facility would be installed underground. This plant would utilize aeration and biologically accelerated treatment to achieve effluent standards acceptable for infiltration directly to ground. Effluent would be disposed of in an on-site infiltration well. The specification of the treatment plant and its related piping/discharge system would be based on the anticipated utilization of the facility and the applicable regulations of the State of Hawai‘i Department of Health.

Domestic Water Supply - Appropriate systems for treatment, piping, and pumping the cistern water for use in the S&O Building would be provided. The cistern water would be used directly for the domestic fixtures of the proposed ATST Project. Water for human consumption would be provided separately through commercial bottled sources.

Grounding and Lightning Protection - The grounding system for the proposed ATST Project would employ several methods to achieve a safe effective electrical ground connection to the very dry, high-resistance volcanic soil. A series of shallow trenches would be dug that extend peripherally around the entire facility and branch out to form a grounding field in the area to the south of the S&O Building. As an alternative to the use of conductive concrete, coke breeze, a black granular material with high electrical conductivity may be specified in the future final design of this system. This proposed system is based on best-proven practices at existing observatories and other critical facilities at high lightning risk sites.

Electricity - Electrical power for the proposed ATST Project would be provided by connection to the Maui Electric Company, Inc. (MECO) substation on HO. The maximum peak electrical demand of the proposed ATST Project is estimated to be 960 kilo-volt amperes (kVA). The current reserve capacity of the main power line to Haleakalā is estimated by MECO to be approximately 1,900 kVA. The ATST project team has been in cooperative contact with MECO engineers who would incorporate the power requirements of the proposed ATST Project into their overall systems planning process, along with other potential future HO needs. A MECO-funded study has been conducted to identify economizing strategies for the proposed ATST Project, such as ice storage to reduce peak-hour power consumption.

The power line for the proposed ATST Project would generally follow the path of existing service lines in order to minimize excavation of previously undisturbed soil. The new service would utilize existing conduits and pull boxes wherever possible. All service lines would be underground and routed around identified archeological features. To provide electrical power in the event of service outages, the proposed ATST Project would include a 300 kilovolt-ampere (kVA) diesel generator to provide for safe shutdown of the telescope and enclosure and for maintaining power to critical systems.

Solid Waste Management - The non-hazardous solid waste (office refuse, food waste, etc.) from operation of the proposed ATST Project would be collected and transported off site regularly for proper disposal in a landfill. Recyclable material in the solid waste (office paper, cardboard, aluminum cans, etc.) would be separated out and taken to an appropriate recycling center.

Communications - The existing facilities at HO are currently served by a microwave link for data transmission; and the U. S. Air Force facility is served by a fiber link. Telephone service for all facilities is provided by Hawaiian Telcom, which has spare fiber lines already in place to the summit. The proposed ATST Project would require connection to those existing data/communications service lines. No upgrade to the current capacity of the lines is anticipated to be necessary.

The proposed ATST Project would require data connectivity of approximately 1 Gigabit per second and transmit data from Haleakalā to locations throughout the world via the Internet. Communications off the summit would use existing fiber optic cables owned by Hawaiian Telecom that stretch from Haleakalā to the Maui High Performance Computing Center in Kihei. Data would also be transmitted to the ATST base facility on Maui using the same fiber optic cables. The location of the Maui base facility and ATST data repository has not been determined.

ES-2.5 Description of the Proposed ATST Project at the Reber Circle Site

As an alternative to the Mees site, the NSF proposes to construct the proposed ATST Project on another site within HO boundaries. This proposed site is the previous location of a radio astronomy experiment referred to as Reber Circle. The principal area of this site is currently unutilized and is the only other area identified at HO that would be large enough to accommodate the proposed ATST Project.

The site is northeast of the preferred site and about 6 meters (20 feet) higher in elevation. It is currently bounded by the two Panoramic-Survey Telescope and Rapid Response System (Pan-STARRS) facilities (PS-1 and PS-2) to the south, the Airglow facility to the south, and the Zodiacal Light facility to the southwest. The site selection process for the proposed ATST Project determined that the Reber Circle site would fulfill all the science criteria as well as the Mees site.

ES-2.5.1 Features of Infrastructure Design

The proposed design of the telescope and instruments is the same as described for the Mees site. The S&O Building would have the same exterior dimensions and the same interior spaces as described for the Mees site. While the Utility Building would be located in a different spot relative to the S&O Building and Telescope enclosure, it would have the same exterior dimensions and would house the same equipment as described for the Mees site. All the same facilities would be constructed at the Reber Circle site as at the Mees site; however, at the Reber Circle site, a new above ground fuel storage tank to support the back-up generator would be required.

ES-2.5.2 Potential Use of MSO and Airglow Atmosphere Facilities

The use of the Reber Circle site would likely still require modifications and use of the MSO facility. The proposed Reber Circle site proximity would be less convenient, would be more constricted by topography and adjacent structures than is the Mees site, and areas for additional facilities would not likely be available. As such, the project would still propose to modify the existing shop in the MSO facility to allow it to serve the needs of both IfA and the proposed ATST Project.

The long-term effect on the proposed ATST Project would be loss of man-hour efficiency due to the movement from one facility to the other. Other potential shared uses for the MSO facility are the same as described for the Mees site. Should the proposed ATST Project be constructed at the Reber Circle Alternative Site, the UH Atmospheric Airglow facility covering 300 square feet would be removed to provide sufficient building space.

The existing UH Atmospheric Airglow instrument platform is a 57-year-old concrete block structure of approximately 300 square feet. Should the proposed ATST Project be constructed at the Reber Circle Alternative Site, the UH Atmospheric Airglow instrument platform would be removed to provide sufficient building space.

ES-2.5.3 Construction Activities

As at the Mees site, project construction would involve land clearing, demolition, grading/leveling, excavation, soil retention and placement, construction, staging, remodeling of the MSO facility, and paving. Most of these activities would be roughly the same in duration and quantity as at the Mees site, with the few exceptions discussed in Section 2.5.3- Construction Activities.

The construction traffic, best management practices, and the construction schedule would be approximately the same for the Reber Circle site as for the Mees site,

ES-2.5.4 Telescope Operation Activities

All proposed ATST operations would be the same at the Reber Circle site as at the Mees site.

ES-2.6 No-Action Alternative

Under the No-Action Alternative, both the Mees site and the Reber Circle site areas would remain in their current undeveloped state and continue to not be utilized within the Conservation District of HO. The No-Action Alternative would limit solar astronomy to current technologies and delay critical observational tests of sophisticated theories and models. Since existing instrumental capabilities at facilities such as the MSO facility no longer are sufficient to take this next step toward understanding the fundamental physical processes that govern the behavior of the Sun, and because no facilities capable of observing the magnetic phenomena in the solar atmosphere at the required level of detail, knowledge of the direct effects of solar activity on life on Earth would not be forthcoming.

ES-3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

A detailed description of the affected environment may be found in Section 3.0.

The affected environment of the proposed ATST Project is on land that was designated and assigned to the University of Hawaiʻi in 1961 for scientific purposes by Governor Quinn's Executive Order (EO) 1987. The 18.166 acres of land assigned to UH is located on State of Hawaiʻi land within a Conservation District. The property boundaries for HO are wholly within Puʻu Kolekole near the summit of Haleakalā. The EO land is about one quarter mile from the highest point in Haleakalā National Park, which is known as Puʻu Ulaʻula Overlook. The Kolekole cinder cone lies just to the southwest of the topographic apex of the Southwest Rift Zone of Haleakalā. The rift zone forms a spine separating the Kula Forest Reserve from the Kahikinui Forest Reserve, both of which are pristine lands along the rift zone.

The affected environment of the proposed ATST Project also includes portions of HALE. The primary area affected by the proposed ATST Project includes the Park road corridor, the historic bridge and multiple culverts. The Park road corridor is included because a SUP is required by HALE to operate commercial vehicles within the Park.

ES-3.1 Land Use and Existing Activities

The Region of Influence (ROI) for determining the affected environment for this section includes HO, the adjacent FAA facilities, and the HALE Park road corridor. The objective of the Conservation District in which HO is located is to conserve, protect, and preserve the important natural resources of the State through appropriate management and use in order to promote their long-term sustainability and the public health, safety, and welfare. The proposed ATST Project is consistent with the intention that conveyed the HO area to UH by the Governor's EO 1987. This area of the Conservation District has been set aside for "…Haleakalā High Altitude Observatory site purposes only." Many facilities conducting astronomical research and advanced space surveillance already exist within HO.

ES-3.1.1 Land Use for the Proposed ATST Project

The proposed ATST Project is an identified use in the General Subzone and would be consistent with the objectives of the General Subzone of the land. It would be in close proximity to other previously developed facilities for astronomy and advanced space surveillance. No changes to the identified land use within HO would occur. Subdivision of land would not be utilized to increase the intensity of land use in the Conservation District.

The Park road corridor is part of HALE, the purpose of which is to further reflected in a key provision of the Organic Act "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as would leave them unimpaired for the enjoyment of future generations." The Park road corridor traverses through HALE toward the summit.

ES-3.1.2 Existing Activities

The HALE Park road corridor falls along the last 10.6 miles of the Haleakalā Highway, which is a 37-mile road from central Maui's main town of Kahului to the summit of Haleakalā. The corridor along the Park road is owned and managed by the NPS. Existing access into and out of HO is exclusively via HALE and then through the entrance to the HO complex just past Puʻu ʻUla ʻUla. There is no general public access to HO and "AUTHORIZED ENTRY ONLY" is posted on the sign located at the entrance to the facilities.

An unimproved, access road known as Skyline Drive originates 0.5 miles away from HO at the Saddle Area. Its entire length is located on State land within the Forest Reserve. There are sections of this trail that have a steep grade and soft cinder roadbed that would only support smaller vehicles with four-wheel drive and not standard construction truck traffic.

Presently, the HO facilities located within HO observe the Sun, provide a world-class telescope for education and research outreach to students all over the world, use lasers to measure the distance to satellites, track and catalogue man-made objects, track asteroids and other natural potential space threats to Earth, as well as to obtain detailed images of spacecraft. It is a principal site for optical and infrared surveillance, inventory and tracking of space debris, and active laser illumination of objects launched into Earth's orbit. These activities are all crucial to the nation's space program.

The FAA operates and maintains a rectangular 2.96-acre property along the southwest boundary of HO, which is referred to as the Haleakalā Peripheral Hi Site. This property was originally granted to the Civil Aeronautics Authority (predecessor to the FAA) in 1957 through an Executive Order from the Governor of the Territory of Hawaiʻi. The site is dedicated to remote air/ground interisland and trans-Pacific communications to and from aircraft.

ES-3.2 Cultural, Historic and Archeological Resources

Cultural, historic and archeological resources were evaluated within the ROI, which, for these resources, falls within both the HO and relevant areas within HALE, including the Park road corridor.

ES-3.2.1 Cultural Resources

Initial Cultural Resource Assessments. The "Cultural Resources Evaluation for the Summit of Haleakalā" was conducted in 2003 of the entire HO property for the LRDP. The 2003 evaluation concluded that, "Kolekole, known as the summit of Haleakalā, or 'Science City' as it is sometimes referred to, is a very sacred place for the Kanaka Maoli (Native Hawaiian), past and present." A subsequent cultural resources study entitled "Cultural and Historical Compilation of Resources Evaluation and Traditional Practices Assessment" was conducted in 2006 as part of the environmental compliance process for the proposed ATST Project.

Supplemental Cultural Impact Assessment. As a result of specific concerns by the commenting public to the cultural and historical evaluation that was included in the DEIS, Cultural Surveys Hawaiʻi, Inc. was commissioned to conduct a Supplemental Cultural Impact Assessment (SCIA) for the proposed ATST Project. The SCIA contains considerable additional historical perspective on Haleakalā. It discusses in great detail the symbology of the mountain, the mountain's role in the history of Maui Island as a living entity, as well as the archeological record. The information provided is intended to educate the reader regarding the spiritual sacredness and cultural relationship of Hawaiians to Haleakalā as a whole and to the summit area in particular. A table of community consultations during this SCIA is presented to summarize the names and affiliations of those who participated.

Haleakalā Summit as a Traditional Cultural Property. There are several reasons why the summit of Haleakalā is a cultural resource in and of itself. It is eligible for listing on the National Register of

Historic Places (NRHP) as a "Traditional Cultural Property" (TCP) through consultation with the State Historic Preservation Division (SHPD) under Criterion "A" for its association with the cultural landscape of Maui and this is reflected in the number of known uses, oral history, *mele* and legends surrounding Haleakalā. The term "Traditional Cultural Property" is used in the NRHP to identify a property "that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that, (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community". The summit is also eligible under Criterion "C" because it is an example of a resource type, a natural summit, a source for both traditional materials and sacred uses.

In recognition of the cultural importance of Haleakalā, Native Hawaiian stonemasons erected the West and East *ahu* (altar or shrine) for ceremonial use by Kanaka Maoli at HO in 2005 and 2006, respectively. Each *ahu* represents a sacred ceremonial site.

Summary of Haleakalā in Native Hawaiian Tradition. The SCIA provides a comprehensive discussion about the role of Haleakalā in Native Hawaiian tradition. Excerpts are provided in this section along with a table summarizing the legends and traditions related to Haleakalā, along with the sources of information.

Traditional Cultural Practices. The SCIA also provides a helpful background for understanding why Haleakalā is an important place where traditional cultural practices take place. A description of the 12 *moku*, or districts, is provided and some of the known traditions are summarized. There are several types of traditional cultural practices that take place within the ROI as well as certain sites that have cultural significance within the ROI, and these are described in this section. They are:

1. Gathering of plants
2. Traditional hunting practices
3. Collecting for basalt and tools
4. Pōhaku Pāloha – The Piko of East Maui
5. Traditional Birth and Burial Practices
6. Haleakalā as a Sacred Mountain
7. Ceremonial Practices, e.g., honoring the solstice or equinox
8. Astronomy
9. Travel

ES-3.2.2 Historic Resources

Historic resources were identified at both the HO site and within the Park road corridor.

HO Site. To augment the comprehensive survey from 2002, a field investigation of the proposed ATST Project site was conducted during fall 2005. One eligible historic site was identified at the Reber Circle site. This site remnant lies at the peak of Pu'u Kolekole. It is designated by the State Inventory of Historic Places as Site 5443 and qualifies for significance under State historic preservation guidelines and is eligible for listing on the NRHP under Criterion "A" because of its association with mid-20th century scientific studies at Haleakalā, and under Criterion "D" for its information content.

HALE Park Road Corridor. The historic roadway has been evaluated by the National Park Service (NPS) and Historic American Engineering Record and determined eligible for listing in the NRHP as an historic cultural landscape with contributing historic features. The applicable eligibility criteria include Criterion "A" (for its development of the National Park System, the development of early NPS landscape architectural design styles, and the craftsmanship of the Civilian Conservation Corps and Criterion "C" (for its association with rustic, Park design that characterized early NPS development during the 1930s).

Historic features of this roadway include: 1 bridge, 11 box culverts, and original culverts with mortared stone headwalls. In addition, the Park road corridor is within the boundaries of the Crater Historic District. The contributing features of the Park road corridor are discussed in detail in this section, including natural systems and features, spatial organization, land use, buildings and structures, circulation, topography, views and vistas, and archeological sites associated with the cultural landscape.

ES-3.2.3 Archeological Resources

Numerous archeological sites have been recorded on the slopes and in the crater of Haleakalā, including, in order of frequency, temporary shelters, cairns, platforms with presumed religious purposes, adze quarries and workshops, caves, and trails. These are all remnants of the very elaborate spiritual and cultural life that the Kanaka Maoli focused around Haleakalā.

Within Kolekole, archeological resources of importance are: temporary habitation or wind shelters, two petroglyph images, one site interpreted as a possible burial, and two ceremonial sites. The sites are important in that they have yielded information on prehistory. However, there were no new construction projects initiated at the site between 1981 and 1993, and therefore no inventories of historic and cultural resources within the HO property were conducted until 1990. Subsequently, studies were conducted in 1998, 2000, and 2002-2003. These are described in this section and a table is presented summarizing HO archeological sites.

A preservation plan was recommended by SHPD, which was prepared subsequent to the survey and was submitted to SHPD in March 2006. The plan calls for passive as-is preservation for all of the sites described above except for the remnant of Reber Circle, which was constructed in 1952. It also calls for no signage for individual sites discussed in this preservation plan. Signage could potentially draw unwanted attention to these sites, possibly causing negative effects and/or security concerns.

Archeological Resources Along the Park Road Corridor

The ROI also includes archeological sites located along the Park road corridor, which are identified and described in a table. There are 11 archeological sites within 50 feet of the Park road corridor. Most of these sites are eligible for listing in the NRHP under Criterion “D”, and one is listed under both Criteria “C” and “D”. These sites include short-term camp sites associated with pre-historic and/or historic activities, cairns that appear to be trail markers and segments of wall associated with cattle ranching.

ES-3.2.4 National Historic Preservation Act, Section 106 Regulatory Compliance

The NSF’s consultation process, pursuant to the National Historic Preservation Act (NHPA) of 1966 is discussed in this section because it has been a mechanism to assist in determining the affected environment. Prior to issuance of the DEIS, NSF’s Section 106 compliance process was initiated. Both formal and informal consultations were conducted as discussed in further detail in Section 5.0-Notification, Public Involvement, and Consulted Parties.

Subsequent to the publication of the DEIS, additional consultations have taken place with Native Hawaiian organizations and individuals, community groups, other State and Federal agencies, and other interested parties to discuss the cultural resources involved, potential effects on those resources, and ways in which those effects could be addressed. All of these additional consultations are detailed in Section 5.0.

The NHPA requires Federal agencies to consider whether their actions will have effects on historic properties eligible for listing in the NRHP. The heart of the NHPA is the Section 106 process, which “seeks to accommodate historic preservation concerns with the needs of Federal undertaking through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties… the goal of consultation is to identify historic properties potentially affected by the undertaking, assess its effects and seek ways to avoid, minimize or mitigate any adverse effects on historic properties." In the State of Hawai‘i, the NSF must also consult with the SHPD and all interested Native Hawaiian organizations and individuals where historic properties of significance are involved. In addition to the NHPA requirements, the State of Hawai‘i policies that require agencies to promote and preserve cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups are discussed.

Since the issuance of the DEIS, NSF and HALE have been working together to address HALE's environmental compliance needs associated with the Special Use Permit required by HALE for commercial vehicles to operate within the Park. NSF and HALE have agreed to coordinate their environmental compliance requirements under both NEPA and Section 106. It was through this partnership that the cultural, historic, and archeological resources of HALE (as discussed in Sections 3.2.1 through 3.2.3, above) were identified.

ES-3.3 Biological Resources

Biological resources were evaluated within the ROI, which, for these resources, falls within both the HO and the Park road corridor.

From 2003 to 2008, surveys at HO were conducted to assess its botanical and invertebrate habitats and to map the visitation flight patterns of avian fauna. These surveys were done as part of the LRDP for HO, AEOS Mirror Coating Section 7 consultations, and more recently, as part of the EIS assessment of the affected environment for the proposed ATST Project.

The results of these surveys generally indicate that the diversity and density of biological populations at HO are dynamic from season to season and over longer temporal periods, depending on a number of factors such as rainfall, temperature variations, and less well-understood factors. Human activities certainly play a role in these dynamic variations.

Mountain summits are typically aeolian deserts populated by a few mosses, lichens, and grasses. The predominant vegetation type at HO is alpine desert/shrubland. Alpine ecosystems exist at elevations of from 9,842 to 11,155 feet above sea level and can be extremely dry. Dry alpine shrublands are sparsely vegetated with dwarf native shrubs. At HO, shrubs consist of interspersed ‘ahinahina and na‘ena‘e *(Dubautia menziesii)*. Vegetation cover is restricted by harsh environmental conditions to 10 percent of the surface area or less. Some areas have little as one percent coverage. The vegetation is also low, generally less than three feet high. The HO botanical diversity is described and endangered biological species at HO are listed.

The biological zones along the Park road corridor are described and endangered species in this portion of the ROI are discussed.

ES-3.3.1 Botanical Resources

The botanical resources within HO are described and include those on disturbed and undisturbed portions of the property. The botanical resources within the climatic zones of the Park road corridor are discussed.

ES-3.3.2 Endangered, Threatened, Listed, or Proposed Plant Species

The ‘ahinahina or Haleakalā silversword are Federally-listed as a "threatened" species, meaning they may become endangered throughout all or a significant portion of their range if no protective measures are taken. As mentioned earlier, in 2002, nine live ‘ahinahina and three dead ‘ahinahina flower stalks were located within the HO property. None of the live plants were located on or around the proposed ATST Project areas. One of the dead plants, also found during the 2005 survey, was located east of Reber Circle. The area around the plant was searched for seeds, but none were found.

There are a number of ‘ahinahina in HALE of designated ‘ahinahina critical habitat and *Geranium Multiflorum* designated critical habitat within the ROI. Within HALE, approximately seven miles of the Park road corridor traverse through Designated Critical Habitat for the ‘ahinahina.

ES-3.3.3 Faunal Resources

Fauna at HO consists of avifaunal species, mammals, and invertebrates. Three Federal- and State-listed animal species occur in the summit area and slopes of Haleakalā. A list of the habitat preference and the likelihood of occurrence of avifaunal species and mammals in the project ROI is summarized in this section. These are the ‘ua‘u, or Hawaiian petrel, the nēnē, or Hawaiian goose, and the ‘ope‘ape‘a, or Hawaiian hoary bat.

ES-3.3.3.1 Endangered, Threatened, Listed or Proposed Avifaunal and Vesper Bat Species

The ‘ua‘u, or Hawaiian Petrel (*Pterodroma sandwichensis*), a Federal- and State-listed endangered bird species, is present in the summit area. About thirty known ‘ua‘u burrows are along the southeastern perimeter of HO and several burrows are northwest of HO, with a large number of burrows within two miles of HO. There are up to 1,000 known burrows within HALE, including a large number along the Park road corridor. The ‘ua‘u can be found nesting at Haleakalā from February to November. The birds make their nests in burrows, and return to the same burrow every year. The species distribution during their non-breeding season is poorly known, but they are suspected to disperse north and west of Hawai‘i with very little movement to the south or east. The ‘ua‘u typically leave their nests just before sunrise to feed on ocean fish near the surface of the water, and just before sunset transit from the ocean back to Haleakalā.

The nēnē, or Hawaiian goose (*Branta sandvicensis,* also known as *Nesochen sandvicensis*), is a Federal- and State-listed endangered species on Haleakalā and is the only extant species of goose not occurring naturally in continental areas. Nēnē formerly bred on most of the Hawaiian Islands, but currently are restricted to the islands of Hawai‘i, Kaua‘i and Maui. Nēnē seem to be adaptable and are found at elevations ranging from sea level to almost 8,200 feet in a variety of habitats, including non-native grasslands, sparsely vegetated, high elevation lava flows, cinder deserts, native alpine grasslands and shrublands, open native and non-native alpine shrubland-woodland community interfaces, mid-elevation (approximately 2,300 to 3,900 feet) native and non-native shrubland, and early successional cinder fall. Critical habitat has not been designated for the nēnē. The nēnē population on Maui is thought to consist of approximately 330 individuals. While the nēnē has been known to fly over HO, the summit area is outside the known feeding range of the bird.

The ‘ope‘ape‘a, or Hawaiian hoary bat (*Lasiurus cinereus semotus*), is a Federal-listed endangered species that resides on the lower slopes of Haleakalā. On Maui, the Hawaiian hoary bat resides in the lowlands of the Haleakalā slopes. Even though several sightings have been reported near HO and have been detected near the Park Headquarters Visitor Center and Hosmer Grove. It is unlikely that the bat is a resident of the area due to the relatively cold summit temperatures and the lack of flying insects in the area, which is the preferred food source.

ES-3.3.3.2 Other Native and Introduced Fauna

Fauna of all types are abundant along the Park road corridor, both native and introduced. Other introduced fauna that could be observed within the summit area include the chukar *(Alectoris chukar),* the feral goat *(Capra hircus),* the Polynesian rat *(Rattus exulans),* and the roof rat *(Rattus rattus)*. The Indian mongoose *(Herpestes auropunctatus)* is occasionally observed on the summit. Cats (Felis catus) and mice (Mus musculus) are also found along the Park road corridor, with cats occasionally seen crossing the Park road. These species are not included on Federal or State threatened or endangered lists.

ES-3.3.3.3 Invertebrate Resources

Due to the harsh environment, fewer insects are present at upper elevations on Haleakalā than are found in the warm, moist lowlands. However, an exceptional assemblage of insects and spiders make their home on the mountain's upper slopes. A survey and inventory of arthropod fauna was conducted for the 18.166 acres of HO in 2003, and the Mees site and Reber Circle site for the proposed ATST Project were revisited in 2005 for additional arthropod collection and analysis. The arthropod species that were collected in the 2005 study were typical of what had been found during previous studies. No species were found that are locally unique to the site, nor were there any species found whose habitat is threatened by normal observatory operations.

A supplemental arthropod inventory in response to comments submitted for the September 2006 DEIS was conducted in March 2007 for sampling for arthropods at the sites considered in the proposed ATST Project. The goal was to detect additional species that may have been missed during previous samplings. This additional survey, including night sampling, covers a seasonal component not included in the two previous studies.

Comments on the DEIS indicated that the collective invertebrate inventories obtained at HO did not address certain "Species of Concern" (SOC). Therefore, USFWS was contacted to obtain a list of SOC for the ROI so that future surveys could include those. SOC is an informal term not defined in the Federal Endangered Species Act. The term commonly refers to species that are declining or appear to be in need of conservation. Many agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts.

Much like plant inhabitants along the Park road corridor, arthropods may be divided into two general population groups — the aeolian dwellers of the upper road and the subalpine species of the lower road. In contrast to the more hospitable shrublands, the alpine or upper slopes of the Haleakalā aeolian ecosystem is extremely xeric (dry) caused by relatively low precipitation, porous lava substrates that retain negligible amounts of moisture, little plant cover, and high solar radiation. There are two notable arthropods of concern, the Argentine ant (*Iridomyrmex humilis*) and the Yellow-jacket (*Vespula pensylvanica*), of which both are predators within the high-elevation shrubland that constitutes the northwest slope portion of the Park road corridor. These predators are discussed.

ES-3.4 Topography, Geology, and Soils

The following discussion on topography, geology, and soils includes both the HO and Park road corridor. Unless otherwise noted, this section applies equally to all areas within this ROI.

ES-3.4.1 Topography

The ROI for this section includes both the HO and Park road corridor. Unless otherwise noted, the discussion in this section applies equally to all areas within the ROI. Haleakalā, the larger volcano on the eastern side of Maui, rises above at 10,023 feet above sea level (ASL). The summit area of Haleakalā is rugged and barren, consisting of lava and pyroclastic materials. Within a 4-mile radius of HO the elevation drops to approximately 3,600 feet ASL, with an average slope greater than 30 percent. The proposed ATST Project is located in the crater area of the Kolekole cinder cone, which is part of the Southwest Rift Zone.

ES-3.4.2 Geology

The ROI for this section includes both the HO and Park road corridor. Unless otherwise noted, the discussion in this section applies equally to all areas within the ROI. The Mees construction site of the proposed ATST Project consists of polygonal to sub-columnar lava horizons, which are broken into large blocks along horizontal and vertical joints. The near horizontal ankaramite lava is ponded and agglutinated with spatter and some cinder. These lava horizons are several feet thick and intermixed with cinder beds. The Reber Circle site did not show gross evidence of faulting, instability or mass wasting, and in a human-referenced time scale, both the Reber Circle site and the Mees site

ES-3.4.3 Soils

The ROI for this section includes both the HO and Park road corridor. Unless otherwise noted, the discussion in this section applies equally to all areas within the ROI. Soil borings at the Mees site identified a soil profile generally consisting of cinder sands and gravels on top of a basalt layer. Soil profiles were obtained from cores at six locations, five within the proposed ATST Project footprint. Moderately hard to hard basalt substrate substantial enough for bearing weight was identified at depths of 5 to 21 feet below grade. Two cores taken at the Reber Circle site identified hard basalt substrate beneath a thin (5- to 15-foot) layer of less consolidated basalt.

ES-3.5 Visual Resources and View Plane

The ROI for this section includes HO, the Park road corridor, other areas within HALE, and a few areas on Maui as discussed below. Approximately 1.7 million visitors annually are attracted to Haleakalā's various lookouts and vantage points for its spectacular vistas. Looking down the slopes to the west, a majestic view of Maui's isthmus and West Maui Mountains is afforded, while to the east are the richly colored scenes of the crater and, on minimal cloud-cover days, the slopes of Mauna Kea and Mauna Loa on the island of Hawaiʻi.

On a cloudless night, Haleakalā also serves as an outstanding platform from which to view the heavens, facilitated by its position above the cloud inversion layer, the clean atmosphere, and the lack of degrading light sources.

Visibility of the summit area would be more likely in the early morning before the daytime cloud inversion layer builds up, and in the late afternoon after the inversion layer dissipates. When mid- and upper-level cloud cover is absent, many of the existing structures at HO are visible from miles away. Some of the facilities can also be seen from public viewpoints and highways that climb the slopes of the mountain. The current facilities at HO that are closest to the northern boundary of the property are visible in various locations on Maui. The tallest of these, the metallic 110-foot tall U. S. Air Force Advanced Electro-Optical System completed in 1994, is easily seen with the unaided eye from most areas within the Central Valley as well as from some windward and leeward communities, especially in morning and late afternoon hours. However, the two white 50-foot domes of the Maui Space Surveillance System are also visible in many of those same areas when the summit area is free of clouds and have been since completion in 1965.

ES-3.6 Visitor Use and Experience

Haleakalā National Park encompasses approximately 33,230 acres and attracts more than one million visitors annually to experience the natural and cultural wonders the park was designated to protect. There are three primary visitor areas within the Park. The first, the "Summit Area," is considered to be the Haleakalā summit. There are two visitor facilities in this area. The Haleakalā Visitor Center, which is near the cinder cone known as Pa Kaʻoao (White Hill), is located on the rim of the crater. Another overlook building accessible by vehicle or foot is located at the highest point of Halealakā on Puʻu Ulaʻula (Red hill) and is also one of the main attractions for visitors to the summit.

The second, the "Wilderness Area," is located over the majority of the eastern side of the Park. A portion of the "Wilderness Area" inside the crater is accessed through the "Summit Area" and offers hiking from two major trailheads. Leleiwi and Kalahaku Overlooks are located along the Park road between the Park Headquarters Visitor Center and the Puʻu Ulaʻula and Haleakalā Visitor Center summit viewing areas.

The frequently visited third area, also part of the "Wilderness Area" is located on the eastern side of HALE near the coast, and is known as Kipahulu. Hiking, swimming, and camping are available in this area of the Park.

Outside of HALE, an unimproved, access road known as Skyline Drive originates 0.5 miles away from HO at the Saddle Area. It traverses the Southwest Rift Zone, ultimately leading to Spring State Recreation Area (also known as Polipoli State Park), which is located at 6,200 feet ASL within the fog belt of the Kula Forest Reserve.

The proposed ATST Project is located within the HO property and is not open to the general public. The closest visitor facility is the Puʻu Ulaʻula Overlook. The Haleakalā Visitor Center and the Keonehe'ehe'e (Sliding Sands) Trail Head are approximately a quarter mile to the east of the entrance to both the Puʻu Ulaʻula Overlook and the road leading to HO. Haleakalā Observatories are clearly visible from the Pu'u ʻUla'ula Overlook located directly to the northeast of the proposed ATST Project location.

Visitor surveys concerning the use of HALE were conducted in 2000 and 2007. The results of these are described in this section.

ES-3.7 Water Resources

The ROI for water resources includes HO and the Park road corridor. The ROI is within the Waiakoa and the Manawainui Gulch watersheds. Haleakalā Observatories is within the Waiakoa and the Manawainui Gulch watersheds. The groundwater boundaries are the Kamaole and Makawao Aquifer Systems of the Central Aquifer Sector and the Lualailua and Nakula Aquifer Systems of the Kahikinui Aquifer Sector.

There is no source or supply of water at the summit area of Haleakalā. At various times during the year — particularly the winter months — rainwater is collected from building roofs, etc., and stored in water-catchment systems. At HO, to supplement this source, water is trucked to each user in certified tanks where it is stored on-site. Users maintain their own collection systems and storage tanks for potable and/or non-potable water, as well as their individual pumping and distribution systems.

ES-3.7.1 Surface Water

All precipitation falling near the summit is infiltrated and flows subsurface toward the natural drainage courses, such as Manawainui Gulch. Loss of rainfall would be caused by evaporation in the soil column.

Due to site topography, as well as a small collection of stormwater conveyance systems consisting of concrete channels and culverts, runoff generated within the HO site is controlled and conveyed via natural drainage paths to an infiltration basin at the western extremity of HO property. Runoff patterns are shown in a stormwater map. Runoff harvesting is also part of the drainage features at HO. Runoff from the Mees building is captured and stored in the adjacent 64,100 gallon cistern and is used for domestic water; and a 24,000 gallon cistern is associated with the Neutron Monitoring Station below Mees. Some of the runoff from IfA facilities is captured by these cisterns before it reaches the infiltration basin.

ES-3.7.2 Groundwater

The groundwater resources below HO are characterized as part of the Kamaole and Makawao systems of the Central sector and the Lualailua and Nakula systems of the Kahikinui sector. The upper aquifer is classified as being replaceable and highly vulnerable to contamination, while the lower dike aquifers are classified as being irreplaceable and moderately vulnerable to contamination. There are no drinking water wells within 11 miles of the summit.

ES-3.8 Hazardous Materials and Solid Waste

The ROI for HAZMAT and solid waste includes HO, the Park road corridor, and the portion of the State highway leading up to the HALE Park road corridor. This section focuses on the solid and hazardous waste management and disposal practices at HO because this location is the main user of such materials and solid waste on the summit. The Park road corridor is discussed primarily within the context of transporting such materials and wastes.

Hazardous waste, as defined by the U. S. Environmental Protection Agency (Title 40 of the CFR, Chapter 1, Subchapter I-Solid Wastes, Part 261-299), refers to substances that have “imminent and substantial danger to public health and welfare or the environment.”

ES-3.8.1 Hazardous Materials

The ATST Hazardous Material and Hazardous Waste Management Plan finalized in April 2006, provides extensive guidance on hazardous material and hazardous waste management for the proposed ATST Project. Guidance on HAZMAT at HO that covers the entire HO property is provided via management plans from IfA and the Air Force Research Laboratory, which are required by several Federal/Dept. of Defense regulations. A list of these plans, an overview of their guidance, and the regulations under which they are required is also in this section. The MSO facility, the Faulkes Telescope Facility, the Pan-STARRS, the Zodiacal Observatory, and the Airglow Facility do not have HAZMAT on-site and are not considered small quantity generators (SQGs). The University of Chicago Neutron Monitor facility is classified as a SQG, since it uses boron trifluoride (BF3) gas and boron is classified as a poisonous gas. Hawaiʻi does not have a hazardous waste disposal facility; therefore, hazardous waste is shipped to the continental United States for proper disposal.

Spill prevention at Maui Space Surveillance Complex (MSSC) is guided by the February 2003, Spill Prevention Control and Countermeasure Plan for MSSC, prepared by Rocketdyne Technical Services, a Boeing Company. This plan outlines procedures for carrying out response actions for releases of HAZMAT into the air, soil, or water that pose a threat to human health or the environment.

The UH Hazardous Material Management Program, dated October 2002, governs the handling of HAZMAT for the HO site. The management plan complies with applicable Federal, State, and local regulations that govern the use of HAZMAT and the disposal of hazardous wastes. The handling of hazardous waste emergencies at MSSC is directed by the Hazardous Material Emergency Response Plan for the MSSC, which was most recently revised in June 2004 by Boeing LTS, which has the prime responsibility for spill response,

There has been only one recorded material spill incident within HO. On September 11, 1999, a subcontractor working at MSSC released 330 gallons of a 20 percent mixture of propylene glycol and water into the cinders and rock. (NOTE: The Food and Drug Administration (FDA) has determined propylene glycol to be “generally recognized as safe” for use in food, cosmetics, and medicines.) All required notifications were made to the appropriate agencies and personnel and a containment trench and plastic covering were installed immediately. Because the material did not violate the Resource Conservation and Recovery Act and was not Federally-regulated, the Environmental Protection Agency (EPA) was not contacted.

Hazardous materials related to the operation of current HO facilities, and as required for the proposed ATST Project require transportation on the public roads leading to the site. This includes the Park road corridor, which is subject to traffic congestion during peak tourist seasons and times of day. Since the risk posed by potential spills of HAZMAT would be heightened in the presence of traffic congestion, the transportation of these materials would be scheduled in advance with HALE to avoid peak traffic hours.

The other safeguards and regulations that would apply to the transportation of HAZMAT are outlined in Section 2.4.4-Telescope Operation Activities.

ES-3.8.2 Solid Waste

Because of the remote location of HO, each facility must be diligent when handling or managing waste. Each facility within the HO complex has its own trash receptacle and each facility's building maintenance personnel are responsible for trash collection. Non-hazardous trash is disposed of off-site in a licensed landfill, with computer paper and aluminum being recycled.

ES-3.9 Infrastructure and Utilities

The ROI for infrastructure and utilities includes both HO and the Park road corridor. The affected Infrastructure and Utilities consist of wastewater treatment, stormwater and drainage systems, electrical and communications systems, and roadways and traffic. A detailed description of these systems may be found in Section 3.0-Description of Affected Environment.

ES-3.9.1 Wastewater and Solid Waste Disposal

Septic tanks are the primary means of sewage disposal within the summit area. There is no central waste/sewage collection or storage system at the Haleakalā summit. Each user provides for the collection and proper storage of wastewater and sewage generated by that site. Trash collection is the responsibility of building maintenance personnel for each facility located within the HO complex. Non-hazardous trash is disposed of off-site in a licensed landfill, with computer paper and aluminum being recycled. Hazardous wastes and petroleum product wastes are segregated at the generation point and handled separately.

ES-3.9.2 Stormwater and Drainage System

At the HO site, this confining layer of basalt ranges from depths of 5 to 20+ feet. The significance of a confining layer of basalt near the summit area is that all precipitation falling near the summit is infiltrated and flows subsurface toward the natural drainage courses such as Manawainui Gulch. As a result, runoff from the impervious surfaces associated with HO facilities and adjacent roads may not increase the total volume of stormwater flow entering natural drainages, but may only affect the way it is transported there.

ES-3.9.3 Electrical and Communications Systems

Maui Electric Company generates electricity for the HO site. There is a 3750/4688 kVA transformer at the Kula substation that presently serves HO. The site is connected via 23 kilovolts (kV) conductors on power lines to a 450 kVA transformer bank and voltage regulators at a substation within HO and distributed from there.

Hawaiian Telcom provides telephone and other communications services for the HO complex. HO is currently served for data and telephone connectivity by a range of copper, fiber-optic, and microwave lines. The U. S. Air Force facilities are served by a dedicated fiber cable with OC3C capacity. The IfA facilities are served by a microwave link with DS3 capacity. Hawaiian Telcom provides commercially available copper and fiber-optic lines to HO with more than 100 percent reserve capacity.

The FAA operates and maintains 50-Watt transmitter and receiving equipment for remote air/ground interisland and trans-Pacific communications to and from aircraft. The antennas for these transmitters/receivers are located on two towers within the FAA property adjacent to HO. The frequencies for transmission and receiving are in the Very High Frequency (VHF) and Ultra-High Frequency (UHF) radio bands, to and from transiting aircraft at altitudes from 8,000 to 50,000 feet.

ES-3.9.4 Roadways and Traffic

The Haleakalā Crater Road (State Route 378) is the only route to the summit of Haleakalā. Various route options to the summit intersect in the Kula community, from which a single, two-lane County- and State-maintained road ascends to HALE, which continues as a two-lane thoroughfare owned and maintained by HALE. The Park road corridor continues to the Park boundary adjacent to HO.

The condition of the road through HALE has been investigated by the FHWA. The pavement condition, at the time of the field testing campaign conducted by the FHWA in early 2009, is characterized in three different sections, identified by milepost (MP) location. The condition of the road, bridge and culverts are discussed, as is the estimated service life of the road sections.

There are two other access roads that serve the Haleakalā summit area. The FAA maintains an exclusive access road to facilities in the Saddle Area and the FAA Low Site. There is also an unimproved access road known as Skyline Drive originates at the Saddle Area and traverses the Southwest Rift zone, ultimately leading to Spring State Recreation Area (also known as Polipoli State Park).

The State of Hawaiʻi Department of Transportation (DOT) conducted the most recent 24-hour traffic survey on September 19 and 20, 2007 (DOT, 2007). This survey was conducted at the intersection of Haleakalā Crater Road, Haleakalā Highway, and Kekaulike Avenue and counted individual vehicles traveling on Haleakalā Crater Road. The traffic counts are relatively consistent with a previous traffic study in 2003, which recorded a total two-way 24-hour traffic volume of 1,616 at the same location.

ES-3.10 Noise

The ROI for noise includes the HO, the Park road corridor, Sliding Sands trail, and the Haleakalā Crater. Hawaiʻi has adopted Statewide noise standards that apply to fixed stationary noise sources and equipment related to agricultural, construction, and industrial activities. The alternatives under the proposed ATST Project involve various construction-related activities, as well as the introduction of stationary sources. The project area is zoned as a Class A district under these Statewide community noise regulations (State of Hawaiʻi, HAR 11-46-4). Class A zoning districts include “all areas equivalent to lands zoned residential, conservation, preservation, public spaces, open space or similar type,” and are the most restrictive of maximum allowable ambient noise levels.

Management policy outlined by the National Park Service states, “The Service will take action to prevent or minimize all noise that, through frequency, magnitude, or duration, adversely affects the natural soundscape or other park resources or values, that exceeds levels that have been identified as being acceptable to, or appropriate for, visitor uses at the sites being monitored.” Noise levels above the natural soundscape can affect the way that visitors experience a National Park. In HALE, various land features such as the summit, the crater, and various other mountain terrains can affect the way that sound attenuation occurs throughout the Park.

There are no noise-sensitive human receptors at HO, such as residences, schools, hospitals, or other similar land uses where people generally expect and need a quiet environment. In addition, HO is not open to the public, The public areas closest to the proposed ATST Project area are the Puʻu ʻUlaʻula Overlook in HALE, which is approximately a quarter mile away, and the Pa Kaʻoao (White Hill) Visitor Center, which is approximately half a mile away. Potential noise-sensitive biological receptors, such as ʻuaʻu, are discussed in Section 3.3.3-Faunal Resources.

ES-3.11 Climatology and Air Quality

The ROI for determining the affected environment for climatology and air quality includes both HO and the Park road corridor.

ES-3.11.1 Climatology

Maui stands out among the other islands in the County as having the tallest summits and thus the most extreme climate variations. The elevation at the summit of Haleakalā is 10,023 feet above sea level (ASL) and at times experiences snow and hail. In contrast to the beach areas, the summit of Haleakalā can become quite cold at times, with low temperatures that can be below freezing levels. Rainfall on Maui usually is heaviest in the mountain areas, while the beaches and coasts are the driest. Rainfall on Haleakalā peaks in a band at elevations between 3,000 to 5,000 feet ASL where the moisture-laden trade winds are cooled as they rise against the mountain front and are held below 5,000 feet ASL by a temperature inversion that acts as a climatological boundary in the Hawaiian Islands. At higher elevations, the air can be much drier, resulting in average rainfall of from less than 15 inches to as much as 60 inches a year.

ES-3.11.2 Air Quality

All areas in Hawaiʻi are considered to comply with Federal and State ambient air quality standards; no areas of Hawaiʻi are classified as non-attainment or maintenance areas. Therefore, all of Maui, including Haleakalā, is currently an attainment area for EPA "criteria" pollutants, which include sulfur dioxide, nitrogen oxides, carbon monoxide, ozone, lead, and certain particulate matter. Furthermore, Haleakalā is categorized as a "Class 1" area under the Clean Air Act's Prevention of Significant Deterioration Program, a category the EPA reserves for the most pristine areas of the country in order to maintain the excellent level of air quality already attained.

The relatively limited commercial or industrial development in Haleakalā results in few local anthropogenic (manmade) emission sources with the potential to affect air quality at HO. However, since the natural substrate at the proposed Project site is a mixture of fine volcanic sand and cinders, a small amount of naturally occurring fugitive dust from the finer material is released when the substrate is disturbed. The primary sources of anthropogenic pollutant emissions at HO are the intermittent activities associated with existing research facility operations. These include low-impact mobile emission sources, such as light vehicle traffic to and from the summit, as well as stationary source emissions resulting from periodic testing of diesel-fueled emergency generators. General maintenance activities at HO likewise result in temporary and low-impact emissions.

ES-3.12 Socioeconomics and Environmental Justice

The ROI for socioeconomics and environmental justice is the island of Maui. This section is a description of the contribution of the proposed ATST Project to the economy and the sociological environment of the ROI, as well as any effects on minority or low-income communities or the health and safety of children within this region.

ES-3.12.1 Resident Population and Housing

The population of the County of Maui almost doubled between 1980 (71,600) and 2006 (139,995). While the increase in population in the State of Hawaiʻi was approximately 29.2 percent, between 1980 and 2006, the population increase for the County of Maui was approximately 97.5 percent.

Total housing units in Maui County increased by 12.8 percent from 2000 to 2006. For 2000, the rate of owner-occupied units on Maui and Maui County was 44 percent. For 2006, the rate of owner-occupied units for Maui County was approximately 59 percent, similar to that of the State of Hawai'i. The vacancy rate in 2006 was 25.3 percent for Maui County and 13.5 percent for the State of Hawai'i.

ES-3.12.2 Employment, Economy, and Income

In the third quarter of 2007, Maui County experienced sharp increases in the number of unemployed people pushing the unemployment rate above 3.0 percent. In that same period, Maui County recorded 1,450 or 2.0 percent more jobs than in the same quarter of 2006. This section also presents the distribution of employment among the various industry sectors and the changes experienced in these sectors between 2001 and 2005 for Maui County and the State of Hawai‘i. For 2001 and 2005, the construction, accommodation and food service, and government sectors were the major source of employment and personal income in both the State and County.

ES-3.12.3 Education

Maui’s school district has a total of 57 schools, with 31 public and 26 private schools. The number of teachers in public schools for the school year 2003 to 2004 was 1,285, with an enrollment of 21,408 students. The number of high school enrollment in public schools for 2003 to 2004 was 5,699. The total number of degrees earned from Maui Community College in 2004 was 308, including 196 associate degrees and 112 certificates of achievement. During fall 2004, there were 1,146 full-time students and 1,850 part-time students. The UH had a total of 56 distance-learning courses in 2005 from Maui County.

Various educational outreach programs for students and others that have potential significance for the proposed ATST Project are currently underway on Maui. These include:

1. The Faulkes Telescope Facility within HO, which provides observations for students in Hawai‘i and the United Kingdom.
2. University of Hawai‘i Space Grant Program, which has previously sponsored students at Maui Community College in astronomy-related projects.
3. Towards Other Planetary Systems program, a five-year NSF-sponsored Teacher Enhancement program.
4. Center for Adaptive Optics (CfAO), which is a partnership between the National Science Foundation Science and Technology Center that is headquartered at the University of California-Santa Cruz, Maui Community College, and the Maui Economic Development Board.
5. The CfAO Akamai Internship Program is designed for all community college and university undergraduates in Hawai‘i –- and kama‘āina studying on the mainland – who are interested in pursuing a career in science, technology, engineering or math fields and have had to overcome barriers to achieve their educational and/or career goals.
6. The Professional Development Workshop brings graduate students and post-doctorates from CfAO’s mainland sites together with community college faculty members and observatory personnel from Hawai‘i for an intensive 5-day training on inquiry-based teaching methods.
7. Industry/Education Collaborative, in which a key component to the success of the partnership comes from a strong collaboration with the technical and scientific community on Maui. Specific activities have been developed to engage this community, as well as mechanisms to obtain input on the courses and programs

ES-3.12.4 Environmental Justice and Protection of Children from Environmental Health or Safety Risks

The primary area of the ROI for this section is the HO. The SDEIS contains a discussion of environmental justice issues in accordance with Executive Order (EO) 12898, and a discussion relating to the protection of children from environmental health risks is presented in accordance with EO 13045. EO 13045, Protection of Children from Environmental Health Risks and Safety Risks, April 1997, seeks to protect children from disproportionately incurring environmental health risks or safety risks that might arise from Federal policies, programs, activities, and standards. Environmental health risks and safety risks to children are those that are attributable to substances that a child is likely to come into contact with or to ingest.

The HO site is clearly defined and a posted sign at the entrance indicates that access to the area is restricted and off limits to unauthorized personnel. The only people who would typically occupy the HO site and proposed ATST project area would be employees of the various facilities or visiting members of the scientific community. Native Hawaiians are welcome to enter for cultural and traditional practices as indicated by the language on the sign.

ES-3.13 Public Services and Facilities

The ROI for determining the affected environment for public services include both HO and the Park road corridor. Public Services and Facilities include police and fire protection, schools, recreational facilities, and healthcare services.

ES-3.13.1 Police Protection

In 1987, the Maui County Police Department (MPD) moved from its old location at 250 High Street in Wailuku, to the current location at 55 Mahalani Street in Wailuku. The station is named Hale Makaʻi. Police substations are located in various communities around the County. The closest police substation is located in Makawao approximately 29 miles from the summit of Haleakalā. A new police substation currently being constructed is located in Kula, which is the community closest to the summit but still approximately 22 miles away. The MPD has no jurisdiction over HALE activities. HALE Federal law enforcement officers are the exclusive policing authority within HALE.

ES-3.13.2 Fire Protection

The island of Maui has ten engine companies, two ladder companies, one rescue/hazmat company, two rescue boats and two tankers. In addition, the department leases a helicopter for rescue and wild land firefighting. The closest fire station is located in Kula approximately 28 miles away from the summit of Haleakalā. Another fire station serving the Upcountry community is located in Makawao approximately 29 miles from the summit. These two fire stations, although the closest to HO, are beyond fire fighting capabilities for HO. National Park Wildlife Firefighters work for the common goal of fire management, wildland fire use, fire prevention, and fire suppression. A militia comprised of approximately 10 to 12 wildland firefighters reside on Maui and are certified for this responsibility

ES-3.13.3 Schools

The closest schools to the proposed ATST Project are located in the Kula community (Haleakalā Waldorf School, King Kekaulike High School, Kula Elementary School, and the Kamehameha Schools) and are approximately 25 to 27 miles from the summit of Haleakalā.

ES-3.13.4 Recreational Facilities

The Haleakalā Visitor Center of HALE is located approximately two-thirds mile northeast of HO and is one of the main points of attraction for visitors of the mountain. Overlooks with orientation panels and descriptive displays are located at Leleiwi, Kalahaku, and Puʻu Ulaʻula along the Park road between the Park Headquarters Visitor Center and the summit. The rare ʻahinahina (Haleakalā Silversword) plants that can be seen at Kalahaku draw many nature enthusiasts.

Annually, 1.7 million visitors are attracted to and enjoy the summit, crater, and the 24,000 acres of pristine wilderness of HALE because of the excellent walking, hiking, and horseback riding opportunities available. As of March 18, 2008, the NPS has issued a News Advisory that the moratorium of commercial downhill bicycle rides in HALE will continue pending a full evaluation of all effects from the activity in the Park's Commercial Services Plan.

The Skyline Trail begins at the 9,750-foot elevation at the lowest point of the paved access road near the Saddle Area and continues for about 6.5 miles, ending at the Polipoli Spring State Recreation Area. Trails through the area are open to the public for hiking and related recreational activities except during times of extreme fire danger or inclement weather.

The Park Headquarters Visitor Center, Haleakalā Visitor Center, and the Kipahulu Ranger Station (located on the east side of Maui) have cultural and natural history exhibits. In addition, these facilities have books, maps, and postcards for sale. Rangers are on duty during business hours to answer questions and assist visitors. Periodic, guided interpretive hikes and activities are available at both the Haleakalā Visitor Center and the Kipahulu Ranger Station.

There is no food or gas available within the Park. Restrooms are located at the Haleakalā Visitor Center, Kalahaku Overlook, Park Headquarters Visitor Center, and Hosmer Grove and are handicapped accessible. Limited emergency services are available at both the Park Headquarters Visitor Center and Headquarters. When snow and/or icy conditions warrant, the Park closes the road.

ES-3.13.5 Healthcare Services

The Maui Memorial Medical Center, located in Wailuku and approximately 50 miles from the summit, is the only full-service hospital on Maui offering a broad range of emergency services including complex diagnostic and treatment services. The formerly named Kula Hospital, located in Keokea, is approximately 40 miles from the summit. Beginning October 31, 2005, the newly named Kula Hospital and Clinic began providing urgent care and limited rural emergency care on a 24-hour, 7-day a week basis offering basic lab and x-ray services and an Emergency Department. The Kula Clinic portion of the facility is a comprehensive outpatient clinic with normal business hours Monday through Friday. Emergency medical service stations are located in Kula and Makawao, which dispatch emergency medical care.

ES-3.14 Natural Hazards

The ROI for this section includes the HO and Park road corridor. Natural hazards in the State of Hawai‘i consist of drought, earthquakes, high surf, high winds, storms and hurricanes, tsunamis, volcanoes, and wildfires. Depending on the lower elevation areas affected by occurrences of these natural hazards, any part of the population could be affected.

Natural hazards at the higher elevations of Haleakalā consist of the potential for earthquake movement, hurricanes, high winds, snow, ice, extreme cold, which can produce hypothermia after even brief exposure to the cold conditions common on the summit, and hypoxia, which can occur because of the thinner air at the high elevation. The specific nature of these hazards is discussed in detail in Section 3.0-Description of Affected Environment.

The 18.166 acres of HO is restricted to only a small number of employees of the various facilities working any time within a 24-hour period. The area outside of HO belongs to the HALE and is predominantly utilized by tourists and HALE personnel during the day. HALE closes the Park road whenever any of the weather conditions listed below becomes critical and serious enough to warrant protecting human life.

Although drought and the possibility of subsequent wildfires is a normal, recurrent feature of climate, it can occur in virtually all-climatic zones, with its characteristics varying significantly from one region to another. Drought is a temporary aberration and differs from aridity, since the latter is restricted to low rainfall regions and is a permanent feature of climate.

Earthquake movement can sometimes be felt at the summit of Haleakalā. Hawaii’s largest earthquakes, up to magnitude 7.5 to 8.1, are associated with dike intrusions into the active volcanoes and expansion of the volcanoes across the old seafloor. While such events can be felt on Maui, they occur too far away to cause any damage. There are, however, other earthquakes that are potentially damaging; caused by the load of the Hawaiian Islands on the Pacific lithosphere.

Hurricanes do not strike Hawai‘i often, with most weakening before reaching Hawai‘i, or passing harmlessly westward and south of the Islands. However, strong winds are always a potential threat from these rare storms, which can occur from June to November, with wind speeds increasing at the higher elevations such as the summit of Haleakalā.

Temperatures commonly range between 40 and 65 degrees Fahrenheit, but can be below freezing at any time of year with the wind chill factor. Hypothermia is a medical condition in which the victims' core body temperature has dropped significantly below normal (occurring below 95 degrees Fahrenheit) and normal metabolism begins to be impaired.

Ice and snow conditions can occur on the Haleakalā roadways making it dangerous for motorists, because, visually, the road appears wet, rather than icy. Under black ice conditions drivers should be prepared to expect little to no traction, little to no braking capability, extremely poor directional control, and the high possibility of skids.

Hypoxia is a pathological condition in which the body as a whole (generalized hypoxia) or a region of the body (tissue hypoxia) is deprived of adequate oxygen supply. Hypoxia is often associated with high altitudes, where it is called altitude sickness. Altitude sickness, also known as acute mountain sickness, is a pathological condition that is caused by lack of adaptation to high altitudes, commonly occurring above 8,000 feet. Symptoms of generalized hypoxia depend on its severity and speed of onset.

ES-4.0 SUMMARY OF ENVIRONMENTAL CONSEQUENCES, CUMULATIVE EFFECTS, AND MITIGATION

Each section describes the methodology used for effect analysis and factors used to determine the significance of effects according to the criteria described in Federal and State regulations. Effects are described where they occur for each resource, including direct, indirect, and cumulative effects. Direct effects are caused by the proposed ATST Project, achieved through implementation at either the Mees site or the Reber Circle site, and occur at the same time and place. Indirect effects are caused by the proposed ATST Project and respective project alternative, but occur later in time or at a distance from the proposed ATST Project. Cumulative effects are the incremental environmental effects of the proposed ATST Project when added to other "past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." Cumulative effects can result from individually minor, but collectively significant, actions taking place over time. The No-Action Alternative is evaluated under the same parameters following the alternative analysis. Effects are described by the following levels of significance:

1. Major,
2. Moderate,
3. Minor; or,
4. Negligible.

This section also evaluates effects based on whether they are long-term or short-term in duration.

ES-4.1 Land Use and Existing Activities

The ROI for Land Use and Existing Activities includes both HO and the Park road corridor. If implemented at the Mees site or the Reber Circle site, the proposed ATST Project would have minor adverse, long-term effects on its current land use designated as Conservation District, General Subzone. No mitigation would be necessary. Under the No-Action Alternative, the proposed ATST Project would not be built and the land use and existing activities at HO would continue to function in its current configuration. There would be negligible adverse effects on land use and existing activities.

ES-4.2 Cultural, Historic, and Archaeological Resources

The ROI for cultural, historic, and archeological resources is considered to be the HO and relevant areas within HALE, including the Park road corridor.

Cultural Resources. Following issuance of the September 2006 DEIS and in response to numerous comments, the Supplemental Cultural Impact Assessment (SCIA) was conducted by Cultural Surveys Hawaiʻi and issued as a publicly distributed report. As concluded in the SCIA, it is apparent that immediate and cumulative effects are expected by the proposed ATST Project atop Haleakalā. Immediate and short-term effects to the summit of Haleakalā would be associated with activities directly related to the construction of the facility, itself, at either proposed site, as well as potential effects to the surrounding infrastructure during the construction phase (i.e. soil and construction staging areas and/or increased use of the roadways).

The assessment needs to take into account the whole of the summit and crater area. Based on the testimony presented by the community, there is a necessity for some people to have an unimpeded view plane from mountain to ocean, particularly in the context of ceremonial activities. For some Kanaka Maoli, the unaesthetic nature of the proposed ATST Project has led to further objections about another observatory as an additional "eye sore" to the summit area. It would compound the adverse effects of the already existing facilities.

The anticipated adverse effects on the summit area of Haleakalā that would result from the construction and day-to-day use of the proposed ATST Project facility brought forth strong opposition from the majority of the Native Hawaiian community who participated in the scoping and public comment period. Responses to the proposed ATST Project were deeply emotional and, for some, the idea of an additional building atop the summit was physically painful.

Also, during the course of Section 106 consultations, the issue of "cultural desecration" due to excavation of Haleakalā's material was also raised on several occasions. Misinterpretation of site plans early in the scoping process inferred that the excavation would be some five stories in depth, which added to the perception that a deep wound would be inflicted on the mountain summit. More explicit information provided by the ATST Project personnel at later Section 106 meetings, indicating that the actual excavation would be no more than about 21 feet, did not appreciably alter the perception of wounding the summit.

Although not nearly as prevalent, there was testimony in support of the proposed ATST Project. In most instances, supporters strongly rallied for educational benefits of Hawaii's youth and the possible opportunities that such a facility might bring to Native Hawaiians.

Mitigation measures during construction would include a cultural specialist to provide oversight for all construction activities and "Sense of Place" training prior to any personnel working at the site, which would reduce the impact on cultural resources from major to moderate, adverse, and long-term. Traditional practices taking place within the ROI require silence/solace and uninterrupted view plane/sacred space. The amount of noise and construction-related activities associated with the proposed ATST Project would have a major, adverse, and short-term effect on the protocols of traditional cultural practices within the ROI. Specifically, the noise generated from the existing facilities at HO and the noise resulting from the construction and operation of the proposed ATST Project would have, during certain times of the day and during certain months, major, adverse impacts on the ability to conduct such practices. Mitigation measures would include restricting on-site construction noise until 30 minutes after sunrise and 30 minutes before sunset ,as well during certain months of the year, along with limitations on the hours and months during which wide load vehicles can come through the Park.

Operations at either the Mees site or the Reber Circle site would continue to have a noticeable effect on the conduct of traditional practices within the ROI due to built facilities, people, and associated noise. However, these effects would be considered minor, adverse, and long-term.

Only ATST-related construction activities have the potential to impact the Park road corridor, and as described in Section 4.10-Noise, noise levels and traffic restrictions would result in negligible, adverse, and long-term impacts on one's ability to practice traditional cultural practices within the Park road corridor.

Recommendations from the SCIA. Based on the information gathered during preparation of the SCIA, the overwhelming evidence from a cultural and traditional standpoint point toward a major, adverse, and long-term effect on some Native Hawaiian traditional cultural practices and beliefs. This determination of major, adverse ,and long-term effect would apply to both the Mees and the alternative Reber Circle sites. To the majority of Native Hawaiians and non-Hawaiians who participated in this process, the proposed undertaking is immitigable and, therefore, following the No-Action Alternative and keeping both the Mees site and Reber Circle site in their current undeveloped state was strongly recommended.

In the event that the proposed ATST Project is approved and funding secured, the SCIA recommended that more time for mitigative proposals be allotted and the development of working relationships with Native Hawaiian groups be actively pursued. As Haleakalā plays a central role in the history and culture of Maui Island Kanaka Maoli.

Two proposals, submitted by Mr. Warren Shibuya and Kahu Charlie Maxwell, were put forth as a potential means to mitigate the effects of the proposed undertaking. While these individuals may not agree with or support the construction of the proposed ATST Project, there is a feeling that Native Hawaiians may be able to derive a benefit in the form of educational facilities from allowing for the use of the summit for astronomy and observation. Informal proposals presented in a talk-story format by the Kahikinui Homestead Community included full scholarships for Native Hawaiian students with an award preference to the students and youth of Kahikinui, as well as the development of a mentorship program between Native Hawaiian students and scientists working atop Haleakalā. The goal of the proposed programs would be to even the educational field and, as Kahu Maxwell points out in his proposal, make it possible for Native Hawaiians to become experts in astronomy. The implication in these proposals is that someday those studying and operating the observatory facility would be Kanaka Maoli.

Maui Community College (MCC) in Kahului, Hawai`i presented a mitigation proposal in response to the proposed ATST Project. As a mitigation initiative, the proposal requests funding to establish a program to be called "Akeakamai I Ka Lā Hiki Ola". The main goal of the program would be to improve the achievement success of Native Hawaiians in math and science, or more specifically, Science, Technology, Engineering, and Math (STEM), to grow workforce advancement and job opportunities for Native Hawaiians. The proposal originates from an underlying assumption of the value of the Sun as a primary source of energy and life itself, which is recognized by kupuna (elders) and scientists alike.

Historic Resources. At the Mees site, there are no historic sites within the grading and leveling footprint, soil placement area, and the staging and lay down area and therefore no recovery plan or preservation plan for specific sites within that footprint were necessary. The only historic site at HO is the Reber Circle site, the radio telescope foundation. Construction and operations of the proposed ATST Project at the

Mees site would not result in any impacts to the Reber Circle site. Accordingly, the effects on historic resources from construction and operation activities are expected to be negligible, adverse, and long-term.

The Park road corridor is a historic cultural landscape. It is the main access road to HO and would be traveled by all vehicles needing access to the Mees site. The Park road corridor is a functioning thoroughfare which is used on a daily basis, and it is part of an historic roadway that has been evaluated by the NPS and Historic American Engineering Record (HAER) as eligible for listing in the National Register of Historic Places. In addition, the Park road corridor is within the boundaries of the Crater Historic District. According to the findings set forth in the recent road report prepared by the FHWA, the relatively small increase in traffic due to construction and operation activities would have little measureable effect on traffic or wear to the Park road corridor, including the historic bridge and box culverts. Therefore, construction-related effects are expected to be minor, adverse and short-term. Operations-related effects on the Park road corridor would be less than the effects from construction-related activities, as the level of traffic related to the proposed ATST Project along the Park road corridor would be less. The intensity of these effects on historic resources within the Park road corridor, however, would remain at minor, adverse, and short-term.

Archeological Resources. Archeological inspection of the Mees site indicates that this portion of the HO parcel was previously affected by earthmoving activities associated with the construction of the MSO facility in 1964, existing access road, weather tower structures, and other structures. It is anticipated that construction related operations at the Mees site would result in negligible, adverse, and long-term effects on archeological resources identified by inventory surveys described in Section 3.2.3-Archeological Resources. The grading and leveling, soil placement areas, and staging and lay down areas that would be employed for the Mees site would not affect any archeological features. The construction activities at the Mees site would be conducted in accordance with the “Science City” Preservation Plan that has been approved by the SHPD. The plan calls for passive preservation of sites during future activities. In the event that a burial site is uncovered during construction of the proposed ATST Project, the requirements of HAR, Title 13, Subtitle 13, Chapter 300, Rules of Practice and Procedure Relating to Burial Sites and Human Remains would be followed.

The construction and operations related activities that would be employed for the Mees Site would not impact any archeological resources within the Park road corridor. The relevant activities that have the potential to affect archeological sites within the Park road corridor include the ATST construction and operations related traffic. Such traffic is expected to remain on the Park road and, thus, would not impact any nearby archeological sites. Therefore, there would be negligible, adverse, and long-term effects on archeological resources along the Park road corridor from the Proposed Action.

Construction- and Operation-Related Effects at the Reber Circle Site

Cultural Resources. By virtue of its height and location within HO, the construction of a project with the vertical elevation of the proposed ATST Project would be more visible from both HALE and populated communities on Maui than at the Mees site. Some Native Hawaiians would interpret the visibility of the proposed ATST Project from these vantage points as cultural desecration of a sacred site. The effects to those individuals would be similar or more pronounced at the Reber Circle site than if construction were at the Mees site. With the exception of the increased vertical elevation, the analysis set forth above for the Mees site applies equally to the Reber Circle Site with regard to impacts on cultural resources, including impacts to traditional cultural practices.

Historic Resources. Construction at the Reber Circle site, which lies at the peak of Pu‘u Kolekole, would have a major, adverse, and long-term impact on what has been described in Section 3.2.3-Archeological Resources as the remnant of a 1952 radio telescope experiment. Applying mitigation measures such as removing the resource in accordance with the Archaeological Data Recovery Plan would reduce the level of effects to moderate, adverse, and long-term. The effects on historic resources based on operating the proposed ATST Project at the Reber Circle site would be negligible, adverse, and long-term.

Archeological Resources. The construction and operations related activities that would be employed at the Reber Circle site would not have any impact on archeological resources identified in the inventory surveys described in Section 3.2.3-Archeological Resources. The construction and operations related activities that would be employed for the Reber Circle Site would not impact any archeological resources within the Park road corridor. The relevant activities that have the potential to affect archeological sites within the Park road corridor include the ATST construction and operations related traffic. Such traffic is expected to remain on the Park road and, thus, would not impact any nearby archeological sites. Therefore, there would be negligible, adverse, and long-term effects on archeological resources along the Park road corridor from the Proposed Action.

Evaluation of Potential Effects for the No-Action Alternative

There would be no affect to cultural, historic, and archeological resources under the No-Action Alternative, as the proposed ATST Project would not be constructed.

ES-4.3 Biological Resources

For evaluation of the potential effects on biological resources as a result of implementing the proposed ATST Project, the ROI would be primarily within both the HO and relevant areas within HALE, including the Park road corridor. Effects on biological resources were evaluated by determining sensitivity, significance, or rarity of each resource that would be adversely affected by the proposed ATST Project. The effects of the proposed ATST Project on each element of the biological ecosystem is explained in this section.

For botanical species during construction, overall effects at HO are anticipated to be minor, adverse, and long-term. These same resources would experience negligible, adverse, and long term effects within the Park road corridor. Effects along the road corridor on botanical Alien Invasive Species would be minor, adverse, and long-term, with respect to introduction and proliferation.

During construction, the anticipated effects on endangered, threatened, proposed, and candidate plant species would be negligible, adverse, and short-term. These species include the ʻahinahina (Haleakalā silversword) and the *Geranium multiflorum.*

With respect to endangered, threatened, proposed, and candidate avifaunal species, construction activities that could induce ground vibration (i.e., heavy equipment grading, excavating, drilling, and compacting) that could adversely affecting ʻuaʻu nesting and fledging success. Confirmed causes of ʻuaʻu mortality could arise from construction include nest collapse, predation by introduced predators, road-kills, collision into such objects as buildings, utility poles, fences, lights, and vehicles.

During informal consultation with the USFWS, mitigation measures implemented by NSF (Section 4.18-Mitigation) in coordination with USFWS would reduce potentially adverse effects to negligible long-term. Mitigation measures to limit road noise, vibration, or transportation of non-native species that could further endanger petrels are discussed.

Construction effects on nēnē (Hawaiian goose) were evaluated. Nēnē may be affected by human activities through the application of pesticides and other contaminants, ingestion of plastics and lead, collisions with stationary or moving structures or objects, entanglement in fishing nets, loss of habitat, disturbance at nest and roost sites, attraction to hazardous areas through human feeding and other activities, and mortality or disruption of family groups through direct and indirect human activities. None of these activities are anticipated to occur within the normal habitat of the nēnē in connection with the construction of the proposed ATST Project and, therefore, negligible adverse short- or long-term effects are anticipated from these activities. The risks to nēnē from vehicular activities are discussed and calculations from historic mortality data indicate an extremely small risk of collision with a vehicle connected with the proposed ATST Project during its lifetime.

Threats to the ‘ope‘ape‘a (Hawaiian hoary bat) identified by the USFWS, some of which could potentially occur at HO, include direct and indirect effects of pesticides, predation, alteration of prey availability (introduced insects), and roost disturbance. Use of either the Mees site or Reber Circle site would not change the current operating procedures or the associated effects on the ecosystem and, although it may affect the extent, the proposed ATST Project would have a negligible adverse long-term effect.

During construction at the Mees site there would be negligible, adverse, and long-term effects on other native and introduced fauna within the ROI. These would include feral goats, rats, avian species, mongoose, cats, and others.

Operations-related effects on biological ecosystems at the Mees Site would be similar to those during construction. Loss of numbers and diversity of native plants has already occurred at HO, and, therefore, it is anticipated that botanical resources would experience the same minor adverse, long-term effects from operations of the proposed ATST Project at the Mees site. It is anticipated that operations of the proposed ATST Project at the Mees site would have negligible, adverse, long-term effects on the small ‘ahinahina population found at HO. Vehicular traffic would increase within the Park road corridor by less than or equal to about one percent and the risk of ‘ua‘u or ‘ope‘ape‘a mortality would be negligible, adverse and long-term.

The Reber Circle site is a greater distance from ‘ua‘u burrows and is on previously developed land. Although the potential for adverse effect on that avian biological resource is slightly less at the Reber Circle site than at the Mees site, the potential still exists. With implementation of the USFWS mitigation measures, the effects on ‘ua’u would be negligible, adverse, and long-term.

Under the No-Action Alternative, no construction would take place and operations would continue unaltered. Therefore, the proposed ATST Project would result in no additional effects. Effects resulting from previous construction and current operations at HO, which include those described below, would continue to occur. These are described in this section.

ES-4.4 Topography, Geology, and Soils

The ROI for topography, geology, and soils is HO and the Park road corridor.

Construction of the proposed ATST Project at the Mees site would require excavation and would result in excess soil placed at locations outside the ATST footprint. The material would be spread over a soil disposal area that would not affect the topography. Minor adverse effects on soils from construction activities and future erosion could be expected during construction of the ATST at the Mees Site.

If the proposed ATST Project were to be constructed at the Reber Circle site, the pu‘u would not be restored as a mitigation measure, as suggested in Vol. II, Appendix F(1)-Cultural and Historical Evaluation. The construction of the proposed ATST Project at the Reber Circle site would not have any effect on the topography, geology, and soils; therefore, no mitigative measures would be planned. Minor adverse effects on soils from construction activities and future erosion could be expected during construction of the ATST at the Reber Circle Site.

Construction and operations-related effects are discussed for the proposed ATST Project at Mees site and Reber Circle site, including effects from land clearing, demolition, grading/leveling, excavating, soil retention and placement, construction, paving and other site improvement activities which may increase the potential for soil erosion and off-site transport of sediment. Park topographic, geological, or soil resources are not expected to be affected during construction and operations of the proposed ATST Project.

There would be negligible adverse or beneficial effects to topography, geology, and soils under the No-Action Alternative,

ES-4.5 Visual Resources and View Plane

The ROI for consideration of effect on visual resources encompasses certain portions of the landmass of Maui, HO, and other areas within HALE (including the Park road corridor) from which structures at HO are visible.

To assess the potential effect of the proposed ATST Project to the viewshed within the ROI, the methodology included evaluation of the effects from past and present actions. Viewshed visibility was computer-modeled using software and potential effects on the Maui viewshed were evaluated using photographic renderings of the proposed ATST Project. Digital photos from various locations on Maui were taken during various times of the year and times of day (to account for changes in atmospheric transparency and lighting) and were then mathematically analyzed to provide accurate positional information for the proposed ATST Project within the HO complex. Using ATST architectural plans and field measurements at HO as the basis for layered graphic software renderings, correctly scaled and oriented digital images of ATST were prepared and inserted into the photographs.

The combination of all viewshed assessment methods provides a prediction of the potential visual effect ATST would have within the ROI. While ATST at the Mees site would be clearly visible as the largest structure within HO from the Puʻu Ulaʻula Overlook and from elsewhere in HALE, it would be less prominent from other locations on Maui. Distance, atmospheric transparency, terrain blocking, and other facilities in the foreground would reduce the visibility of ATST such that in some locations it would be difficult to distinguish between ATST and the other existing facilities at HO.

To assess effects on visual resources in the analyses below, a combination of quantitative and qualitative evaluations was used. The quantitative evaluations include such information as estimates of how much the actual view planes are affected by past and present actions at HO, based on objective physical effects. For the purpose of this EIS, a value of less than 1 percent is considered to be negligible, less than 10 percent considered a minor effect, more than 10 percent but less than 20 percent is considered to be moderate, and more than 20 percent considered to be a major effect. The qualitative seeks to describe in what ways those visual resources are affected from an aesthetic viewpoint. Although independently assessed, the two evaluations result in one effect intensity.

Construction would result in a moderate, adverse visual effect to observers at the Puʻu Ulaʻula Overlook, as a result of the use of three to five cranes to lift building and telescope components and as a result of the evolving building structures during construction. It is anticipated that cranes would be needed at various times over a period of approximately four years during construction. These types of obstructions would be clearly visible from the Puʻu Ulaʻula Overlook in HALE during periods when they are raised into operating position. The 250-foot crane would be considerably taller than any other structure at the summit and would be readily visible when extended during daytime working hours. As the proposed ATST Project would be constructed, the structure would become visible from the Puʻu Ulaʻula Overlook when the structure reached a height a little over 30-feet, which would be during construction of the lower enclosure. From then until the rotating upper enclosure was constructed, the proposed ATST Project would be clearly visible.

Within the part of the ROI for visual resources that includes the areas of HALE adjacent to HO but outside of the Puʻu Ulaʻula Overlook, the visibility of the proposed ATST Project construction equipment at the Mees site would be quite variable. However, it would not be visible from anywhere in this portion of the ROI until structure height reached about 30 feet. It would then be clearly visible from the summits of Pa Kaʻoao and Magnetic Peak. The effect on visual resources in this portion of the ROI from the construction of the lower and upper enclosure would be moderate adverse and long-term.

The construction of the proposed ATST Project at the Mees site would not be visible to observers on the upper two miles of the Park road corridor until the lower enclosure structure is completed, at about 78 feet above ground level. Once the lower enclosure of the proposed ATST Project is constructed, observers along the road would be able to see the structure along the Park road corridor. Again, the effect on visual resources in this portion of the ROI from the construction of the lower and upper enclosure would be moderate, adverse, and long-term.

The viewshed modeling that was completed for the proposed ATST Project predicted that structures taller than 153 feet would be seen from the crater. Therefore, the 250-foot crane, but not other shorter construction equipment, would be visible from trails and campsites within the crater. At no time during construction would the proposed ATST Project structure itself be visible within the crater. The lower enclosure and additional non-revolving section would be about 78 feet tall and the addition of the upper enclosure would bring the structure to its full 143-foot height above ground level, which is below the 153-foot threshold predicted by viewshed modeling to be visible from within the crater.

The evolving facility structure of the proposed ATST Project construction at the Mees site would not be visible from the lower portion of the Park road corridor until structure height reached about 100 feet, at which time the upper enclosure would become visible along the approximately one mile of Park road corridor from the entry station to just beyond the Park Headquarters Visitor Center, including Hosmer Grove. At that distance from the Mees site the structure would be visible but would be very similar in height and reflectivity to the other structures in HO. The effect on visual resources would therefore be minor, adverse, and long-term.

Construction of the proposed ATST Project at the Mees site would result in relatively negligible, adverse visual effects on observers in population centers on Maui as a result of construction cranes at the site, and also as a result of the increasing height of the proposed ATST Project.

When completed at the Mees site, the proposed ATST Project would be visible from portions of the Maui landmass, from HO, as well as from certain areas within HALE. However, as described for construction effects, it would not be visible from any HALE public trails or campsites within the crater or from approximately two thirds of the Park road corridor. It also would not be visible from those portions of the Maui landmass shielded by terrain. The highest intensity of effect at these locations would be moderate, adverse, and long-term.

Construction and operations-related visual effects at the Reber Circle Site would be more pronounced than at the Mees site. Major, adverse, and long-term effects would result at the Puʻu Ulaʻula Overlook and areas of HALE adjacent to HO. Other areas within the upper Park road corridor would also experience major, adverse, and long-term effects, while the lower Park road corridor would experience minor, adverse, and long-term, effects. Due to the higher ground level at Reber Circle, the top of the proposed ATST Project would be visible along trails in the crater and result in minor, adverse, and long-term effects on visual resources.

ES-4.6 Visitor Use and Experience

There would be moderate adverse, short-term effect on visitor use and experience from changes in the quality of recreational activities such as sightseeing, hiking, backpacking, photography, and camping from constructed-related noise increases, changes in view from construction activity at the proposed ATST Project and along the Park road corridor, and from air quality associated with increased construction vehicle traffic and use. These effects only occur over the short-term, would be mitigated to the greatest possible extent, and would cease to affect the visitor use experience in the long-term. There would also likely be minor beneficial, long-term effects on the visitor use experience from the proposed ATST Project, as it may open a new tour for visitors. Were this to result, this would be a minor, but beneficial effect, as it would increase the number of recreational activities available to Park users.

There would be no direct effect to the visitor use experience under the No-Action Alternative, as the visitor use experience would remain the same as the existing conditions outlined in Section 3.0-Description of Affected Environment. It is possible that over time, indirect effects would result due to a decline in facilities and outdating of available information at the Park (i.e. as a result of no changes or upgrades). Likewise, there would be no effect on the visitor use experience if the proposed ATST Project were not built.

ES-4.7 Water Resources

The ROI for this resource is HO and the Park road corridor, which are within the same system. This system is within the Waiakoa and the Manawainui Gulch watersheds. The groundwater boundaries are the Kamaole and Makawao Aquifer Systems of the Central Aquifer Sector and the Lualailua and Nakula Aquifer Systems of the Kahikinui Aquifer Sector.

The proposed ATST Project is anticipated to have negligible adverse environmental effects on the surface water or groundwater in the ROI. Based on the hydrologic modeling prepared to control runoff of the IfA facilities on Haleakalā, existing surface water features appear adequate to contain stormwater runoff at the site with the addition of the proposed ATST Project.

The proposed ATST Project would have minor adverse and beneficial effects on groundwater sources or supplies. Construction at the Mees and the Reber Circle site would include an advanced aerobic Individual Wastewater System (IWS) that would be installed to treat sanitary wastewater. The unlikely event of system failure, a potential for wastewater discharge may occur adversely affecting groundwater. However, the innovative design of the IWS and the high quality of effluent expected to discharge from the system would result in a minor beneficial, long-term effect on groundwater as compared to the existing cesspool system. The existing infiltration basin is estimated to overtop during storm events larger than the five-year recurrence interval, resulting in minor adverse short-term effects on the infiltration basin. Adherence to the guidelines in the Stormwater Master Plan (SWMP) for HO would reduce adverse effects on surface water features and drainage to negligible levels and no effect to HALE resources would be expected.

The No-Action Alternative would have minor adverse long-term effects on groundwater from potential discharges of domestic wastewater. The existing cesspool at MSO would continue to be used for wastewater treatment. Untreated wastewater and septic waste is discharged directly into the ground in cesspool systems, potentially contaminating subsurface water quality.

ES-4.8 Hazardous Materials and Solid Waste

The ROI for HAZMAT and solid waste includes HO, the Park road corridor, and the portion of the State highway leading up to the Park road corridor. The proposed ATST Project would utilize HAZMAT and produce hazardous and solid waste. The operations of the proposed ATST Project at the Mees site would have negligible adverse long-term effects on solid waste management, handling or use of

HAZMAT. Management plans have been prepared for the proposed ATST Project, containment features have been designed, and on-site training would be required for personnel. There would be no change from the current management of solid waste. Facilities would continue to be responsible for their waste. Negligible adverse effects on solid waste management would be experienced.

There would be no change from the current management of solid waste under the No-Action Alternative. Facilities would continue to be responsible for their waste. Negligible adverse effects on solid waste management would be experienced. Under the No-Action Alternative, the proposed ATST Project would not be constructed; thereby omitting any short-term use of materials. Existing facilities would continue to use materials for mirror coating and cleaning, lubrications, refrigerants, etc. Therefore, the potential for a release would still exist. Negligible adverse effects are expected as a result of the No-Action Alternative.

ES-4.9 Infrastructure and Utilities

The ROI for infrastructure is HO and the Park road corridor. These include HALE, and private, Federal, and State lands. The ROI for utilities is focused on the HO property, which is separately served by MECO and Hawaiian Telcom and the Park road leading up to HO.

To obtain objective professional guidance on effects assessment with regard to the road through the Park, HALE initially requested and the NSF subsequently supported a field investigation and preparation of a formal report by the FHWA. Their initial investigation, completed in May 2007, was inconclusive as to the extent of effect to the Park road from traffic related to the proposed ATST Project and recommended follow-up testing and further study. That additional work was later completed and the results of all the investigative efforts by the FHWA are described in their final report issued in March 2009 (revised in April 2009). This report addresses the current condition of the Park road, as well as the drainage structures along its route, consisting of one bridge and multiple culverts. The FHWA report also includes recommended mitigation measures to reduce the potential for any effects to the historic road, bridge and culverts that might occur as a result of traffic related to the construction and operation of the proposed ATST Project.

Evaluation of Potential Effects at the Mees Site

Wastewater. The removal of the existing cesspool and implementation of an independent wastewater system (IWS) under the proposed ATST Project, if implemented at the Mees site would result in a minor beneficial, long-term effect on the wastewater system. The implementation of an IWS at the Reber Circle site would have negligible adverse, long-term effects on the wastewater system.

Stormwater and Drainage System. The proposed ATST facility would capture stormwater and surface water for reuse. As such, runoff is not expected to increase as a result of the proposed ATST Project. Capturing surface water and stormwater and implementing the guidance of the Stormwater Master Plan for HO would reduce effects on surface water and drainage patterns. The proposed ATST Project would have negligible adverse, long-term environmental effects on the surface water.

Electrical Systems. The estimated total electric service for the proposed ATST Project is 960 kVA. The entirety of that load would not be concurrent. Applying a diversity factor of 70 percent, the maximum anticipated new electrical demand would be approximately 670 kVA. The reserve capacity in the existing MECO substation at HO is estimated by MECO engineers to be adequate for the existing connected loads and all currently identified future loads, including the proposed ATST Project.

Although the existing HO substation has adequate capacity, the equipment is considered obsolete. MECO is planning to upgrade it to a new 2500 kVA substation with improved efficiency and safer reserve capacity. MECO engineers would ensure that the full potential, future electrical power demand for the

ROI is considered in the design of that upgrade. With this upgrade, there should be sufficient capacity to handle activities at the Mees or Reber Circle sites.

A MECO-funded study has been completed that identified ways to reduce the peak proposed ATST Project electrical load through specification of more efficient equipment and shifting cooling loads to off-peak times. These identified strategies have been incorporated into the planning for the proposed ATST Project. All connections would be through below ground electrical lines. The MECO upgrade would result in improved efficiency and a safer reserve capacity, which would have moderate beneficial long-term effect on the electrical system at HO.

Communications Systems. The proposed ATST Project would require data connectivity of approximately 1 Gigabit per second to the base facility, assumed to be the IfA headquarters in Kula and/or Pukalani. Connectivity from the site to the base headquarters would use existing dark optical fiber from the proposed ATST Project. Arrangements are being made with the commercial provider to lease the necessary capacity. The hardware to implement the connection and the service agreement with the commercial provider would be supplemental to the existing communications connections in the ROI, and would have negligible adverse and long-term effects on them. Communication connections to serve the proposed ATST Project would be through existing reserve lines or new lines that would follow the path of existing lines. Any required new lines would be placed during site excavation.

The FAA RCAG system on Puʻu Kolekole maintains two sets of frequencies for contact with interisland air traffic down to 8,000 feet. As a result of the potential addition of the proposed ATST Project at the Mees site, physical obstruction to the geometric line-of-sight for signals from RCAG could occur. These frequencies could experience attenuation, which would be defined as signal loss in a narrow swath of 5 degrees originating at the RCAG antennas and intersecting the width of the proposed ATST Project structure about 800 feet away.

Construction-Related Effects on Roadways and Traffic

During the heavy construction phase of the proposed ATST Project, moderate, adverse, and short-term effects to roadways and traffic would occur. Traffic along State highways and Haleakalā Crater Road would be affected by heavy equipment, delivery of concrete and materials, service trips, and daily commuting of construction workers. HO and Haleakalā Crater Road would continue to be used for ongoing observatory operations. The different areas of roadway are subject to different levels of traffic, are managed by different agencies, and require varying levels of maintenance. They are treated separately in this section to allow for appropriate assessment of the effect of the construction of the proposed ATST Project.

During the construction phase of the proposed ATST Project, the roads at HO would continue to be used for ongoing observatory operations. Any necessary barricading would be temporary and would be prearranged with other road users.

The roads within HO are maintained by IfA, with contributions from all users of roads and easements. Vehicular traffic is normally slow-speed and low in volume and would not be substantially affected by the cyclic integration of construction vehicles and equipment related to the proposed ATST Project. Currently, most roadways within HO require very little maintenance and have considerable longevity. These observatory roads were not designed, however, to support unusually heavy loads, such as large trucks and construction vehicles. Construction of the proposed ATST Project would inevitably result in moderate, adverse, and short-term effects to the condition of the roads within HO.

The roadways leading to the construction site for the proposed ATST Project include a series of State-maintained highways up until the Park entrance and the Park road itself, which is managed and maintained by HALE. Traffic along these routes would primarily be affected by heavy equipment, delivery of concrete and materials, and miscellaneous service trips. The specific effect to the Park road is described in the FHWA Road Report

Since the issuance of the September 2006 DEIS, concerns were raised about potential effects to State Road 378. In response to the DEIS, the DOT, the agency having jurisdiction over this portion of the road, identified no special concerns regarding road conditions or traffic related to the proposed ATST Project. It is anticipated that there would be minor to negligible effects associated with construction-related traffic on the State roadways.

This section also addresses the effects on the Park road from construction traffic. It estimates road wear from the traffic and based on the conclusions of the FHWA Road Report, the use of the Park road by these vehicles would have a minor, adverse, and long-term effect on the longevity of the pavement. It is anticipated that there would be minor to negligible effects associated with construction-related traffic on the State roadways.

The proposed ATST Project at Reber Circle would have the same effects on wastewater, stormwater and drainage system, electrical systems, communications systems, and roadways and traffic.

ES-4.10 Noise

The ROI for noise effects is HO a 50-foot corridor along the Park road corridor and the adjacent properties that could be exposed to non-impulse noise levels above State threshold levels.

Noise effects from the construction of the proposed ATST Project along the Park Road Corridor and at HO are anticipated to be minor adverse and short-term. The effects would be primarily from point source emitters such as machinery and equipment. These noise emissions would increase the existing ambient noise levels at the summit but would be temporary and intermittent. Trucks and mobile construction machinery would also raise ambient noise above background levels during the construction period. These sounds could have an effect on Native Hawaiian cultural practitioners and those engaged in recreational activities, as discussed in Section 4.6-Visitor Use and Experience.

Construction at the Reber Circle site would result in a greater noise effect above area background levels initially relative to the Mees site, because roughly twice the volume of site material would require excavation and stockpiling under the Reber Circle site (approximately 7,150 cubic yards versus 4,650 cubic yards under the Mees site), the duration of excavation stages of the proposed ATST Project and the frequency of haul trips required by heavy trucks between the job site and the soil stockpiles would be considerably greater. However, ambient noise quality and its effects from operations at the Reber Circle site would be essentially identical to those described for the Mees site.

Standard operational processes for the proposed ATST Project would not emit significant nuisance noises or vibration to the surrounding research environment. Mirror stripping and cleaning and restorative recoating of the reflective surface, which would occur approximately once every few years, would not generate appreciable noise levels outside the enclosed buildings.

There would be no significant change to ambient noise conditions at HO resulting from vehicle traffic because the relative increase in daytime commuters accessing the proposed ATST facility would not noticeably add to the current level and pattern of vehicle use associated with existing HO operations. Personnel traveling to and from the facility would use the network of roads and parking lots, therefore vehicle-related noise would not be expanded to areas not already experiencing traffic sounds; a negligible adverse, long-term effect on the current sound setting at the summit would result.

There would be no change to existing conditions under the No-Action Alternative. There would be no construction introducing machinery-related noise intrusion to the area and no operational noise aside from existing sources. There would be negligible adverse, long-term effect to noise conditions under the No-Action Alternative.

ES-4.11 Air Quality

The ROI for air quality effects is HO and the adjacent properties that could be detrimentally affected by consequences of the proposed ATST Project on air quality. Use of construction vehicles and heavy equipment would result in low-level, intermittent exhaust emissions. These emissions would generate minor amounts of hazardous air pollutants and mobile source emissions. However, these would not result in appreciable air quality effects, even compared to the low levels of emissions from baseline HO operations. To minimize fugitive dust emissions, contractors would be required to comply with applicable State regulations under HAR 11-60.1-33, which require the implementation of “reasonable precautions” for controlling fugitive dust, which would be subject to rigorous mitigation measures that have already proven effective at HO. There would be only minor, adverse, and short-term air quality effects from fugitive dust.

Under the No-Action Alternative, there would be no site work or construction associated with this proposed Project, however, other construction and development activities would continue as approved, resulting in similar effects as discussed for the proposed ATST Project. These activities would be held to the constraints and protocol outlined in the LRDP. Likewise, because ATST would not be built, there would be no additional mirror coating activities containing that emission source. Adverse effects to air quality for this alternative would remain, however they would be negligible.

ES-4.12 Socioeconomics and Environmental Justice

The ROI for determining the affected environment for socioeconomics and environmental justice is the island of Maui. This section describes the contribution of the proposed ATST Project to the economy and the sociological environment of the ROI, as well as any effects on minority or low-income communities or the health and safety of children within this region.

The proposed ATST Project, whether located at the Mees site or the Reber Circle site, would need approximately 20 people for the first year of commissioning. This number is estimated to become between 50 and 55 by the final year of commissioning. Approximately two-thirds of the newly hired personnel would work on Maui with the remaining personnel working for the proposed ATST Project remotely from either Maui or the UH Manoa campus on O‘ahu. The permanent population would not exceed population projections, there would be no displacement of residents in their communities, and demand for housing can be accommodated with existing vacant housing units. Therefore, there would be a minor, long-term effect on population and housing. The proposed ATST Project would have both short- and long-term beneficial effects on the local economy and employment.

The proposed ATST Project would not result in adverse effect on the schools within the ROI. Local universities and schools would benefit from the research conducted at HO and from internships, post-doctoral fellowships, and other student programs.

The proposed ATST Project would also have no adverse effects on environmental justice to children because it would be constructed in a Conservation District where no urban or rural population is allowed.

Under the No-Action Alternative, no new personnel would be relocated to Maui and existing conditions and operations would not change.

No adverse effects on the local economy and employment would occur under the No-Action Alternative because existing conditions and operations would not change. Similarly, none of the beneficial short-term or long-term effects identified under each of the other project alternatives would be realized under the No-Action Alternative.

The No-Action Alternative would have no adverse effect on the schools and community within the ROI because the existing conditions at the proposed site location would remain unchanged. Similarly, none of the beneficial short- or long-term effects identified under each of the other project alternatives would be realized under the No-Action Alternative

ES-4.13 Public Services and Facilities

The ROI for public services and facilities is considered to be the Upcountry area of Maui. Due to its remote location near the summit of Haleakalā, HO is 22 miles from the nearest public services and facilities. With a travel time of nearly an hour to the closest police or fire stations, the facilities at HO are unable to utilize timely services from these Maui public departments. The nearest school and healthcare facility is in Kula, which is 27 miles from HO. Therefore, HO is considered to be independent of most public services and facilities.

Police Protection. It is not anticipated the proposed ATST Project would affect police operations. Police communication facilities in the summit area would not be affected by construction or operations at either the Mees or Reber Circle site locations. The few extra vehicles on the road during construction and operation of the proposed ATST Project in comparison with the approximately 1,600 vehicles that ascend the summit each day would not expand demands on police services. MPD would experience negligible adverse, long-term effects as a result of immeasurable and imperceptible changes brought on by the proposed ATST Project.

Fire Protection. The closest fire station is located in Kula approximately 28 miles away from the summit of Haleakalā. Another fire station serving the Upcountry community is located in Makawao, approximately 29 miles from the summit. These two fire stations, although the closest to HO, are beyond fire fighting capabilities for HO. Therefore there is no anticipated effect from the proposed ATST Project on these services at either the Mees or Reber Circle site locations. The few extra vehicles on the road during construction and operation in comparison with the approximately 1,600 vehicles that ascend the summit each day would pose negligible adverse, long-term demands on fire protection services.

Schools. The closest schools to the proposed ATST Project are located in the Kula community (Haleakalā Waldorf School, King Kekaulike High School, Kula Elementary, and the Kamehameha Schools) and are approximately 25 to 27 miles from the summit of Haleakalā. No effect is anticipated from construction or operation of the proposed ATST Project. Negligible adverse, long-term effects are anticipated from construction or operation of the proposed ATST Project.

Recreational Facilities. The proposed ATST Project would have moderate adverse, long-term effects on recreational facilities, due to a change in visual resources. The change would be noticeable at various locations in HALE as described in Section 4.5. No access to any HALE or State Conservation Land facilities, including the Park road corridor, would be blocked or impeded, and no trails would be eliminated or re-routed.

If the proposed ATST Project were not constructed, there would be negligible adverse, long-term effects on public services and facilities. The Pu‘u Ula‘ula Overlook would not have an additional facility within its viewshed and the Skyline Trail, which is located below HO, would not have a view of the upper portions of the facility from locations along the upper third of the trail.

Federal Aviation Administration. In response to a request for concurrence to NSF's determination of negligible adverse effect, the FAA issued a Notice of Presumed Hazard in October 2007, suggesting that the proposed ATST facility would result in radio frequency shadowing at the FAA Remote Communications Air-Ground (RCAG) facility located about 800 feet to the West of the proposed project. In accordance with 11 CFR Part 77.35, FAA Obstruction Evaluation and Spectrum Management specialists are working to identify and help quantify the predicted effect to the RCAG. Once the attenuation is sufficiently quantified and if a potential hazard may result, FAA obstruction specialists are working to identify whether mitigation would be necessary and if so, which acceptable engineering solutions would mitigate any adverse effect to RCAG transmit and receive capability.

ES-4.14 Natural Hazards

The ROI for natural hazards is considered to be that portion of the summit area of Haleakalā that is under direct management and control of UH IfA and the 50-foot corridor along the Park road corridor.

The potential natural hazards at HO are high winds; extreme rain, ice, and snow due to storms or hurricanes; earthquakes due to Hawaii's position within a seismically active zone; and, hypoxia due to the high altitude of the site. Any of these may affect the HO site and personnel at any time. All HO contractors and operations staff would be trained on the natural hazards unique to the site in order to minimize potential injuries. Therefore, the construction and operation of the proposed ATST Project would have negligible adverse effects on the safety of the public and adverse effects on the environment would be negligible such as to cause damage, destruction, or loss of life.

ES-4.15 Summary of Potential Effects of the Proposed ATST Project

A table in this section summarizes the effects from the proposed ATST Project. These include beneficial and adverse effects on resources in the ROI from the proposed ATST Project, whether implemented at the Mees site or the Reber Circle site. The proposed ATST Project has the potential for major adverse, long-term effects which are mitigable for historic and cultural resources as well as on an endangered species. No major adverse immitigable effects would result from implementing the proposed ATST Project at the Mees site. Major adverse effects to visual resources would result along the Park road corridor from the construction at the Reber Circle site. Beneficial effects would be expected to occur on the economy and education. In view of the beneficial and adverse incremental effects of the proposed ATST Project, the long-term environmental consequences are further discussed in Section 4.17-Cumulative Effects to the Affected Environment.

ES-4.16 Other Required Analyses

NEPA requires additional evaluation of the project's effects with regard to the following:

1. The relationship between local short-term uses of the environment and long-term productivity; and,
2. Any irreversible or irretrievable commitment of resources.

Short-term damage to the environment from implementation of the proposed ATST Project at either the Mees site or the Reber Circle site would be limited. No major effects were identified that could not be mitigated to a less minor level, except for a major effect on visual resources due to a visual intrusion along the Park road as a result of the proposed structure at the Reber Circle site.

The long-term productivity of either of these project alternatives is based on NSF's mission, and specifically its objective to progress solar observation. While NSF would take whatever actions are reasonable and practicable to preserve and protect the natural environment under its stewardship, by advancing the knowledge of solar function and meeting the objectives discussed in Section 1.0, NSF has the ability to make significant advances in what we know about solar history, developments, and functions. The project alternatives are designed to meet these goals.

NEPA requires an analysis of the extent to which the proposed project's primary and secondary effects would commit non-renewable resources to uses that would be irreversible or irretrievable to future generations. A commitment would be irreversible when primary or secondary effects limit the future options for a resource. An irretrievable commitment refers to these or consumption of resources neither renewable nor recoverable for future use. Construction of the proposed ATST Project would consume energy and building materials.

Petroleum, oils, and fuels would be used by construction vehicles and equipment and by staff vehicles during operation. Furthermore, equipment used in the facility would require lubricants, oils, and solvents. Construction material such as steel, cement, and aggregate would be expended. There would be increases in water, power, and other resources necessary to maintain and operate new facilities and machinery. Finally, there would be a slight increase in local resources required to support the additional staff and their families. These physical resources are generally in sufficient supply and their commitment to the project would not have an adverse effect on their availability. In some cases, certain material resources such as concrete, steel, or water could be reclaimed, recycled, and reused.

ES-4.17 Cumulative Effects to the Affected Environment

The CEQ, NEPA-implementing regulations, defines cumulative effects as the incremental environmental effects of the action when added to other "past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." Cumulative effects can result from individually minor, but collectively significant, actions taking place over time.

In November 2005, and again in February of 2009, agencies known to have facilities and operations within the ROI for the resource-specific affected environments were contacted with a request to provide information on current and planned activities that could occur within the reasonably foreseeable future and contribute to cumulative effect when considered with the proposed ATST Project at HO. Incremental addition of the proposed ATST Project was examined in light of ongoing and planned actions as well as present and past actions within the analysis area for each resource.

ES-4.17.1 Summary of Past Actions

Within the ROI, the past history and important events at HO and those of its adjacent neighbors are described in a table that lists the facility or action, its status, and reasonably foreseeable future actions that could change that status. The past history of the Park road corridor is also briefly described.

ES-4.17.2 Summary of Present Actions

Present actions at HO and its adjacent neighbors are summarized, including the FAA and MECO facilities on Kolekole. The corridor along the Park road is described along with its important visitor attractions and vehicular visit statistics.

ES-4.17.3 Reasonably Foreseeable Future Actions

There is only one action in the reasonably foreseeable future at HO. The SLR 2000 is an autonomous and eye-safe photon-counting Satellite Laser Ranging (SLR) station that would be installed on the southwestern side of the Mees Solar Observatory. There are no planned actions within the reasonably foreseeable future at HALE along the Park road corridor.

For Greater Maui, the Maui Island Plan calls for community development over the next 20 years that would enlarge the total of developed lands by more than 25,000 acres. The development would be a mix of commercial and residential units.

ES-4.17.4 Land Use and Existing Activities

Detailed descriptions of the effects from past, present, and reasonably foreseeable future actions within the ROI are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on the land use and existing activities within the ROI.

Development activities from existing projects and reasonably foreseeable future actions by others and the proposed ATST Project would not contribute to changes in the identified land use within HO or the adjoining properties that constitute the ROI. The other responding agencies describing ongoing or planned land use actions are consistent, according to their submissions claim, with State land use planning. The proposed ATST Project would not result in further subdivision, thereby avoiding additional intensity or exhaustion of land uses within the Conservation District. Since the proposed ATST Project would support and be consistent with the goals and objectives of State, County, HO, and community plans, the effects of the Proposed ATST Project when added to the effects from past, existing and reasonably foreseeable future actions within the ROI would not result in increased cumulative impacts on land use within HO or the Park road corridor. Overall, the combined effects of all past, present, and reasonably foreseeable future actions, would be minor, adverse, and long-term.

ES-4.17.5 Cultural, Historic, Archaeological and Resources

Detailed descriptions of the effects from past, present, and reasonably foreseeable future actions within the ROI are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on the cultural, historic, and archeological resources within the ROI.

In coming to terms with the effects of past and present actions within the ROI for the proposed ATST Project, it is clear that for those who believe that any portion of development or all development within the ROI for cultural, historic, and archeological resources has resulted in major, adverse effects and the adverse effects have already occurred. For others, the past and present actions within the ROI, including HO and the Park road corridor are detectable, localized, are small, and of little consequence to the observer and would be considered minor, adverse, and long-term.

For those who consider the summit area of Haleakalā a sacred site, the effects on cultural resources resulting from past, present, and reasonably foreseeable future actions are already major, adverse, and long-term; and the addition of the proposed ATST Project within the ROI for these resources at the Mees site would continue to have major, adverse, long-term effects. As discussed, some Native Hawaiians consider that the proposed ATST Project would limit or prevent them from conducting their spiritual practices, in particular because of its size and color. For Native Hawaiians, an uninterrupted view is often cited as necessary to make an emotional and physical connection to a place of importance. Therefore, because the view is already interrupted by man-made structures in the summit area, the addition of the proposed ATST Project would be incremental in degradation of the spiritual values of the ROI with respect to the view, according to some individuals. While there is no way to quantify the cumulative effects of the incremental addition on spiritual values, in consideration of the past, present, and reasonably foreseeable future actions, the addition of the proposed ATST Project would result in readily detectable, localized effects, with consequences at the regional level to cultural practitioners within greater Hawaiʻi. Therefore, the cumulative effects on cultural and historic resources of the proposed ATST Project combined with past, present, and reasonably foreseeable future actions is considered moderate, adverse, and long-term.

With respect to archeological resources, the LRDP ensures that any activity at HO is required to follow procedures and practices that will avoid adverse, long-term effects on archeological sites. This effort has been successful in that passive preservation has worked well to avoid adverse effects to those resources. The LRDP also has detailed procedures for preservation of historic and cultural resources during construction or operations, through training, monitoring, and reporting for those resources. Therefore, it is anticipated that negligible, adverse, and long-term cumulative effects on the archeological inventory at HO would occur from the proposed ATST Project.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site
The effects on cultural resources resulting from past, existing, and known reasonably foreseeable future actions, and the addition of the proposed ATST Project within the ROI for these resources at the Reber site would result in major adverse and long-term effects. Because of its location within HO, the proposed ATST Project at the Reber site would appear to be more prominent at the HO site from locations within the upper HALE road corridor and from some populated areas of Maui

No-Action Alternative
The No-Action Alternative would not contribute to changes in cultural, historic, or archeological resources within HO or along the Park road corridor that constitute the ROI. For those who believe that any human activities in the summit area that not dedicated to spiritual practices are a form of desecration would continue to find those activities an adverse effect.

ES-4.17.6 Biological Resources

Detailed descriptions of the effects from past, present, and reasonably foreseeable future actions within the ROI are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on the biological ecosystems within the ROI. The results indicate that when combined with past, present, and reasonably foreseeable future actions in the ROI, the effect on botanical resources would be minor, adverse, and short-term.

In combination with past, present and reasonably foreseeable future actions at HO, the effects of the proposed ATST Project at the Mees site on endangered, threatened, proposed, and candidate plant species would be negligible, adverse, and long-term.

For endangered, threatened, proposed, and candidate avifaunal species, the mitigation efforts agreed to for the proposed ATST Project have reduced potentially adverse effects for the ‘ua‘u and nēnē to a level of discountable effects for these species. In combination with past, present, and reasonably foreseeable future actions within the summit area, this would be considered a negligible, adverse, and long-term effect. For the ‘ope‘ape‘a, the combined cumulative effects of the proposed ATST Project with past, present, and reasonably foreseeable future actions would be negligible, adverse, and long-term.

For other native and introduced fauna, the combined effects of past, present, reasonably foreseeable future actions and the proposed ATST Project would be negligible, adverse, and long-term.

ES-4.17.7 Topography, Geology, and Soils

Detailed descriptions of the effects from past, present, and reasonably foreseeable future actions within the ROI are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on topography, geology and soils within the ROI. The results indicate that when combined with past, present, and reasonably foreseeable future actions in the ROI, the cumulative effect on these resources would be minor, adverse, and short-term.

ES-4.17.8 Visual Resources and View Plane

Detailed descriptions of the effects from past present and reasonably foreseeable future actions within the ROI are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on the visual resources and view plane within the ROI. The results indicate that when combined with past, present, and reasonably foreseeable future actions in the ROI, the effect on those resources would be moderate adverse and long-term from the Pu‘u Ula‘ula Overlook and areas of HALE adjacent to HO. From the upper two miles of Park roadway, the cumulative effects would be minor, adverse, and long-term, and from the lower portions of the roadway, it would be negligible, adverse and long-term. From populated areas of Maui near sea level or higher elevations, the cumulative visual effects would be negligible, adverse and long term.

ES-4.17.9 Visitor Use and Experience

Detailed descriptions of the effects from past present and reasonably foreseeable future actions within the ROI are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on the visitor use and experience within the ROI. The results indicate that when combined with past, present, and reasonably foreseeable future actions in the ROI, the effects for the loudest construction impact sounds, would result in a major, adverse and long-term effect on visitor's ability to enjoy ambient sound levels at Pu'u 'Ula'ula Overlook and at the start of the Sliding Sands hiking trail. The mitigation measures described in Section 4.6-Visitor Use and Experience and 4.10-Noise would reduce the effects of construction noise before sunrise and after sunset and between April 20th and July 15th in compliance with USFWS mitigation measures for petrel incubation. However, considering noise, visual losses and temporary air quality effects, when combined with past and present actions at HO, construction of the proposed ATST Project at HO would result in major, adverse and long-term effects on the experience of visitors to the Pu'u 'Ula'ula Overlook, Sliding Sands trailhead and the surrounding HALE areas adjacent to HO.

ES-4.17.10 Water Resources

Detailed descriptions of the effects from past present and reasonably foreseeable future actions within the ROI are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on water resources within the ROI.

The proposed ATST Project would include removing the existing cesspool and replacing it with the IWS, which would capture and process domestic wastewater prior to infiltration into the ground resulting in minor, beneficial, and long-term effects on groundwater. Overall, when added to the past, present, and reasonably foreseeable future actions, the proposed ATST Project and its associated MECO upgrade would result in cumulative minor adverse effects on the water resources

ES-4.17.11 Hazardous Materials and Solid Waste

Detailed descriptions of the effects from past present and reasonably foreseeable future actions within the ROI are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on hazardous materials and solid waste within the ROI.

There are no future projects that have been identified to occur outside of HO that would have any effect on HAZMAT management or the potential for on-site contamination at HO.

The proposed ATST Project would be a Conditionally Exempt Small Quantity Generator of hazardous waste, in that it would not generate more than 100 kilograms (approximately one-half of a 55-gallon drum, 27 gallons, or 220 pounds) of hazardous waste, not more than 1 kilogram (2.2 pounds) of acute hazardous waste in one month, and not more than 1,000 kilograms (approximately five 55-gallon drums, or 275 gallons, or 2,200 pounds) of total accumulated hazardous waste and not more than 1 kilogram (2.2 pounds) of accumulated acute hazardous waste at any time. Because the proposed ATST Project and each of these proposed facilities would be obligated to comply with the requirements of the LRDP, negligible adverse, long-term cumulative effects on HAZMAT, solid waste, and site contamination at HO would be expected.

If implemented at the Reber Circle site, cumulative effects of existing projects and the proposed projects from HAZMAT and solid waste would be similar to those described for the Mees site, with the exception of the installation of an aboveground storage tank for storing diesel fuel. Increased use, storage and disposal of HAZMAT and waste and solid waste as a result of the future proposed projects and the proposed ATST Project would result in negligible adverse, long-term cumulative effects.

ES-4.17.12 Infrastructure and Utilities

Detailed descriptions of the effects from past present and reasonably foreseeable future actions within the ROI are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on infrastructure and utilities within the ROI.

***Wastewater*.** The existing cesspool at the MSO facility would be removed and an advanced aerobic would be installed to treat sanitary wastewater. Therefore, construction of the proposed ATST Project would likely result in a beneficial change in effluent quality that, along with present and past actions at HO and adjacent neighbors, would constitute a minor, beneficial, and long-term effect on wastewater generation.

***Stormwater and Drainage*.** The proposed ATST Project facility design would include stormwater capacity and path configuration that would tie it into the operating drainage system for HO. In combination with the minor, adverse, and long-term effects on stormwater and drainage patterns from past, present, and reasonably foreseeable future actions within Kolekole, it would be expected that the proposed ATST Project would result in cumulatively minor, adverse, and long-term effects.

***Electrical Systems*.** The total power requirement for all planned actions at HO was less than one percent of the total available Maui capacity as of the beginning of 2006. Development activities from existing, foreseeable future projects and the proposed ATST Project, would have very minor, beneficial, and long-term cumulative effects on electrical systems at HO and negligible adverse and long-term effects on the Maui electrical system.

***Communications Systems*.** The cumulative effect of the proposed ATST Project on communication systems within the ROI would be minor, adverse, and long-term. For telecommunications, there would be negligible cumulative effects serving the site or anywhere else on Maui. The cumulative effects on the FAA RCAG facility from all actions would be negligible, adverse, and long-term, considering that NSF and the FAA are working together to address any potential issue involving a degradation of signal as a result of the proposed ATST Project. If there is such a degradation of signal, a resolution of the issue would be developed and accompanied by the appropriate level of NEPA compliance. In addition, NSF would work with the FAA to obtain adequate funding for implementation of the resolution.

***Roadways and Traffic*.** Considering the past and existing conditions, combined with expected effects from the proposed ATST Project and those of the anticipated SLR 2000 project in the ROI, there is a potential for moderate, adverse, and short-term cumulative effects on roadways and traffic within HO during construction of the proposed ATST Project. The cumulative effects from traffic on the HALE roadway would be moderate, adverse, and long-term as well. Mitigation measures for the Park road described in Section 4.16.15-Summary of Potential Effects of the Proposed ATST Project would reduce the adverse effects to minor, adverse, and long-term within HALE. A principal source of cumulative effects to roadways and traffic would be the collateral damage to roadways caused by heavy vehicle traffic during construction of the proposed ATST Project and interference with visitor traffic during peak travel times to HALE and the summit of Haleakalā. The use of the Park road by these vehicles in combination with past and present actions at HO and adjacent neighbors would have a cumulative minor, adverse, and long-term effect on the longevity of the pavement.

ES-4.17.13 Noise

There would be no permanent increase in background noise levels in the ROI above existing conditions; however, construction of the proposed ATST Project would result in high impact noise levels during certain times of the year and during certain hours, as described in Section 4.10-Noise. The cumulative noise effects on persons within 2,500 feet of the proposed ATST Project site from construction at either the Mees site or Reber Circle site would likely be major, adverse, and long-term. Mitigation measures restricting noise would be implemented from a half-hour before sunrise and a half hour before sunset, and between April 20th and July 15th, in coordination with USFWS and NPS mitigation measures, reducing the effects to negligible, adverse, long-term during those periods.

ES-4.17.14 Air Quality

Detailed descriptions of the effects from past present and reasonably foreseeable future actions within the ROI are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on air quality within the ROI. The cumulative effects on air quality with the ROI from past, present, and reasonably foreseeable future actions, including the proposed ATST Project would essentially be considered negligible, adverse, and long-term.

ES-4.17.15 Socioeconomics and Environmental Justice

Detailed descriptions of the effects from past, present, and reasonably foreseeable future actions within the ROI, which includes Greater Maui, are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on socioeconomics and environmental justice within the ROI. The socioeconomic effects associated with past, present, and the foreseeable future project at HO combined with those anticipated from the proposed ATST Project would be minor, adverse, and long-term, and, for employment, economics and income, it would be minor, beneficial, and long-term. Specifically:

1) the cumulative effects on housing would be minor, adverse and long-term,
2) the cumulative effects on economics and income would be minor, beneficial and long-term,
3) the cumulative effects on education and outreach would be minor, beneficial, and long-term,
4) the cumulative effects on environmental justice would be negligible, adverse and long-term; and,
5) the cumulative effects on the protection of children from environmental health or safety risks would be negligible, adverse and long-term.

ES-4.17.16 Public Services and Facilities

Detailed descriptions of the effects from past present and reasonably foreseeable future actions within the ROI, which includes Greater Maui, are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on public services and facilities within the ROI.

Police Protection. Construction or operations of the proposed ATST Project at the Mees site would not affect Maui Police Dept. (MPD) operations, which are too distant to be summoned for emergencies typically requiring such services. In combination with past, present, and reasonably foreseeable future actions, Park rangers or MPD would cumulatively experience negligible, adverse, and long-term effects on police protection.

Fire Protection. Fire fighting would be difficult, since the closest fire station located in Kula is approximately 28 miles away from the summit of Haleakalā, which is beyond fire fighting capabilities. Therefore, the cumulative effects of the proposed ATST Project along with past, present, and reasonably foreseeable future actions on fire protection services is negligible, adverse, and long-term.

Schools. Due to the distance to the nearest schools, the addition of the proposed ATST Project at the Mees site would contribute a negligible, adverse, and long-term effect to the already negligible, adverse effects of the past, present, and reasonably foreseeable future actions within the ROI. The overall effects would be negligible, adverse, and long-term.

Recreational Facilities. The activities at HO already pose a minor, adverse effect on recreational facilities from some locations along the Park road corridor, e.g., those closer than 0.6 mile from HO, where those activities are clearly visible and where some people viewing them have negative feelings. The addition of the proposed ATST Project would pose more loss in the value of those recreational facilities, but recreational resources at HALE are neither limited to nor mostly present on the Park road corridor. The main attractions for recreation are the locations where most visitors congregate, i.e., the Puʻu Ulaʻula Overlook, the Haleakalā Visitor Center, the Leleiwi Overlook, the Park Headquarters Visitor Center, and the crater trails, none of which would be have a line-of-sight to the proposed ATST Project. During construction, the cumulative effects on recreational facilities would be major, adverse, and long-term for high impact noise out to a distance of about 2,500 feet from the proposed ATST Project area. Mitigation measures would reduce the effects part of the time. During operations of the proposed ATST Project, the cumulative effect from past, present, foreseeable future activities and the proposed ATST Project on recreational resources for the Park road corridor would be minor, adverse, and long-term.

Healthcare Services. The overall cumulative effect of the proposed ATST project along with past, present, and reasonably foreseeable future actions would remain negligible adverse and long-term.

ES-4.17.17 Natural Hazards

Detailed descriptions of the effects from past, present, and reasonably foreseeable future actions within the ROI, which includes Greater Maui, are combined with the potential effects from the proposed ATST Project to assess the cumulative effects of these actions on natural hazards within the ROI.

Implementing the proposed ATST Project, including the associated MECO upgrade, would not increase the potential for natural hazards and would not change the nature of natural hazards which occur within the ROI. Therefore, the cumulative effects from existing projects, the proposed ATST project at the Mees site, and the reasonably foreseeable future actions would be negligible, adverse, and long-term.

The construction and operation of the proposed ATST Project would have a negligible, adverse effect on the safety of the public and adverse effects on the environment would be negligible such as to cause damage, destruction, or loss of life.

ES-4.17.18 Summary of Intensities and Effects

Tables 4-8 to 4-10 in this section summarize the highest intensities of effects, both adverse and beneficial, during past, present, and reasonably foreseeable future actions at HO and its adjacent neighbors, as described for the fourteen aspects of the affected environment. Table 4-11 summarizes the overall anticipated cumulative effects on the fourteen aspects of the affected environment from the addition of the proposed ATST Project at the Mees and Reber Circle sites.

ES-4.18 Mitigation

Mitigation is defined by CFR Title 40 Parts 1500 to 1508, Section 1508.20-Mitigation as including avoiding, minimizing, rectifying, reducing, or compensating for the effect by replacing or providing substitute resources or environments. To ensure compliance with any mitigation measures that are ultimately implemented if the proposed ATST Project goes forward, NSO is in the process of developing a management plan that would utilize monitoring and evaluation mechanisms to determine if the proposed ATST Project is achieving the mitigation objectives and adjust actions accordingly. This management plan is intended to cover both phases of the proposed ATST Project, including construction and operations.

ES-4.18.1 Land Use and Existing Activities

No mitigations are anticipated or planned for land use and existing activities.

In response to a request for concurrence to NSF's determination of negligible adverse effect, the FAA issued a Notice of Presumed Hazard in October 2007, suggesting that the proposed ATST Project would result in radio frequency shadowing at the FAA RCAG facility located about 800 feet to the West of the proposed ATST Project. In accordance with 11 CFR Part 77.35, FAA specialists working with NSF will address any potential issue involving a degradation of signal as a result of the proposed ATST Project. If there is such a degradation of signal, a resolution of the issue will be developed and accompanied by the appropriate level of NEPA compliance. In addition, NSF will work with the FAA to obtain adequate funding for implementation of the resolution. This would reduce the effects to negligible, adverse, and long-term.

ES-4.18.2 Cultural, Historic, and Archeological Resources

In order to minimize the effect on cultural resources, proposed ATST construction would require the consultation and monitoring of a Cultural Specialist. The Cultural Specialist would be engaged at the earliest stages of the planning process, monitor the construction process, and consult with and advise the on-site Project Manager with regard to any cultural or spiritual correction.

Secondly, the NSF is still in the process of conducting its Section 106 consultations to resolve adverse effects with the Advisory Council on Historic Preservation (ACHP), SHPD and Native Hawaiian organizations, individuals, and members of the public. To that end, through the Section 106 consultation process, consulting parties would provide input into and, ultimately, develop a draft Memorandum of Agreement (MOA)/Programmatic Agreement (PA) that would address ways to avoid, minimize, and/or mitigate adverse effects.

An MOA/PA involves solicitation of resolution proposals from the community. NSF has requested proposals for addressing adverse effects related to the proposed ATST project throughout the Section 106 consultation process.

ES-4.18.3 Biological Resources

Mitigation of effects related to construction of the proposed ATST Project would include coordination with the USFWS, implementation of the practices required in the LRDP, and measures identified by the USFWS to minimize effects on threatened and endangered species. Video surveillance data of the ‘ua‘u colony collected simultaneously with video surveillance data of construction would be used to correlate any potential disturbance or disruption of the nesting cycle that might occur during construction activities.

Mitigations for the operation of the proposed ATST Project at either the Mees site or the Reber Circle site would also include implementing the practices required in the LRDP. Projects conducted by other Federal agencies that could affect these species would require coordination with the USFWS. Actions by State agencies, such as the IfA, would be subject to the requirements of the Federal Endangered Species Act.

ES-4.18.4 Topography, Geology, and Soils

With the consent of interested Native Hawaiians and as part of the Section 106 consultation process, construction of the proposed ATST Project at the Mees site could result in a mitigation measure for topography effects to cultural resources. Native soils and rock could be used to restore the pu‘u at Reber Circle from its present truncated cone shape to a closely rounded natural appearance. From the geologist's calculations, an estimated 24 feet of additional height would be needed to restore the natural slope.

ES-4.18.5 Visual Resources and View Plane

No mitigations are anticipated or planned for visual resources and view plane.

ES-4.18.6 Visitor Use and Experience

No mitigations are anticipated or planned for visitor use and experience.

ES-4.18.7 Water Resources

No mitigations are anticipated or planned for water resources.

ES-4.18.8 Hazardous Materials and Solid Waste

No mitigation is anticipated or planned for HAZMAT and solid waste other than compliance with the relevant legal authorities.

ES-4.18.9 Infrastructure and Utilities

The most practicable and prudent mitigation measure to address potential cumulative traffic effects is to coordinate construction-related projects and traffic with affected parties (e.g., HALE roadway improvements and the other concurrent projects). For long-term operational related traffic, a preferred mitigation measure would be implementing mandatory carpooling programs to HO.

Communications. In response to a request for concurrence to NSF's determination of negligible adverse effect, the FAA issued a Notice of Presumed Hazard in October 2007, suggesting that the proposed ATST Project would result in radio frequency shadowing at the FAA RCAG facility located about 800 feet to the West of the proposed ATST Project. In accordance with 11 CFR Part 77.35, FAA Obstruction Evaluation and Spectrum Management specialists are working to identify and help quantify the predicted effect to the RCAG. Once the attenuation is sufficiently quantified and if a potential hazard may result, FAA obstruction specialists are working to identify whether mitigation would be necessary and if so, which acceptable engineering solutions would mitigate any adverse effect to RCAG transmit and receive capability.

ES-4.18.10 Noise

To mitigate noise, contractors would implement reasonable noise-reduction practices and abatement procedures. These would include the source control mitigation measures regarded as somewhat standard in the industry. Other standard mitigation measures and BMPs would further reduce any effects.

Of concern during construction would be the effect of noise on the ‘ua‘u in the Kolekole colony. The ‘ua‘u video monitoring system would be employed as a mitigation measure, augmented by noise monitoring equipment that would be capable of correlating on-site noise, video of construction activities and ‘ua‘u activity, to establish whether noise is affecting the ‘ua‘u habitat, and if so, at what threshold level can construction noise occur without disturbing the colony. At least one year of pre-construction baseline data for ‘ua‘u behavior at Pu‘u Kolekole is already being collected in coordination with the USFWS and HALE avian experts.

Noise levels from the Utility Building are also a concern for the protection of ‘ua‘u and the ability of Native Hawaiian practitioners to conduct traditional practices within the ROI. Although sound abatement devices would be built into the equipment, the potential for noise effect on the nearby colony of ‘ua‘u and on Native Hawaiian practitioners at the East Ahu was considered to assess mitigation measures. Sound levels immediately outside of the equipment building and at the nearby ‘ua‘u burrows and ahu were modeled. How these locations may be affected was evaluated from both the Mees site and the Reber Circle site.

As designed, the sound proofing for the Utility Building would achieve sound levels (at the frequencies of interest) at the nearest ‘ua‘u burrows and East Ahu that are lower than the guidelines for Churches, Mosques, and Synagogues as well as private rooms and operating rooms in hospitals. In addition, the baseline configuration, location, and orientation of equipment and the Utility Building at the Reber Circle site would not require any extraordinary measures for noise control to achieve the same sound levels.

ES-4.18.11 Air Quality
No mitigations are anticipated or planned for air quality.

ES-4.18.12 Socioeconomics and Environmental Justice
No mitigations are anticipated or planned for socioeconomics and environmental justice.

ES-4.18.13 Public Services and Facilities
No mitigations are anticipated or planned for public services and facilities.

ES-4.18.14 Natural Hazards
Mitigation measures for the proposed ATST Project to reduce potential for cumulative effect on other facilities at HO and within the ROI from natural hazards would ensure that all structural elements of the proposed ATST Project would meet or exceed currently in-force building code requirements for seismic risk on the island of Maui. The current design standard is Seismic Zone 2b as defined by the 1997 Uniform Building Code.

ES-4.18.15 SUP Mitigation Measures
The following mitigation measures are discussed in each of the resource sections of Section 4.0 where they are applied to reduce adverse effects on individual resources.

<u>Use of Park Road for Project Vehicles</u>

Load Limits. The mitigation includes limiting loads on the bridge to the current load rating, along with certification for the load limits.

Wide Loads. The ATST Project will make every effort to minimize the number of wide loads, defined as one that requires special provisions including restriction of traffic in the opposite direction to safely traverse the Park road. The total number of wide loads will not exceed 25, including no more than 2 loads up to 10 meters (32 feet 10 inches) and no more than 23 loads up to 7 meters (23 feet 0 inches) over the course of the proposed ATST Project. The ATST Project must ensure that these wide loads will not exceed the clearances along the Park road.

Entrance Station. The Level and Improve Shoulder option outlined in the "*HALE Entrance Station Clearance for ATST Loads*" report prepared by the ATST Project in April 2009 will be allowed to accommodate wide loads coming through the Park entrance station.

Underground Utilities. There are a total of 4 manhole covers in the roadway, approximately 3.5 feet wide by 5.5-feet long. Precautions will be taken by the Project to ensure no damage to the covers during the haul of heavy loads to the proposed Project site.

***Pre- and Post-Project Documentation*.** Prior to and after the proposed ATST Project, all historic features and other areas susceptible to potential impact along the Park road shall be photographed and documented.

***Traffic Controls*.** A general traffic plan shall be submitted for approval by the NPS prior to the start of work that addresses such items as the timing for moving large loads through the Park, staging and parking areas, prior notification for wide loads, signage, press releases, pilot cars, coordination with Park staff, etc.

Biological Resources

Biological Monitor. The Project will fund an agreed upon and qualified person to conduct reasonable biological monitoring activities as outlined by the USFWS in its informal consultation. Specifically, the monitor will ensure that any changes in behavior and any petrel mortality associated with the proposed ATST Project are monitored and reported to the NPS and USFWS. The monitor will also monitor the impacts to nēnē and other biological resources.

Endangered Species Act Compliance. The construction schedule must adhere to the mitigation measures outlined in the informal Section 7 consultation with the USFWS.

Alien Invasive Species Prevention. NPS vehicle, equipment, and materials washing and inspection protocol will be followed by the ATST Project.

Programmatic Monitoring. A programmatic monitoring plan for invertebrates, flora and fauna during the project will be submitted for approval by the NPS and implemented by the ATST Project.

Visitor Use and Experience. Slow moving vehicles and/or vehicles that are class 5 or larger should not travel through the Park between approximately 11:00 a.m. and 2:00 p.m.

Information. The ATST Project shall provide regular updates to appropriate NPS staff during the proposed ATST Project so NPS staff can provide information to Park visitors.

A project monitor will be funded by the ATST Project to ensure that all mitigation measures and stipulations in the SUP are being followed. This person will be the NPS point-of-contact during the project.

ES-5.0 NOTIFICATION, PUBLIC INVOLVEMENT, AND CONSULTED PARTIES

Pursuant to the National Environmental Policy Act (NEPA) and upon recommendation by the State of Hawaiʻi Dept. of Health, Office of Environmental Quality Control (OEQC), Federal and State agencies, Native Hawaiian Organizations (NHOs) and individuals, other organizations and members of the public were notified, contacted, and consulted during the course of planning for the proposed ATST Project or in the course of preparing studies or submitting applications for various approvals.

Details of public and agency disclosure and involvement regarding the proposed ATST Project consisting of notification letters, agency and media announcements, document distribution lists, and descriptions of public hearings, consultations, and comment periods are detailed in the following subsections. Responses to issues and concerns raised during the public hearings, comment periods, and consultation meetings were addressed by the ATST point-of-contact.

Consultation meetings pursuant to the Section 106 process of the National Historic Preservation Act (NHPA) also took place both before and after publication of the DEIS. At times, the NEPA and NHPA processes were linked (as is reflected in some of the notification letters and cards), and at other times, there were additional focused Section 106 consultation meetings. This section discusses the Section 106 process, including the consultations with Native Hawaiian organizations and individuals for the proposed ATST Project. KC Environmental, Inc. (KCE), the NSF, and the archeological consultant for the proposed ATST Project initiated early and detailed consultations with the SHPD and the ACHP. These consultations have continued since 2005 and are summarized in this section.

Consultation with the U. S. Fish and Wildlife Service also took place pursuant to the Endangered Species Act. A summary of that interaction and the results of consultation are provided in Section 4.3-Biological Resources and Vol. II, Appendix M-Section 7 Informal Consultation Document.

ES-5.1 EIS Process

ES-5.1.1 Pre-Assessment Notification

Federal Process. After considering the proposed ATST Project, NSF determined that it would prepare an EIS to assess the environmental effects of the proposed Project pursuant to NEPA. On June 23, 2005, the Notice of Intent (NOI) for the proposed ATST Project was published in the Federal Register. (The Federal Register is a legal newspaper published every business day by the National Archives and Records Administration (NARA). The Federal Register contains: Federal Agency Regulations, Proposed Rules and Notices, Executive Orders, Proclamations, and Other Presidential Documents. The proposed ATST Project comes under the Federal Register's organizational category of "Notices, including scheduled hearings and meetings open to the public, grant applications, and administrative orders.")

State Process - Office of Environmental Quality Control. The OEQC was established in 1970 to help stimulate, expand and coordinate efforts to maintain the optimum quality of the State's environment. The OEQC implements the Environmental Impact Statement law, Chapter 343, HRS. If the lead agency decides that a proposed project may have a significant environmental effect, a State EIS must be prepared prior to implementing the proposed project. For the proposed ATST Project, the UH IfA, as the accepting authority for the proposed Project, decided that a State EIS must be prepared. The announcement for the proposed ATST Project was published on June 23, 2005 in the OEQC Bulletin. In addition, formal notification letters announcing the intent of the NSF to prepare an EIS for the proposed ATST Project were sent in June 2005 to State of Hawaiʻi elected officials, organizations, Federal and State agencies, and community individuals.

During consultation with the OEQC, it was determined that an EIS Preparation Notice (EISPN) was needed to address requirements under HRS Chapter 200, Title 11, in that the proposed ATST Project may potentially meet one or more of the significance criteria for effects on Conservation District Land. The EISPN, which was a lengthy document describing the proposed ATST Project, was also prepared in accordance with HAR 13-5-31, which requires an EIS to accompany the required CDUA, where significant effects may be anticipated. The EISPN was published and distributed in August 2005 to the OEQC, a recommended number of elected officials, agencies and organizations, libraries, and other interested individuals. Additional copies of the EISPN were distributed during the following months as agencies or individuals requested a copy.

ES-5.1.2 Pre-Assessment Public Scoping Meetings Pursuant to NEPA and OEQC Guidance

Three pre-assessment Public Scoping Meetings to assist the lead agency in determining the scope of environmental analysis, resources involved, and potential concerns about effects were held on Maui, Hawaiʻi. Each meeting was facilitated by Mediation Services of Maui, was recorded by a transcriptionist from Iwado Court Reporters, and a Hawaiian language interpreter was available for individuals wishing to speak in Hawaiian, although no testimony was heard in the Hawaiian language at any of the scoping meetings. The attending public was invited to sign-in, view and collect information made available about the proposed ATST Project, listen to presentations given by members of the NSF, the NSO, the National Optical Astronomy Observatory (NOAO), the UH IfA, and the environmental consultants. The public was given the opportunity to ask questions, comment about issues and concerns, and given 30 days to submit written commentary or a written request to be included as a consulting party to the proposed ATST Project. Although particular comment periods were determined by the OEQC and Federal regulations, all written comments were accepted for inclusion into the DEIS and made part of the NSF's Administrative Record for the proposed ATST Project.

ES-5.1.3 Additional Public Meetings

An additional six meetings were held upon the request of the community or at the request of ATST project members. Those in attendance were given the opportunity to ask questions and comment on the proposed ATST Project. All information presented during these additional meetings was identical to the July 2005 Public Scoping meetings.

ES-5.1.4 Publication of the Draft Environmental Impact Statement

The DEIS was formally published in the Federal Register on September 6, 2006. It was formally published in the OEQC Bulletin on September 8, 2006 and distributed to the OEQC, an OEQC–mandatory and –approved number of State and County of Maui agencies, organizations, libraries, elected officials, and other interested individuals. Additional copies of the DEIS were distributed during the following months upon request.

The public was given the required 45-day period in which to submit written on the DEIS. During this time period, the public was also invited to submit requests to become consulting parties pursuant to Section 106 of the NHPA.

ES-5.1.5 DEIS Public Comment Meetings

The DEIS was published on September 8, 2006, which initiated a 45-day public comment period. The DEIS addressed the multi-year site selection process by the scientific community to locate scientifically-viable sites. The DEIS also addressed the potential direct, indirect, and cumulative environmental effects of on-site construction, installation, and operation of the proposed ATST Project. Notification of the public hearings on the DEIS was published in the Maui News, and the Haleakalā Times and Maui Weekly-South Edition, September 13 to 26, 2006 issue. The 45-day public comment period began on September 8, 2006, and ended on October 23, 2006; however, public comments were accepted beyond the deadline and would be included in the final EIS, along with comments for this SDEIS.

Three DEIS public hearings were held on Maui, Hawaiʻi. The format for each meeting was identical. Mediation Services of Maui facilitated all meetings and, at the onset of each meeting, set courtesy rules for comment and/or response interaction, notified participants that a court stenographer was in attendance to record the meeting, notified participants that those who signed up to give oral comments would be called upon to speak, and encouraged participants to submit comments either by oral testimony, via mail, facsimile, or e-mail before the comment deadline. As a result of public request, meeting transcripts are included in the SDEIS in Vol. III. The public was informed that all comments would be addressed in the final EIS, either individually or collectively, depending on the nature of the comment.

ES-5.1.6 Public Comments and Responses

Public input was solicited throughout the scoping process and on the DEIS. Comments submitted before publication of the DEIS are included in Vol. III, Appendix A and responses to substantive comments to the DEIS and the SDEIS will be provided in the Final Environmental Impact Statement (FEIS). All comments were carefully evaluated during the preparation of the SDEIS and, where appropriate, they were incorporated into the document. Full consideration was given to the concerns, suggestions, information, and documentation provided by the commenting individuals, groups, and agencies.

ES-5.2 The Section 106 Consultation Process Pursuant to the National Historic Preservation

As stated in 36 CFR Part 800, *"Section 106 of the National Historic Preservation Act requires Federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings."*

In compliance with Section 106, NSF invited participation in this process to organizations and individuals who may attach religious and cultural significance to a historic property that may be affected by a proposed undertaking.

At the time the DEIS was published, NSF continued its outreach efforts to identify relevant Native Hawaiian organizations that might have an interest in the Section 106 consultation process. To that end, assistance was requested from the Office of Hawaiian Affairs (OHA) and the Native Hawaiian community prior to each consultation meeting to identify relevant Native Hawaiian organizations to invite.

In September of 2007, the U.S. Department of the Interior's Office of Hawaiian Relations published in the Federal Register, Vol. 72, No. 186, a Notice regarding the development criteria for establishment of a Native Hawaiian Organization (NHO) Notification List. The intent of the NHO list is to make available to other Federal agency officials this mechanism to assist with reasonable and good faith efforts to identify NHOs that are to be notified or consulted with when required by statute or when desired. Although the NHO list was not published prior to the publication of the DEIS, NSF did review the NHO list prior to conducting its August 2008 consultation meetings and invited all organizations appearing on the NHO list that had not previously been identified

ES-5.2.1 Section 106 Consultation Chronology

The ACHP was sent a formal notification letter in June 2005 announcing the intent of NSF to prepare an EIS for the proposed ATST Project. This pre-assessment letter included a project description with the intent to publish an EIS, detailed information about the three Public Scoping Meetings, and ATST project management contact information. On July 6, 2006, a letter was sent to the ACHP, pursuant to 36 CFR § 800.6(a)(1)(iii), informing the ACHP of NSF's finding of adverse effect regarding the proposed undertaking. The letter also included a list of organizations and individuals the NSF has been in consultation with throughout the Section 106 process, a copy of CKM Cultural Resources' evaluation for the proposed Project, and a copy of a letter that was sent to Melissa Kirkendall, Maui archeologist, SHPD, requesting concurrence of the agency's adverse effect finding (ACHP, 2006). Additional information pursuant to Section 800.11(e) of the ACHP regulations was submitted to the Council for their review and determination of whether their participation in this matter is warranted. Ultimately, the ACHP decided to become a consulting party to NSF's Section 106 process.

The SHPD is the responsible State of Hawaiʻi entity with which NSF is required, pursuant to the NHPA, to engage in Section 106 consultations regarding the proposed ATST Project. A letter dated June 20, 2005 was sent to the SHPD (Melanie Chinen, former Administrator; Melissa Kirkendall, former Maui Archeologist; and Cathleen Dagher, former Assistant Maui Archeologist) to notify them of NSF's intent to prepare an EIS. NSF directly, and through KCE, corresponded with the SHPD regarding formal and informal consultation meetings. Since the publication of the DEIS, NSF and the SHPD have engaged in consultations regarding NSF's Section 106 process and ways in which adverse effects need to be addressed. NSF continues to consult with the SHPD regarding the goal of developing a Memorandum of Agreement/Programmatic Agreement designed to address adverse effects associated with the proposed ATST Project. In September 2005, on behalf of the NSF, KCE initiated consultation in accordance with Section 106 of the NHPA through numerous communications between Melissa Kirkendall, former Maui Archaeologist of the Hawaiʻi SHPD and Archaeologist Erik Fredericksen of Xamanek Researches, LLC.

On January 24, 2006, informal consultation was initiated with Kahu Charles K. Maxwell, Sr. and Dane Maxwell of CKM Cultural Resources and Kumu Hula Hokulani Holt-Padilla of the Maui Arts and Cultural Center, all of whom are knowledgeable about the traditional, cultural, and spiritual significance of Haleakalā.

During consultations with HALE in January 2006, the HALE Superintendent expressed concerns about potential effects from construction of the proposed ATST Project on the historic Park road. Specifically, the Superintendent commented that the historic roadway has been evaluated by NPS and Historic American Engineering Record (HAER) as eligible for listing in the National Register of Historic Places under Criterion “A” (for its development of the National Park System, the development of early NPS landscape architectural design styles, and the craftsmanship of the CCC and Criterion “C” (for its association with rustic Park design that characterized early NPS development during the 1930s).

Formal Consultation Meeting – March 28, 2006. A letter inviting participation in a formal Section 106 consultation was sent by KCE on behalf of the NSF on February 22, 2006. This letter was sent to elected officials, agencies, organizations, and members of the community who submitted written requests to be a consulting party to the proposed ATST Project. A copy of the letter and mailing distribution list was also sent to the SHPD and OHA. Identical public notices were published in the Maui News on March 1 and 23, 2006, the Haleakalā Times in the March 15 to 28, 2006 issue and the Maui Weekly-South in the March 16 to 22, 2006 issue.

Formal consultation meetings were held on March 28, 2006, at Mayor Hannibal Tavares Community Center and on May 1, 2006, at the Paukūkalo Community Center. The intent of both meetings was to introduce the Section 106 process to the public, discuss avoidance, mitigation and minimization proposals, answer questions and listen to testimony, request assistance in providing NSF with contact information for other Native Hawaiian organizations and individuals who may want to participate in this process, and to encourage discussion on identifying and resolving adverse effects. Proposals arising from these interactions were received from Mr. Warren Shibuya (March 28, 2006 and August 28, 2008), Mr. Charles K. Maxwell, (March 28, 2006), and Chancellor Clyde Sakamoto, Maui Community College (May 14, 2007).

Consultation was held on March 28, 2006, with Retired Judge Boyd Mossman, Maui Trustee of OHA. NSF was given a list of additional Native Hawaiian groups that Judge Mossman recommended be invited to participate in the Section 106 process. Invitation letters dated March 31, 2006 were distributed and included a brief summary of the proposed ATST Project as it relates to the Section 106 process.

Formal Consultation Meeting – May 1, 2006. Notification postcards were sent to agencies, organizations, and members of the community announcing a second formal consultation meeting. This meeting was held on May 1, 2006 at the Paukūkalo Community Center. A copy of the postcard announcement and mailing distribution list was sent to SHPD and OHA.

Identical public notice advertisements were placed in the Maui News on April 21, 2006, the Haleakalā Times in the April 26 to May 9, 2006 issue, the Maui Weekly-South in the April 27 to May 3, 2006 issue, and posted to the ATST web site. At the meeting, the public was invited to participate in the Section 106 process, public testimony was heard, written testimony was accepted, and questions were answered. During public testimony, specific concern was heard about which organizations and individuals were contacted, the IfA’s LRDP, and the NSF’s role in educational outreach specifically for women and Native Hawaiians. Documentation addressing all of these concerns was posted to the ATST website within the week following the meeting.

DEIS Notification and Section 106 Resolution Proposals Status Update – June 5, 2006. On behalf of the NSF, KC Environmental, Inc. (KCE) sent information postcards to agencies, organizations, and members of the community with information announcing the anticipated publication of the DEIS and the subsequent public meetings to comment on the DEIS. It also announced that scheduled meetings with interested individuals and groups who submit resolution proposals for the Section 106 process would be held during the week of the DEIS public meetings. A copy of the postcard and mailing distribution list was sent to SHPD and OHA. The information on the postcard was also published in the Maui News, Haleakalā Times, Maui Weekly-South and posted on the ATST web site.

OHA Formal Consultation Meeting – September 27, 2006. On September 27, 2006, NSF met again with OHA following issuance of the DEIS. That meeting took place in Honolulu with OHA Administrator, Clyde Nāmu'o. At that meeting, Mr. Nāmu'o said he was glad NSF engaged OHA early on in its Section 106 process, and he indicated that NSF was taking the right steps and engaging the right people.

Supplemental Cultural Impact Assessment Distribution – July 4, 2007. Extensive comments were received on the DEIS and during the Section 106 consultations concerning the proposed ATST Project's effect on historic and cultural resources. In view of these comments, NSF decided that it would be necessary to have a supplemental cultural impact evaluation prepared to assist in both its NEPA process and its ongoing Section 106 consultations. The SCIA provided by Cultural Surveys Hawai'i, Inc. substantially addressed the comments received on the DEIS and reflects additional consultative interactions requested in those comments.

ACHP Letter and Maui Community College Mitigation Proposal – November 8, 2007. The November 8, 2007, consultation letter from NSF to ACHP summarized the current Section 106 process, including consultations with interested parties. The November 8th letter also expressed NSF's desire to hold a meeting with the consulting parties to discuss all mitigation proposals submitted to date and allow for submission of additional proposals. Finally, the letter notified ACHP of the receipt of a Mitigation Proposal from MCC, and requested a meeting with the ACHP to discuss a path forward in the consultation process. A copy of both the November 8, 2007 ACHP letter and the MCC Mitigation Proposal were sent to the consulting parties.

Formal Consultation Meeting – June 16 and 17, 2008. An invitation to attend formal Section 106 consultation meetings on June 16 and 17, 2008, was sent to all consulting parties. Those meetings were held at the University of Hawai'i Institute for Astronomy Maikalani Facility. A meeting facilitator was present as well as a court reporter.

While several consulting parties who attended the June 2008 meetings expressed concerns about and objections to the location of the proposed ATST Project, other consulting parties provided creative suggestions for mitigation provisions that could be included in a Memorandum of Agreement. Some of these suggestions included providing educational programs for Native Hawaiians, at both the University and K through 12 levels; placing a "Hawaiian Star Compass" on the summit in recognition of the role navigation has played in Native Hawaiian culture; having the Native Hawaiian community identify a person with appropriate *kuleana* (responsibility)who could serve in a capacity similar to that of a Konohiki to work with the University of Hawai'i to facilitate traditional cultural practices at the Haleakalā High Altitude Observatory Site and to provide interpretation of the summit; removing the concrete remnants of the Reber Circle and cleaning up other areas on the summit; and putting a 50 year limit on the life of the proposed ATST Project. All of these suggestions and other comments by the consulting parties in attendance are set forth in the transcripts of both meetings; those transcripts, the notes of the facilitator, and other important information containing NSF's Section 106 compliance efforts to date were posted on the ATST project website.

Follow-up from June 16 and 17, 2008 Consultation Meetings. Following the June, 2008 consultation meetings, NSF engaged in extensive conversations with the ACHP, the SHPD, HALE, and DOI's OHA regarding an appropriate path to move forward in its Section 106 consultation process. Concerns were expressed by the ACHP, the SHPD, and HALE regarding the outreach efforts NSF had made to include members from the Native Hawaiian Community.

The ACHP wrote a letter to NSF on July 17, 2008, requesting further information regarding NSF's outreach efforts. In response to specific questions raised by the ACHP, NSF responded with a letter excerpted in Chapter 5.

On July 24, 2008, NSF sent a letter to all consulting parties inviting them to consultation meetings scheduled for the following month (on August 27th and 28th). That invitation letter was also sent to an additional 87 individuals/entities who NSF considered to be potentially interested parties. These parties expressed an interest in participating in the Section 106 process at some point over the past three years, but were ultimately not included in the list of consulting parties due to inactivity and/or an apparent lack of interest. Nevertheless, NSF decided to reach out to them to provide them with another opportunity to participate in the process.

Discussions also ensued regarding expanding the Area of Potential Effects to include the Park road corridor. NSF agreed to do so. NSF continued to work closely, primarily with the ACHP, to structure the format for additional consultation meetings scheduled for August 27 and 28, 2008. In structuring the August meetings, NSF also consulted closely with HALE and reached out to the SHPD.

An invitation letter announcing the next consultation meetings which were scheduled to take place on August 27, 2008 at the University of Hawai‘i Institute for Astronomy Maikalani Facility – was sent to all persons listed as consulting parties and those from the NHO list that had not previously been included in the process. In addition, an invitation letter was sent to those persons/entities who previously expressed an interest in NSF's Section 106 process, but who became inactive and/or demonstrated an apparent lack of interest in participating further in the process. A Public Notice announcing the August 27, 2008 consultation meetings was published in the Maui News, the Honolulu Advertiser, and the Honolulu Star Bulletin on August 24, 2008.

Both meetings on August 27, 2008, were intended to provide opportunities for consulting parties to meet with NSF to discuss ways in which to address adverse effects to historic properties associated with the proposed ATST Project through avoidance, minimization, and mitigation. At the meetings, there were no suggestions provided by the consulting parties regarding ways in which to minimize or mitigate any adverse effects associated with the proposed ATST Project; most of the people present stated that they were against the proposed ATST Project and that they were in favor of avoiding the effects. NSF explained that, due to the scientific criteria required to build the proposed ATST Project, adverse effects resulting from the color, size, and location of the proposed Project could not be avoided unless NSF were to select the No-Action Alternative and issue a decision to not fund the proposed Project's construction.

An additional meeting was held on August 28, 2008, attended only by representatives of NSF, the ATST project team, the ACHP, HALE, and the SHPD, to discuss next steps in the process. It was agreed upon that NSF would host another consultation meeting to address potential effects to the Park road corridor once a road condition survey was completed (that survey was completed in January, 2009, by the FHWA, and the final report was issued on March 4, 2009). Due to the very small attendance of consulting parties at both the June and August 2008 consultation meetings, the NSF, ACHP, HALE, SHPD and ATST project team representatives discussed, again, ways in which to improve outreach efforts to include more participation by Native Hawaiians. That discussion is ongoing and NSF and HALE are working to find ways to increase participation by consulting parties in the next consultation meetings, scheduled for the week of May 4, 2009.

ES-5.2.2 Addressing Adverse Effects

Mitigation for resolving adverse effects is described in Section 4.18.2-Cultural, Historic, and Archeological Resources. Minimization and mitigation proposals from all interested groups and individuals are incorporated into this SDEIS. Written proposals for mitigating adverse effects were submitted during the consultation process--an abbreviated and detailed proposal submitted by Kahu Charles Maxwell, Sr. on March 28, 2006, two proposals submitted by Mr. Warren Shibuya on March 27, 2006 and August 28, 2008 and a proposal submitted by Chancellor Clyde Sakamoto on behalf of Maui Community College.

These mitigation proposals and all other suggestions for addressing adverse effects are included in Chapter 5 and are currently under consideration by NSF. In advance of the next Section 106 consultation meetings, to occur during the public comment period for this SDEIS, NSF intends to prepare a draft Memorandum of Agreement/Programmatic Agreement designed to incorporate the ideas generated during the Section 106 consultation meetings held thus far. This draft will be available for review and consideration by the consulting parties and serve as part of a basis for discussion during NSF's next Section 106 consultation meetings.

ES-5.3 Consultation Under the Endangered Species Act

In July 2005, NSF began its consultation with the USFWS, and a site visit to the primary and alternate sites for the proposed ATST Project was arranged for September 2005. On-site discussions with an avian biologist from USFWS included representatives from HALE, NSO/NOAO, IfA, and KCE. At that time, the USFWS and HALE biologists suggested that pre-construction video monitoring of the ‘u‘au burrow colony adjacent to the primary site for the proposed ATST Project would be a useful tool to characterize the behavior of the ‘u‘au prior to the proposed ATST Project, so that potential effects during construction, if any, could be recognized. They also suggested that monitoring of a “control” ‘u‘au colony in HALE during construction would provide a better understanding of potential effects, if any, during construction, by comparing the behavior of ‘u‘au much further away from construction activities. In response to that suggestion, NSF initiated a day/night, motion activated, video monitoring program of 30 ‘u‘au burrows at HO in February 2006, with video data collected during the entire nesting season.

On June 15th, 2006, NSF requested initiation of formal consultation for the construction and use of the proposed ATST Project, pursuant to Section 7 of the Federal Endangered Species Act of 1973, as amended (16 USC, 1531, et seq.). At that time, NSF determined that the construction of the proposed ATST Project could adversely affect the endangered ‘u‘au. NSF also determined that the construction would not adversely affect the nēnē, ‘ope‘ape‘a, or ‘ahinahina. During the pre-consultation and formal consultation process, NSF and USFWS worked cooperatively to develop avoidance and minimization measures to reduce effects to listed species, specifically for the ‘u‘au occupying burrows in the vicinity of the proposed ATST Project.

In a February 2007 conference call between USFWS and NSF, the USFWS concurred with the NSF determination “...that the inclusion of avoidance and minimization measures had reduced project effects to the level of insignificance” Although not anticipated, it was agreed that if a nēnē or ‘u‘au was harmed or killed as a result of ATST construction activities, work action would cease and formal consultations would be initiated with USFWS at that time.

After further consideration of the potential effects on the ‘u‘au in March 2007, e.g., the unlikely prospect of “incidental take” of ‘u‘au during construction, USFWS decided to issue an Informal Section 7 Consultation Document rather than a Formal Biological Opinion. The Informal Consultation Document concurred that the proposed ATST Project is not likely to adversely affect the endangered species in question. It also circumscribed the Action Area not likely to be adversely affected by the proposed ATST Project to include the HALE summit area and Park road corridor.

ES-6.0 UNRESOLVED ISSUES

There are three issues that remain unresolved, but are in a significant stage of development.

Section 106 consultation process pursuant to the NHPA. As further outlined in Section 5-Notification, Public Involvement, and Consulted Parties, NSF has been involved in a Section 106 consultation process for the proposed ATST Project since 2005. Nearly 30 formal and informal consultation meetings have been held with consulting parties; three more consultation meetings will be held on June 8, 9, and 10, 2009. NSF has been working with the consulting parties, including the Hawai‘i State Historic Preservation Division (SHPD, the Advisory Council on Historic Preservation (ACHP), and the National Park Service (NPS) to develop a programmatic agreement to address the adverse effects related to the proposed ATST Project. This process is also intended to serve as the Section 106 process for the NPS in support of its consideration of the issuance of the SUP required by the NPS to operate commercial vehicles on the HALE road during the construction and operation of the proposed ATST Project.

Special Use Permit. Since August of 2008, NSF has been working with the ATST Project team and the NPS on a proposed SUP to allow ATST-related commercial vehicles to traverse along the Park road during the construction and operations phases of the proposed ATST Project. The environmental compliance efforts required in support of the SUP are underway; the NPS is working with NSF with the goal of using NSF's environmental compliance efforts to satisfy the obligations of both agencies. While the parties have agreed to several items in concept, the details of the SUP are currently being negotiated.

Federal Aviation Administration Mitigation. The National Science Foundation and the Federal Aviation Administration (FAA) are working together to address any potential issue involving a degradation of signal as a result of the proposed ATST Project. If there is such a degradation of signal, a resolution of the issue will be developed and accompanied by the appropriate level of NEPA compliance. In addition, NSF will work with the FAA to obtain adequate funding for implementation of the resolution.

1.0 INTRODUCTION

The proposed ATST Project is an applicant action by the National Science Foundation (NSF) for the development of the Advanced Technology Solar Telescope ("proposed ATST Project") within the 18.166-acre University of Hawaiʻi Institute for Astronomy (IfA) Haleakalā High Altitude Observatory (HO)[1] site at the summit of Haleakalā, County of Maui, Hawaiʻi.

The primary goals of the proposed ATST Project are to understand solar magnetic activities and variability, both because the Sun serves as a key resource for understanding the underpinnings of astrophysics and our understanding of magnetic plasmas, and because activity on the Sun drives space weather. Space weather creates hazards for communications to and from satellites, as well as for astronauts and air travelers. Furthermore, and perhaps most importantly, the variability in solar energy induced by solar activity affects the Earth's climate. The key to understanding solar variability and its direct impact on the Earth rests with understanding all aspects of solar magnetic fields, which in turn control the fluctuating Sun.

This Environmental Impact Statement (EIS) is also being prepared to evaluate the potential environmental effects associated with issuing a National Park Service (NPS) Special Use Permit (SUP), pursuant to 36 Code of Federal Regulations (CFR) § 5.6 to operate commercial vehicles on the Haleakalā National Park Road during the construction and operation of the proposed ATST Project.

This EIS is a joint Federal and State of Hawaiʻi document prepared in compliance with the following documents and guidelines:

1. NSF has prepared this EIS in accordance with the Federal National Environmental Policy Act (NEPA) process (42 U.S. Code (U.S.C.) §4321 et seq., to evaluate the potential environmental effects associated with the siting, construction, and operation of the proposed ATST Project. The EIS was prepared in compliance with NEPA, Council on Environmental Quality (CEQ) NEPA Implementing Regulations (40 CFR Parts 1500-1508), the National Science Foundation's NEPA implementing regulations (45 CFR Part 640), and NPS Director's Order 12 Conservation Planning, Environmental Impact Analysis and Decision Making (NPS/USDOI 2001).

   As stated in those regulations, the purpose of an EIS is "to serve as an action-forcing device to insure that the policies and goals defined in the Act are infused into the ongoing programs and actions of the Federal Government. It shall provide full and fair discussion of significant environmental effects and shall inform decision makers and the public of the reasonable alternatives, which would avoid or minimize adverse effects or enhance the quality of the human environment." (40 CFR 1502.1).

2. The Federal NEPA process is separate and distinct from the State of Hawaiʻi environmental process to be completed by the University of Hawaiʻi (UH) in accordance with applicable State of Hawaiʻi statutes and regulations, as follows:

   a. The State of Hawaiʻi Chapter 343 Hawaiʻi Revised Statues (HRS), and Title 11, Chapter 200 Hawaiʻi Administrative Rules (HAR), EIS Rules, in that the proposed ATST Project may potentially meet one or more of the significance criteria for effects on Conservation District Land; and,

[1] The observatory facilities located at the summit of Haleakalā are sometimes locally referred to as "Science City" because of the numerous scientific research facilities present at the summit; however, the correct name is the Haleakalā High Altitude Observatory (HO).

b. HAR 13-5-31 (Permit and Applications), which requires an EIS to accompany the required Conservation District Use Application (CDUA), where significant effects may be anticipated.

No final action will be taken by the NSF pertinent to funding for the on-site construction, installation, and operation of the proposed ATST until the decision-making process under NEPA has been completed.

1.1 PROJECT LOCATION

The proposed ATST Project would be located on State of Hawaiʻi land within the Conservation District on Puʻu (hill) Kolekole, near the summit of Haleakalā. The UH IfA Long Range Development Plan (LRDP) for the Haleakalā High Altitude Observatory Site (http://www.ifa.hawaii.edu/haleakala/LRDP/) is a publicly vetted document that discussed two possible locations for the future development of a large solar telescope. Following the same review process for environmental documents, the LRDP was distributed to State of Hawaiʻi and County of Maui entities, NPS, U.S. Air Force, community associations, individuals, and to Maui public libraries. Notice of release of the draft LRDP was also published in the Maui News. The draft LRDP had an extended 9-month public comment period.

Puʻu Kolekole is about 0.3 miles from the highest point, Puʻu Ulaʻula (Red Hill) Overlook, which is in Haleakalā National Park (HALE). At an elevation of 10,023 feet, Haleakalā is one of the prime sites in the world for astronomical and space surveillance activities. The Kolekole cinder cone lies near the apex of the Southwest rift zone of the mountain. The rift zone forms a spine separating the Kula Forest Reserve from the Kahikinui Forest Reserve, both of which are pristine lands along the rift zone.

Immediately east of HO is the former General Broadcasting Area. A Federal Aviation Administration (FAA) air traffic control repeater station and a U.S. Department of Energy (DOE) research facility are situated immediately to the west of HO. Other land bordering HO is owned by the State of Hawaiʻi and controlled by the Department of Land and Natural Resources (DLNR). The only access road leading up to HO traverses through HALE. The NPS has exclusive jurisdiction over this portion of the road, which begins at 6,800 feet above sea level (ASL). This portion of the road is historically important and eligible for listing on the National Register of Historic Places.

Figure 1-1 shows the proposed ATST Project location on the island of Maui. Figure 1-2 is an aerial photograph showing existing structures within the HO complex. Figure 1-3 is a contour map of the HO and the DOE and FAA properties that are directly adjacent to HO.

The proposed ATST Project would be located within the 18.166-acre HO site at the summit of Haleakalā, County of Maui, Hawaiʻi, on approximately 0.86 acres of undeveloped land. The 0.86 acres includes the leveling area, buildings, and paved pads. The preferred site is east of the existing C. E. Kenneth Mees Solar Observatory (MSO) facility and will be referred to in the EIS as the Mees site. The alternative site would be at a currently unutilized site within the HO referred to as Reber Circle, and will be referred to in the EIS as the Reber Circle site. Figure 1-4 shows the location of both these sites within HO. As a NEPA requirement, the No-Action Alternative has also been considered. These alternatives are further defined in Section 2.0- proposed ATST Project and Alternatives.

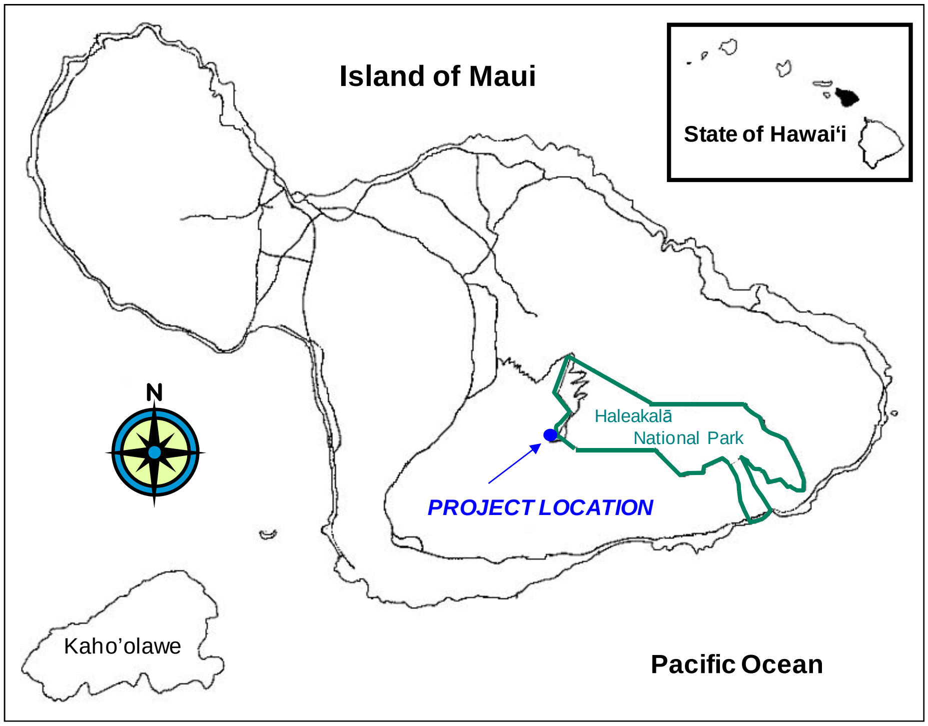


Figure 1-1. Proposed ATST Project Location on Island of Maui, Hawai‘i.

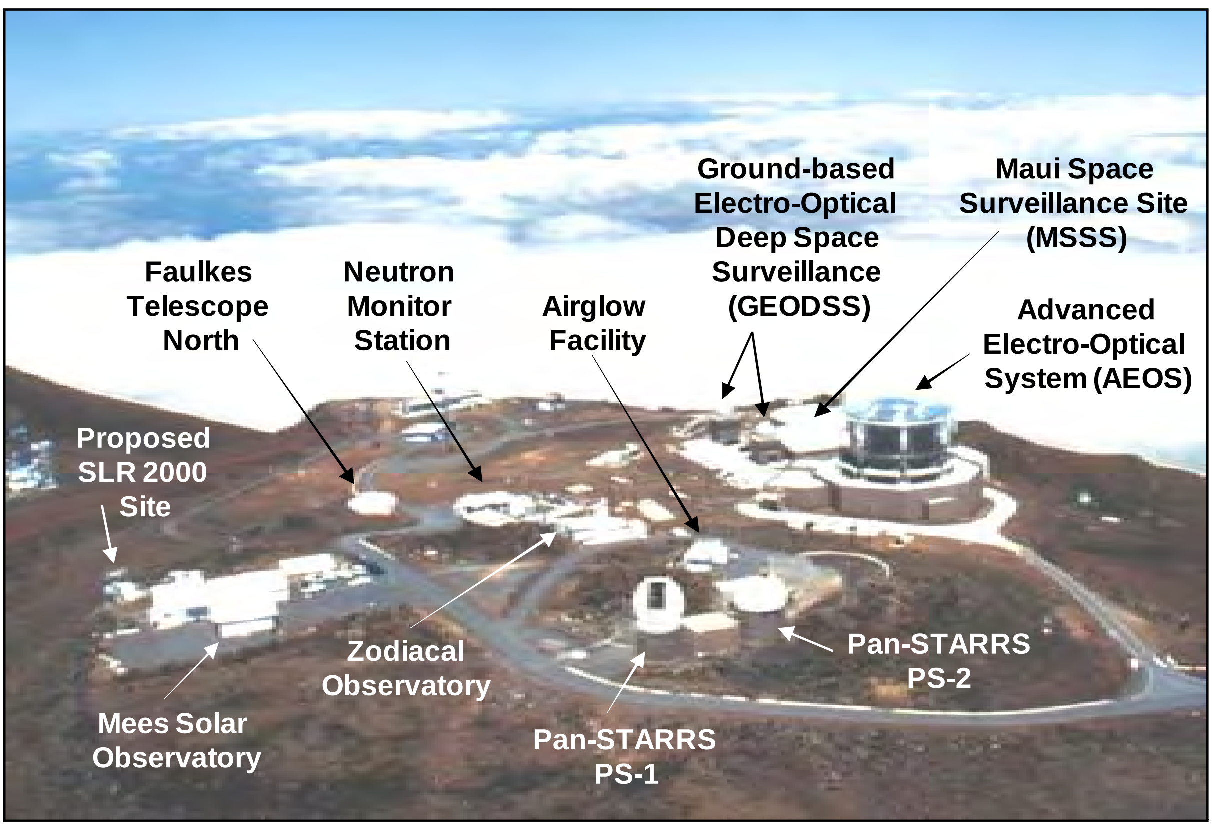


Figure 1-2. Haleakalā High Altitude Observatory Site Aerial Showing Existing Facilities.

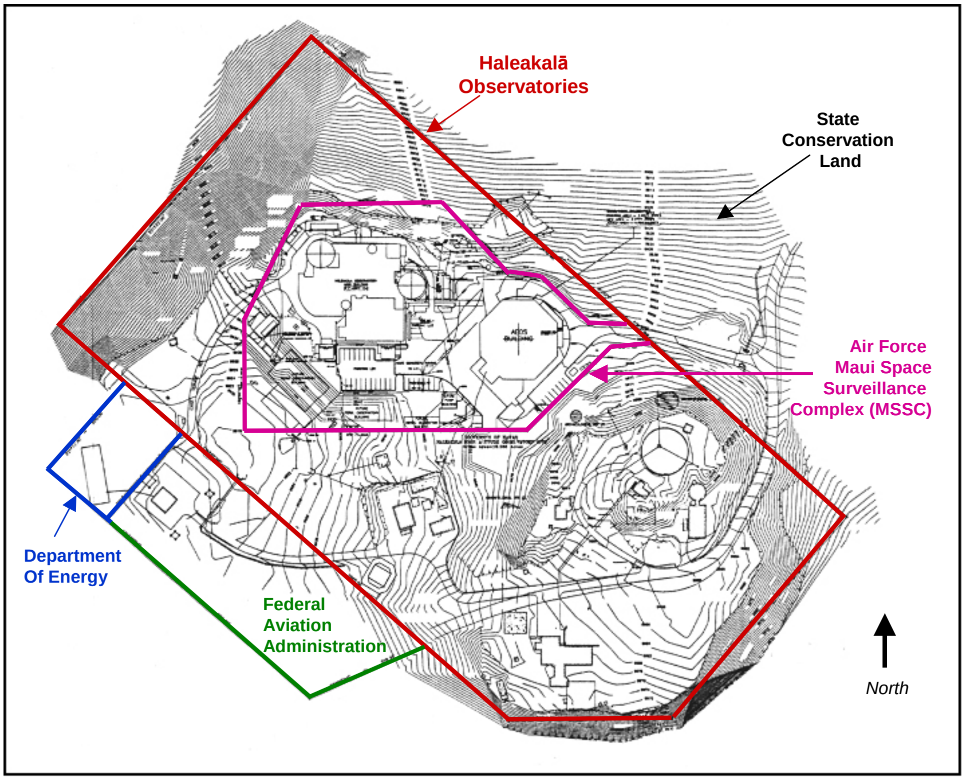


Figure 1-3. Haleakalā High Altitude Observatory Site, Department of Energy, and Federal Aviation Administration Properties.

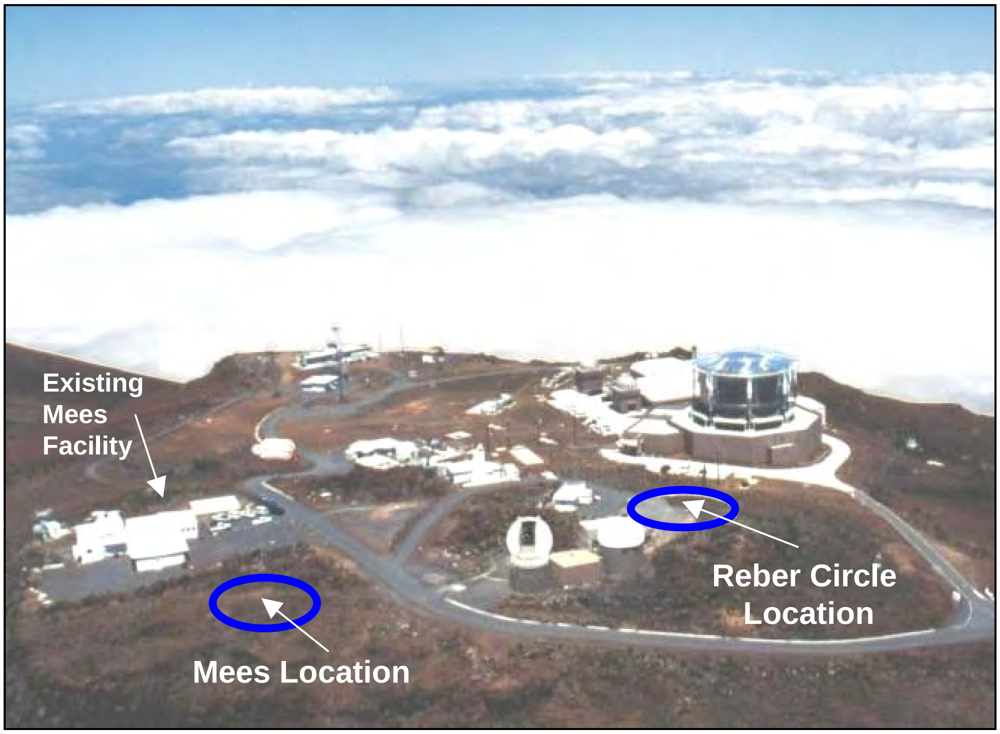


Figure 1-4. Aerial Showing Mees Site and Reber Circle Site Locations.

1.2 LAND OWNERSHIP

In 1961, an Executive Order (EO) by State of Hawaiʻi Governor Quinn set aside 18.166 acres of land on the summit of Haleakalā in a place known as Kolekole to be under the control and management of the IfA for scientific purposes. The site is known as HO and it is the only such property on Haleakalā specifically designated for such purposes. UH is the recorded fee owner of the parcel identified as Tax Map Key (TMK) (2) 2-2-07-008. Figure 1-5 shows the tax key map and general location of the proposed project. UH IfA is responsible for managing and developing the land. Other agencies established adjacent facilities through EO during the same period. Figure 1-6 shows the HO site TMK and adjacent properties.

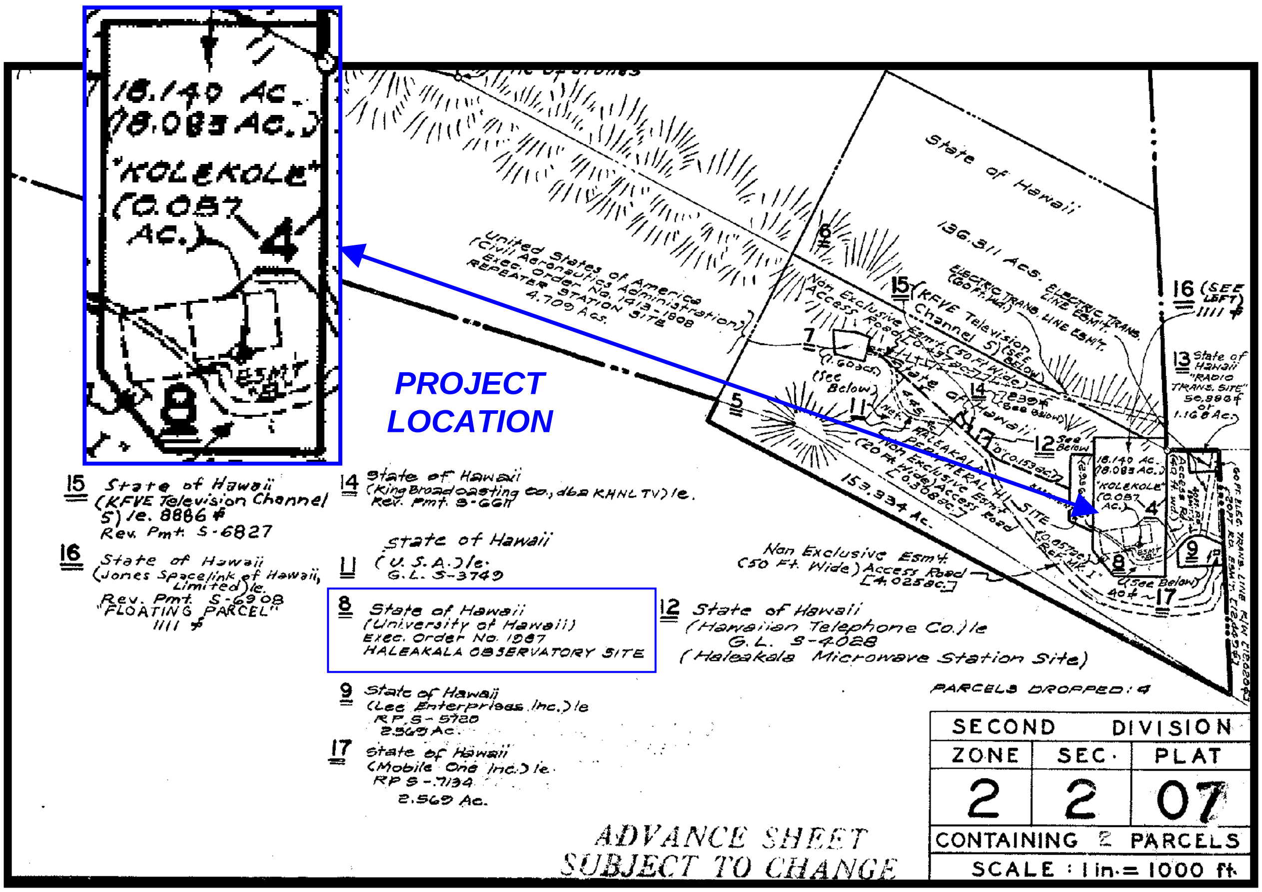
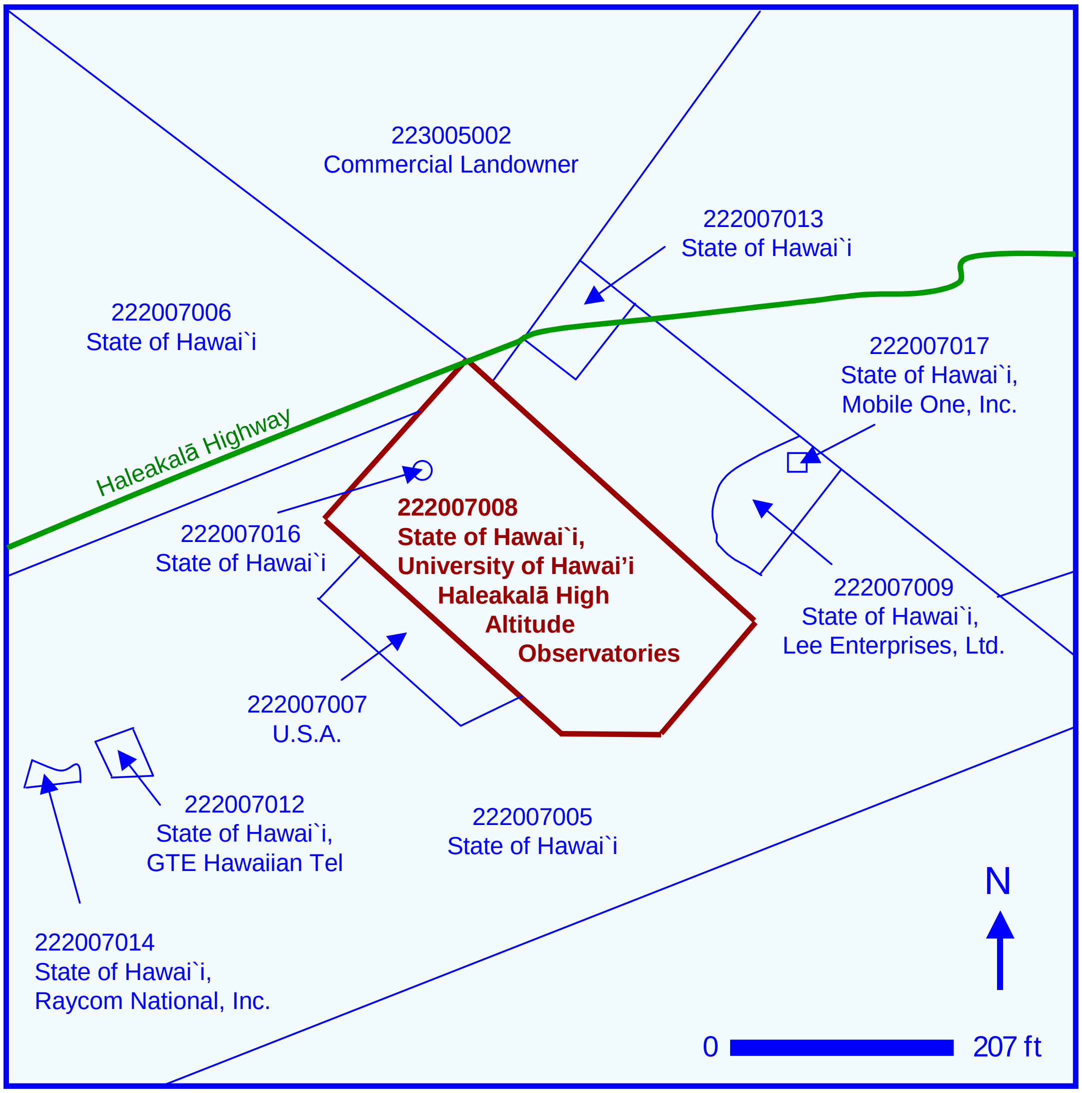


Figure 1-5. Haleakalā High Altitude Observatory Site Tax Map Key.



Internet website: http://kivanetext.co.maui.hi.us/kivanet/2/permit/index.cfm

Figure 1-6. Haleakalā High Altitude Observatory Site and Adjacent Properties.

1.3 IDENTIFICATION OF AGENCIES PROPOSING THE ACTION

National Science Foundation

NSF serves as the lead Federal agency for review under NEPA. NSF would fund construction of ATST if the project were to be approved.

The NSF is an independent Federal agency created by Congress in 1950. The NSF's Statutory Mission is "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense."

The NSF Vision

Enabling the Nation's future through discovery, learning and innovation. Realizing the promise of the 21st century depends in large measure on today's investments in science, engineering and mathematics research and education. NSF investment — in people, in their ideas, and in the tools they use — will catalyze the strong progress in science and engineering needed to secure the Nation's future.

Association of Universities for Research in Astronomy

The Association of Universities for Research in Astronomy (AURA) is a consortium of universities, and educational and other non-profit institutions that operates world-class astronomical observatories, termed "centers". Its members are comprised of 33 U.S. institutions and 7 international affiliates. AURA acts on behalf of the science communities that are served by its centers, and as trustees and advocates for the centers' missions.

AURA Mission Statement

"To promote excellence in astronomical research
by providing access to state-of-the-art facilities."

National Solar Observatory

The proposed ATST Project is a project of the National Solar Observatory (NSO) that is being considered for funding by the NSF. The IfA is one of several partners collaborating on this project and, therefore, it is cooperating in the Federal NEPA process, as well as leading the parallel State of Hawai‘i EIS process.

The proposed ATST project is an international venture led by the NSO. AURA operates the NSO under a cooperative agreement with NSF. Principal partners on ATST are the University of Hawai‘i Institute for Astronomy, the High Altitude Observatory (HAO) of the National Center of Atmospheric Research (NCAR), the University of Chicago, and the New Jersey Institute of Technology. Figure 1-7 is a chart identifying the primary agencies for the proposed ATST Project.

Together with the National Optical Astronomy Observatory (NOAO), NSO forms a Federally Funded Research and Development Center. NSO receives operations and development funds through a cooperative agreement with AURA, the NOAO/NSO management organization.

Mission of the NSO

The mission of the NSO is to advance knowledge of the Sun,
both as an astronomical object and as the dominant external influence on Earth,
by providing forefront observational opportunities to the research community.

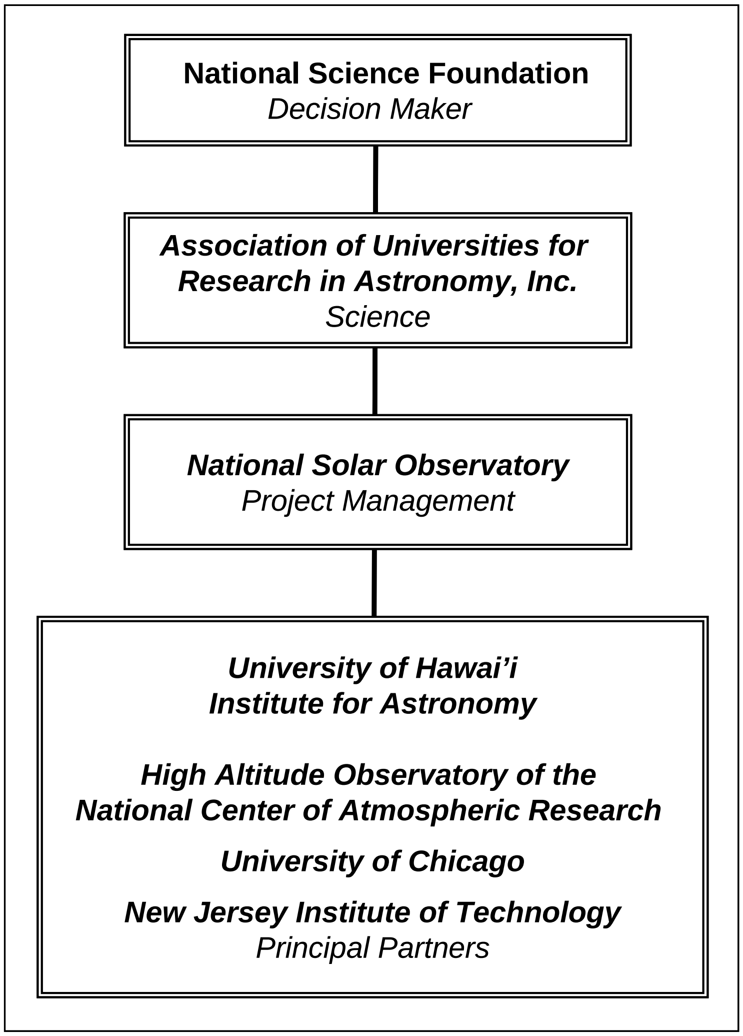


Figure 1-7. Primary Agencies for the Proposed ATST Project.

The mission includes the operation of cutting edge facilities, the continued development of advanced instrumentation both in-house and through partnerships, conducting solar research, and educational and public outreach. NSO accomplishes this mission by:

1. Providing leadership for the development of new ground-based facilities that support the scientific objectives of the solar and solar-terrestrial physics community.
2. Advancing solar instrumentation in collaboration with university researchers, industry, and other government laboratories.
3. Providing background synoptic observations that permit solar investigations from the ground and space to be placed in the context of the variable Sun.
4. Providing research opportunities for both undergraduate and graduate students, helping develop classroom activities, working with teachers, and mentoring high school students.
5. Innovative staff research.

1.3.1 Identification of Federal Agency

The Federal agency is the NSF, Division of Astronomical Sciences. The primary contact and authorized representative for the NSF is Craig Foltz, Ph.D., ATST Program Manager.

National Science Foundation, Division of Astronomical Sciences
4201 Wilson Boulevard, Room 1045, Arlington, VA 22230
Telephone: 703-292-4909 Fax: 703-292-9034

1.3.2 Identification of Accepting Authority

Federal

The accepting authority for the proposed ATST Project would be the National Science Foundation, which is also the applicant agency primarily responsible for the action. It assumes responsibility for preparing the EIS in accordance with NEPA, the CEQ NEPA-Implementing Regulations (40 CFR Parts 1500-1508), and the National Science Foundation's NEPA-implementing regulations (45 CFR Part 640). The primary contact is Dr. Craig Foltz, Program Manager.

National Science Foundation, Division of Astronomical Sciences
4201 Wilson Boulevard, Room 1045, Arlington, VA 22230
Telephone: 703-292-4909 Fax: 703-292-9034

State of Hawai'i

The NSF is the agency primarily responsible for the action and assumes responsibility for the EIS in accordance with HAR Title 11 Chapter 200-4(a). The accepting authority for the proposed ATST Project would be UH IfA (OEQC, 2005). The primary contact is Dr. Rolf-Peter Kudritzki, Director.

University of Hawai'i Institute for Astronomy
2680 Woodlawn Drive, Honolulu, HI 96822-1897
Telephone: 808-956-8312 Fax: 808 988-2790

The IfA was founded at the University of Hawai'i in 1967 to manage Haleakalā and Mauna Kea Observatories, and to carry out its own program of fundamental research into the stars, planets and galaxies that make up our Universe. One of eleven research institutes within the University of Hawai'i, it has a total staff of over 200, including about 45 faculty.

1.4 PROJECT SUMMARY

Project Name:	Advanced Technology Solar Telescope
Location:	Haleakalā High Altitude Observatory site, Maui, Hawai‘i
Judicial District:	Waiakoa, Papa‘anui, Makawao
Applicant:	National Science Foundation
Recorded Fee Owner:	University of Hawai‘i
Tax Map Key(s):	(2) 2-2-07:008
Land Area:	18.166 acres (HO), 0.86 acres (Proposed ATST Action)
Existing Use:	Observatories
State Land Use:	Conservation, General Subzone
County General Plan:	Conservation
County Zoning:	None
Special Management Area:	Not within Special Management Area
Accepting Authority:	Federal: National Science Foundation State of Hawai‘i: University of Hawai‘i

1.4.1 Need for the Project

Since George Ellery Hale’s 1908 discovery that sunspots coincide with strong magnetic fields, astronomers have become increasingly aware of the Sun’s magnetic field as a complex and subtle system. The familiar 11-year sunspot cycle is just the most obvious of its many manifestations. Recent advances in ground-based instrumentation have shown that sunspots and other large-scale phenomena that affect life on Earth are intricately related to small-scale magnetic processes whose inner workings happen on scales that are too small to be observed with current ground- and space-based telescopes.

At the same time, using advances in computer science and technology, scientists have developed intriguing new theories about those small-scale processes, but they lack empirical observational data to verify the validity of their models. Scientists are positioned for a new era of discovery about the Sun and how it affects life on Earth, how distant stars work, and how to possibly control plasmas in laboratories.

To embark on that journey, astronomers must observe the Sun and its magnetic activities at higher resolutions on three fronts:

1. Spatial — The telescope and its instruments must resolve fundamental scales of structures on the solar surface and in its atmosphere. In other words, they must depict those phenomena in sufficient detail to resolve the smallest features on the solar photosphere.
2. Spectral — The telescope and its instruments must resolve narrow slices of the solar spectrum for better measurements of magnetic fields and thermal structure. In other words, it must precisely divide up the Sun’s energy into different parts of the solar spectrum.
3. Temporal — The telescope and its instruments must be capable of obtaining high cadence (frequent) images and spectra of rapidly developing events in the solar atmosphere. In other words, it must acquire many more pictures in the same time interval in order to track rapid evolution of features on the Sun.

Further, astronomers must not only observe in familiar near-ultraviolet (UV) and visible light, but must also further exploit the relatively unexplored infrared solar spectrum. Scientists must see the faint solar corona in the infrared, measure the polarization of sunlight with greater precision, and cover a large field-of-view so extended areas of solar activity can be studied. These capabilities would reveal hidden aspects of magnetic activities and help us bridge the gap from what is known today to what must be learned in the future. But doing so requires a large and more technologically advanced telescope to overcome limitations imposed by current instruments.

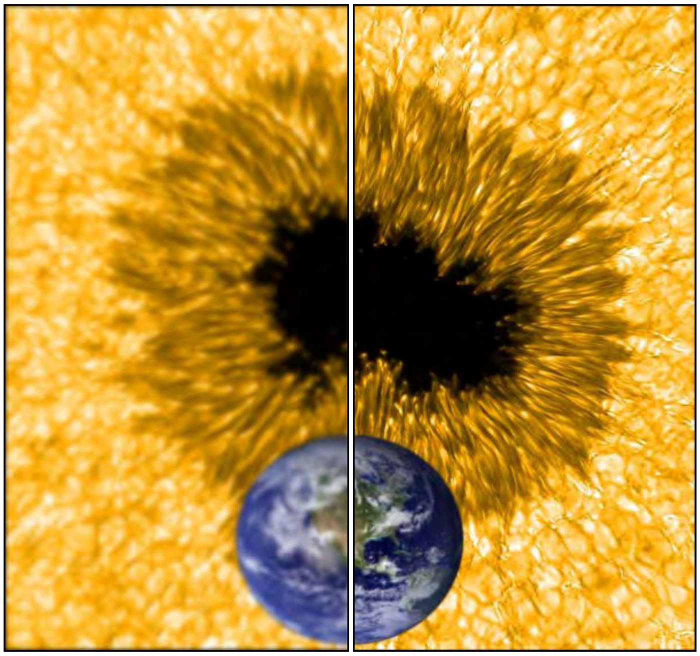
The technologies currently being used by the Mees Solar Observatory on Haleakalā are insufficient to meet these future challenges. The solution is a large aperture solar telescope supporting an array of advanced scientific instruments.

The NSO's long range plan recognizes that progress in understanding the Sun requires that it be treated as a global system, in which critical processes occur on all scales, from the very small (<100 kilometers, <62.1 miles) to scales that encompass the whole Sun. This was recognized by the National Research Council in its recent decadal report entitled, "Astronomy and Astrophysics in the New Millennium, 2001":

> *The first scientific goal for advancing the current understanding of solar magnetism is to measure the structure and dynamics of the magnetic field at the solar surface down to its fundamental length scale.*

Despite the brightness of the Sun, solar physicists share a problem with their nighttime colleagues: "photon starvation." While bright images of the solar disk, the corona, sunspots, and flares are the most familiar of solar observations, definitive work is done at high spectral and spatial resolution while observing a small section of the Sun in a spectrally narrow subset of the available light. This is like looking through a microscope and switching to higher powers and inserting a color filter: as you get closer to the object, you also reduce the available light, eventually approaching blackout. The amount of light that a telescope collects increases with the square of the telescope's diameter. Therefore, a four-meter (13.1-foot) telescope, such as the proposed ATST Project, is able to collect sixteen times more light than a telescope with a one-meter (3.3-foot) diameter.

Furthermore, the ultimate detail that a telescope can resolve, the so-called "diffraction-limit", is set simply by the diameter of its light-collecting primary lens or mirror. So, a telescope with a four-meter diameter can theoretically see four times more detail than can a one-meter telescope. In practice and like their nighttime astronomer counterparts, solar physicists must cope with atmospheric "seeing". Seeing is a term used by astronomers as a measure of the image quality with "excellent seeing" referring to conditions under which the images delivered through the atmosphere are very sharp and "bad seeing" referring to atmospheric conditions that blur the images. Looking up through Earth's atmosphere is like looking up from the bottom of a swimming pool — turbulence in the air blurs the images of celestial objects just like turbulence in the water blurs the view of objects above the pool. Without corrective measures, seeing limits current ground-based solar telescopes to the study of structures no smaller than a few hundred kilometers in size on the surface of the Sun (see Fig. 1-8). A larger telescope can solve the problem of light (photon) starvation, but atmospheric seeing would limit it to the same spatial resolution as smaller telescopes unless corrective steps are taken. Adaptive optics (AO), an emerging technology that corrects most of the atmospheric distortion, can enhance existing solar telescopes, but just to the diffraction limit set by their small apertures. Orbiting telescopes have a perfect seeing environment, but in order to achieve the resolution needed to study the smallest structures on the Sun, would require a large aperture, making for a prohibitively expensive telescope. Furthermore, space telescopes are expensive to operate, have lifetimes considerably shorter than ground-based telescopes, and greatly limited flexibility for instrument development and facility upgrades.



This image illustrates the size of sunspots and the clarity offered by high-resolution optical technologies that would be used in the 4-meter Advanced Technology Solar Telescope. Earth is shown to scale against an active region studied in September 2005 (AR 10810) by the Dunn Solar Telescope at Sunspot, NM. The left half depicts conventional ground-based seeing of 1 arc-second (i.e., the smallest feature is 1/3,600th of a degree wide), a result of blurring by Earth's atmosphere. The image at right is the result of adaptive optics (AO) that compensate for blurring and let the telescope see 7 times sharper, 0.14 arc-second, in a blue part of the spectrum. With its large aperture and high-order AO, the ATST would probe down to 0.02”, revealing for the first time the fundamental magnetic building blocks and their dynamical interaction with the plasma flows.

Figure 1-8. The Impact of Atmospheric Seeing and Correction by Adaptive Optics Techniques.

A large ground-based telescope — such as the proposed ATST with its 4-meter (13.1-foot) aperture and integrated AO system — can simultaneously advance spatial, spectral, and temporal resolution of solar observations. The proposed ATST Project would be a unique scientific tool providing an unprecedented combination of spatial, temporal, and spectral resolutions across visible and infrared wavelengths. As such, this telescope is expected to be useful and innovative for several decades to come and would be the first large, ground-based telescope designed to serve the entire community of solar and space physicists to be constructed in nearly 40 years.

To meet this challenge, a team led by the NSO is developing the ATST as the world’s largest optical solar telescope. An unobstructed 4-meter (13-foot) diameter primary mirror combined with the latest in computer and optical technologies would give ATST sharper views of solar activities than any telescope on the ground, in space, or in the planning stages. After a careful two-year study that began with more than 70 possible worldwide observatory sites, the NSO team, in collaboration with representatives from the solar physics scientific community, demonstrated that Haleakalā is the only site satisfying the ATST science goals. Section 2.0- proposed ATST Project and Alternatives provides a discussion of site selection criteria as well as justification for alternate sites considered but removed from further consideration. ATST would be an unprecedented facility, supporting world-class science from its “first light” anticipated in 2015 throughout future decades. It would be an indispensable tool for exploring and understanding physical processes on the Sun that ultimately affect Earth.

The proposed ATST Project would address questions that include:

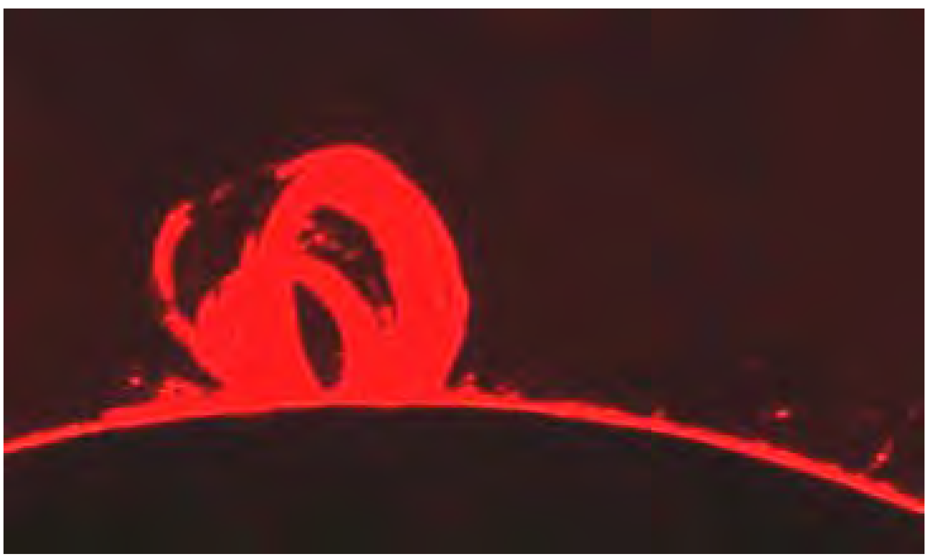
1. How are the highly intermittent magnetic fields observed at the solar surface generated? How are they dissipated?
2. What magnetic configurations and evolutionary paths lead to flares and coronal mass ejections (CMEs) (Figs. 1-9 and 1-10)?

3. What mechanisms are responsible for variations in the dynamo that drives the sunspot cycle and the Sun's energy output?

These are important because magnetic fields are key to fluctuations in solar energy. Their configuration and interactions are critical to our understanding of solar flares and CMEs that impact space weather and the mechanisms that drive sunspots that are not well understood.

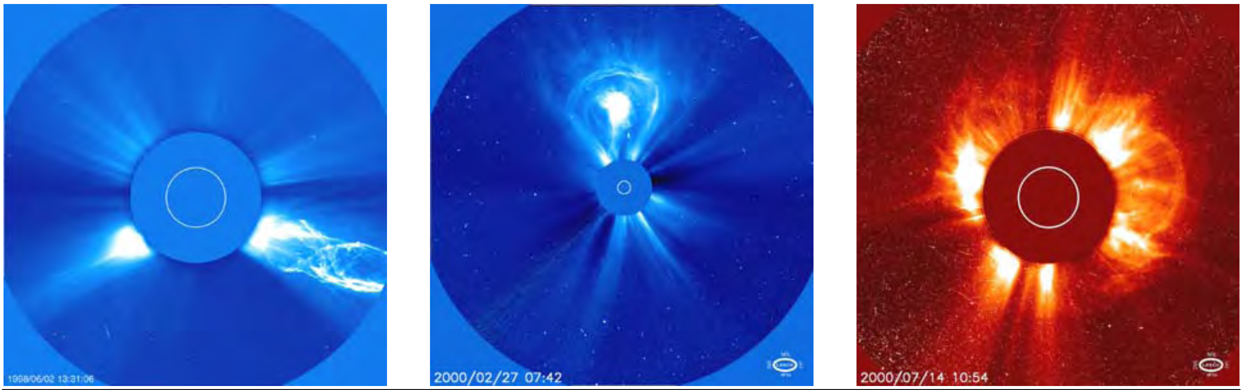
From a site on Haleakalā, the proposed ATST Project would have unprecedented sensitivity for measuring the Sun's outer atmosphere and it would be able to see the finest details on the disk of the Sun. The proposed ATST Project would be unique in its ability to resolve fundamental length and time scales of the basic physical processes governing variations in solar activity. Just as fundamental problems in atomic, nuclear, and gravitational physics were revealed through earlier studies in solar physics, the proposed ATST Project would have a broad impact on astronomy and astrophysics, plasma physics for potential future power systems, solar-terrestrial relations and climatology and ultimately, prediction of solar activity.

The existing NSF-funded, ground-based solar telescope facilities operated by the NSO were built more than a generation ago. The proposed ATST Project represents a once-in-a-life-time investment of significant expense and as such the selection of the site is critically important. The two primary science drivers — highest resolution seeing and dark daylight sky close to the Sun's corona — are the most critical when evaluating potential sites for the telescope.



While coronal loops, prominences, and other phenomena have inherent natural beauty, solar physicists see magnetic activity that is poorly understood at this time. The loop structure forms when coronal gases condense along magnetic field lines. With its large aperture and a suite of advanced instruments, the 4-meter Advanced Technology Solar Telescope would probe the structure and dynamics of coronal loops providing data to decipher the role they play in space weather and other solar activities.

Figure 1-9. Coronal Phenomena.



Coronal mass ejections (CMEs), flares, and other eruptions pose major hazards to spacecraft and to humans making future voyages to the Moon and Mars. Solar eruptions can fire large quantities of energetic particles across space and damage sensitive electronics and human tissue. The 4-meter Advanced Technology Solar Telescope will help scientists understand the origins of CMEs and other eruptions and to develop predictive tools.

Figure 1-10. Massive Eruptions on the Sun.

1.4.2 Purpose of the Project

Just a century after astrophysicist George Ellery Hale's breakthrough discovery, the ATST would take us deeper into the heart of sunspots, flares, and other key solar activities. Observations of the small-scale processes at the solar surface and through the overlying atmosphere of the Sun would help us understand the life cycle of magnetic fields. ATST would be a powerful, flexible system that would serve the U.S. and international solar physics communities as the primary ground-based facility in the first half of the 21st century.

At the onset of the 21st century, fundamental physical processes that govern the behavior of the Sun and many other astrophysical objectives remain elusive. The Sun provides the laboratory and unique opportunity to probe cosmic magnetic fields with unprecedented resolution in space and time and to test theories of their generation, structure, and dynamics. The field of solar physics has developed rapidly during the last decade, to a point where sophisticated theories and models await critical observational tests. However, existing instrumental capabilities no longer are sufficient to meet this challenge. Recent incorporation of practical AO systems in astronomical telescopes, coupled with other advances in unique and powerful instrumental techniques, now promises a major advance in solar observing capabilities. To achieve observational progress in solar astronomy, a solar telescope would have to have the capabilities listed in Table 1-1.

Table 1-1. Capabilities Required for Solar Observational Progress.

1. An angular resolution of 0.1 arcsecond*[a] or better to resolve the pressure scale height and the photon mean free path. In other words, the sharpest visual image possible using a telescope with optics sufficiently refined to produce that level of detail.
2. A high photon flux at the critical spatial resolution for precise magnetic and velocity field measurements. In other words, the capability of collecting as much "useful" solar radiation as possible and delivering it to the telescope's instruments.
3. Access to a broad set of diagnostics, from 0.3 to 35 microns*[b]. In other words, to observe the widest spectrum of solar light to observe atmospheric properties from the various structures on the Sun.

*a. Arcsecond: The second division of a degree of arc. One sixtieth of an arc minute (1/3600th of a degree.)
b. Micron, micrometer: A metric unit of length equal to one millionth of a meter.

Neither the current MSO facility on Haleakalā nor any other current or planned ground-based or space-based solar telescope in the world has these capabilities.

The following major advances in technology and instrumentation make it possible to realize a facility and telescope such as the proposed ATST Project before the end of the coming decade:

1. Functioning solar AO systems in the visible and infrared spectral regions.
2. An open-air solar telescope that provides diffraction limited images.
3. Large-format cameras operating in the visible and infrared spectral regions.

The astronomical community recognizes that technology has advanced to a point where better data can now potentially be obtained. Two studies established a roadmap for new solar observational capabilities: 1) the National Research Council report titled "Ground-based Solar Research: An Assessment and Strategy for the Future" (Parker and Canizares, 1998); and, 2) in the National Research Council's Astronomy and Astrophysics Survey Committee Decadal Survey, "Astronomy and Astrophysics in the New Millennium" (McKee and Taylor, 2001).

In the late twentieth century, a group of universities and laboratories formed a consortium to develop clear scientific objectives that would address the needs for fundamental measurements of solar magnetic variability and then to submit a proposal to the NSF to develop a concept that would address these needs. These objectives are defined and discussed in Section 1.4.3-Primary Objectives for the Project. In 2000/2001, these groups formed a Science Working Group (SWG) to quantify these science goals and translate them into design specifications for the telescope and site characteristics that would permit the telescope to obtain data that could meet the science objectives. A conceptual design for the telescope was developed that could fulfill the design specifications and hence meet the science goals if properly sited. Via this process, the science drivers were translated or "flowed down" into well-defined demands on both the telescope design and the detailed characteristics of any potential site.

In 2001 a smaller Site Survey Working Group (SSWG) was formed to evaluate potential sites. The conceptual design for the ATST facility was the basis for a construction proposal submitted to the NSF in January of 2004. The construction proposal was reviewed on the basis of this design assuming that the selected site could meet required observational conditions.

1.4.3 Primary Objectives for the Project

1.4.3.1 Understanding Solar Magnetic Activity

A primary goal of the proposed ATST Project would be to help scientists understand the solar magnetic activities and variability that drive space weather and the hazards it creates for astronauts and air travelers, and for communications to and from satellites. Space weather occurs when a solar storm on the Sun ejects a vast amount of ionized gas that travels through space and impacts the Earth’s magnetosphere, the protective sheath produced by the Earth’s own magnetic field. This magnetic field extends outward from the Earth’s core into interplanetary space where it encounters the magnetic field and moving charged gases (plasma) of the solar wind. The Sun flings one million tons of matter out into space every second. This mass loss, the so-called “solar wind”, is formed as the Sun’s topmost layer blows off into space carrying with it magnetic fields still attached to the Sun. It is driven by gusts and disturbances associated with violent events on the Sun. The buffeting of this solar wind against the Earth’s protective magnetic shield in space is responsible for storms we call space weather.

Studying space weather (Odenwald, 1999) is important to our national economy because solar storms can affect the advanced technology we have become so dependent upon in our everyday lives. The energetic plasma and radiation from solar flares and associated “coronal mass ejections” that cause colorful auroras at higher latitudes can also:

1. Harm astronauts in space,
2. Damage sensitive electronics on orbiting spacecraft and cause them to change position,
3. Create blackouts on Earth when they cause surges in power grids; and,
4. Disrupt communications networks.

The solar storms that can cause billions of dollars in damage to satellites and communication systems occur more frequently than may be expected. For example, the probability of such a storm or change in solar output affecting commerce with multi-billion dollar impact is estimated to be about 90 percent in our lifetime.

Another primary objective for the proposed ATST Project would be to resolve fundamental length and time scales of the basic physical processes governing variations in solar activity associated with climate changes on Earth. The Sun is indisputably the chief driving force for our terrestrial climate. The annual march of the seasons as the Earth’s axis of rotation tilts toward or away from the Sun’s direction is sufficient proof of that, while the presence of periodicities in glacial deposits matching those of known orbital variations has revealed the apparent sensitivity of global climate to relatively small changes in the distribution of sunlight. What has remained debatable and controversial, however, is the question of whether or not variations in the Sun’s radiative and plasma emissions occur that are capable of influencing the weather and climate at the Earth’s surface.

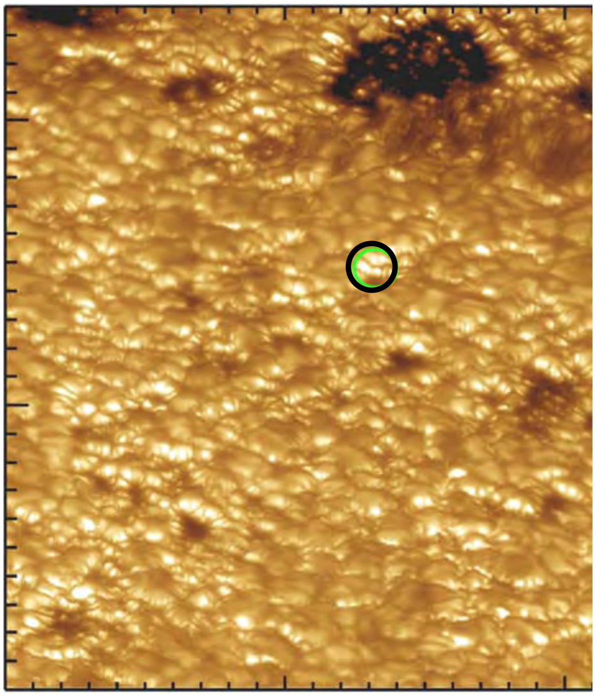
Like other stars of similar age, size, and composition, the Sun shows many signs of variability. Most pronounced and by far the most familiar is a cycle of about eleven years’ duration (NASA, 2006) in the number of “sunspots” on its glowing surface. But although the Sun is known to be a variable star, its total output of radiation is often assumed to be so stable that we can neglect any possible impacts on climate. Testimony to this assumption is the term that has been employed for more than a century to describe the radiation in all wavelengths received from the Sun: the so-called “solar constant”, whose value at the mean Sun-Earth distance is a little over 1.3 kilowatts per square meter of surface.

In actuality, the “solar constant” varies. Historical attempts to detect possible changes from the ground were thwarted by variable absorption of radiation by the Earth’s atmosphere. Measurements from spacecraft bypass this problem since they are outside the atmosphere. The most precise of these, made continuously since 1979 have revealed changes on all time scales — from minutes to decades — including a pronounced cycle of roughly eleven years. Sunspots and other forms of solar activity are produced by magnetic fields, whose changes also affect the radiation that the Sun emits, including its distribution among shorter and longer wavelengths. The most highly variable parts of the Sun’s spectrum of radiation are found at the very shortest wavelengths — the UV and X-ray region — and in the very longest and far less energetic band of radio waves.

Insights into the variable nature of the Sun and comparisons with weather and climate records are part of a determined effort to demonstrate that keys found in the cyclic nature of solar behavior might open the doors of down-to-Earth predictions. After more than a century of controversy, the debate as to whether solar variability has any significant effect on the climate of the Earth remains to be settled. This long unanswered question has some urgency when viewed in the context of widespread concerns about global warming and greenhouse gases. In order to gauge the possible impacts of anthropogenic greenhouse gases (those that are derived from human activities) on the present or future climate, scientists must first know the natural variations on which our own activities are imposed. Specifically, to understand the impacts of solar variations on climate they need to know how much the solar inputs vary, how the climate system responds to these changes; and, most importantly, scientists need answers to a number of questions about the Sun itself in order to predict how solar radiation will vary.

As the sunspot number rises or falls, the distribution of energy within the spectrum of sunlight also changes. High levels of solar activity enhance radiation at UV and X-ray wavelengths, and at radio wavelengths, far more than in the visible portion of the spectrum. At peaks of the eleven-year cycle, radiation at longer UV wavelengths, for example, increases by a few percent, compared with an increase of but 0.1 percent in the total radiation. Still larger changes — factors of two or more — are found in extremely short UV and X-ray wavelengths.

Changes in the Sun’s total radiation and its distribution in wavelength occur primarily because solar activity produces two different phenomena that alter the surface brightness, and hence modulate the outward flow of radiated energy. The first of these are sunspots that appear in great number during times of high solar activity. Cooler than surrounding regions, sunspots “block” some of the radiation that the Sun would otherwise emit for a time. The second are known collectively as *faculae* (Fig. 1-11). These are brighter than the surrounding surface, and add to the overall radiation from the Sun. The radiation that is emitted from the Sun varies continually in response to the push and pull of these two competing and constantly changing phenomena. In years of maximum solar activity, it is the bright faculae that prevail, raising the levels of both total and UV radiation.



A subtle, poorly understood aspect of energy from the Sun is faculae (Latin for "little torch"). These are bright points (the circle indicates an example) that are visible mainly near the limb of the Sun where we are looking at the sides of columns of hot gas circulating from the interior of the Sun. They are believed to be associated with magnetic flux tubes that emerge on scales that are too small to be studied easily with current solar telescopes.

Large numbers of faculae will form plages, bright areas that show up best in colors emitted by super-hot hydrogen atoms or calcium ions, and are a factor in the Sun's total irradiance, and hence its energy input to the Earth's atmosphere. Resolving and understanding the structure and formation of these faculae requires the capabilities of the 4-meter Advanced Technology Solar Telescope.

Figure 1-11. "Little Torches" on the Sun.

The major asset of the proposed ATST Project would be to enable precision studies of light emitted in narrowly defined colors. These would permit scientists to observe small, fast changing phenomena — with high-speed "movies" rather than just a few still images — and resolve the small scale magnetic structures in the solar atmosphere that are responsible for the majority of solar variability discussed above. These capabilities would come at a time of great progress in computer modeling of solar magnetic activity and would let scientists test theory with observations. Currently, the level of detail in the computer models of the interplay of the gas motions and magnetic fields on and above the solar surface is better than our ability to measure with current solar telescopes. Therefore, it is impossible to assess the validity and predictions of the models. This then hampers the development of better models and creates an impasse where our theories of solar physics cannot be checked and future progress is impeded.

To summarize, there are three primary objectives for the ATST telescope that must be met:

Objective 1: The ability to efficiently observe the solar atmosphere at or near the diffraction limit of the telescope (in other words, when turbulence in the atmosphere is minimal);

Objective 2: The ability to efficiently observe the faintest outer layers of the solar atmosphere, the corona, adjacent to the very bright photosphere; and,

Objective 3: The ability to observe the solar atmosphere at wavelengths from visible through mid-infrared wavelengths.

The ability to address these objectives defines NSF's purpose and need for the proposed ATST Project. In considering the potential funding of the proposed ATST, NSF has relied on the opinions of a large number of experts in the fields of astronomy, solar and space physics, as well as experienced telescope engineers and builders. In their consideration of the proposed ATST Project, these experts scrutinized the ability of the ATST design to meet the three primary science objectives in the context of an assumed satisfactory site.

As noted above, these science drivers establish detailed design constraints as well as strict demands on the properties of any potential site. The ability of the design to address the science objectives is no more or less important than the selection of the site. A very capable telescope placed at an inadequate site is no better than a poorly performing telescope on an exquisite site. In their evaluations, the ATST reviewers examined the design under the assumption that a satisfactory site exists and strongly recommended that the facility be constructed. Therefore, in considering the project for Federal funding, the design of the telescope and the quality of the site are inexorably linked such that both must meet strict criteria in order for the purpose and need to be met.

1.4.3.2 ATST Education and Public Outreach

The ATST consortium provides Education and Outreach (E&O) on several fronts that leverage and expand existing programs within the partnering groups and create unique opportunities offered by the ATST during both its development and operation. An Educational and Outreach Officer has been appointed to coordinate the efforts of the ATST partnering organizations.

The goals of the ATST E&O program include:

1. Increase student, teacher, and public understanding of the Sun, both as a star and as a prime driver of conditions on Earth,
2. Foster and sustain the growth of a new generation of solar physics research,
3. Increase the strength and breadth of the nation's university community pursuing solar physics and related fields; and,
4. Enhance the understanding and application of science and math education in our schools, colleges, and the public at large.

The E&O Program would draw from and reach out to the public at large, high school students, teachers, K-12 and college community programs, undergraduate and graduate students, post-doctoral and staff researchers and university staff.

A goal is to establish several graduate student positions at the partnering universities, including UH. Thesis topics would encompass a range of innovative engineering and solar science applications relating to the proposed ATST Project. Well-established, ongoing E&O activities complement the goals of the proposed ATST Project. The NSO is also developing a proposal to the NSF to fund activities specific to supporting new E&O activities associated with fulfilling the educational goal of the proposed ATST Project. NSO anticipates applying to the NSF in 2006-07 for a Planning Grant that would fund the definition of this new E&O Program and set the stage for seeking grants to implement proposed E&O activities and the hiring of qualified staff. Should the proposed ATST Project be funded, the NSO's goal would be to begin implementing activities before operations begin.

NSO has extensive experience in E&O programs at its Sunspot, New Mexico, and Tucson, Arizona, sites. It can also call on the experience of its colleagues within the broader AURA: NOAO, the Gemini Observatories, the Cerro-Tololo Inter-American Observatory, and the Space Telescope Science Institute. It would also call on expertise from the University of Hawai'i Institute for Astronomy.

NSO conducts annual programs offering both graduate and NSF Research Experience for Undergraduates (REU) students the opportunity to participate in hands-on astronomical research programs, working closely with staff scientists and engineers. A large fraction of today's active solar astronomers have participated in this extremely successful NSF-funded program. Students would be recruited into these programs specifically to work on science projects and instrument development programs related to the proposed ATST Project.

The proposed ATST Project's science and technology would be incorporated into classroom material that NSO produces and distributes nationally through participation in the Astronomical Society of the Pacific (ASP) Project ASTRO. NSO personnel participate as mentors and instructors in the NSF Research Based Science Education (RBSE) program and the NSF Research Experiences for Teachers (RET) program. Through these programs, high school teachers would work with NSO staff scientists to develop classroom exercises based on the proposed ATST Project's developments and extensive related NSO data that are available via the Internet (e.g., the Virtual Solar Observatory). NSO is a strong participant in the Southwest Consortium of Observatories for Public Education (SCOPE), and would participate in similar organizations in Hawai'i. This valuable collaboration would result in excellent interaction among the public and the educational outreach staff of these groups and include cooperative promotion, visitor center display sharing, and the ability to leverage limited funding into additional outreach opportunities. Materials would be produced that reflect the new capabilities of the proposed ATST Project to describe solar astronomy and the effects of the Sun on the Earth for dissemination by SCOPE.

Some preliminary plans for the E&O Program include:

1. <u>Internships:</u> NSO would develop a program for internships with college students from Hawaiʻi. Activities would include scientific research and hands-on work in the branches of engineering and the leading-edge technology involved in developing and operating the proposed ATST Project. Local educators would be consulted closely to develop the details of the program to meet their students' needs. The program would be open to all students with emphasis on Native Hawaiians and would concentrate on the development of a technically capable workforce.
2. <u>Post-doctoral Fellowships:</u> The NSO would provide opportunities for Post-doctoral candidates to participate in analysis, modeling, simulation and instrumentation efforts related to the science and engineering objectives of the proposed ATST Project.
3. <u>Student Programs:</u> The science and technological aspects of the proposed ATST Project offer a unique opportunity to greatly increase the role of solar physics in undergraduate education. The NSO E&O Program would develop educational modules designed to take advantage of the new observations and insights that would be derived from science operation of the proposed ATST Project. A plan would be developed for integrating these into existing astronomy and physics curricula following development work and field-testing with teachers and students at local schools. The NSO E&O Program associated with the proposed ATST Project would feature elements that could be deployed as permanent exhibits at visitor centers, as classroom activities at different grade levels in schools, as special events at summer camps or established science centers and museums on Maui, and as web-based activities.

The proposed ATST Project would encompass materials and in-service training for a range of hands-on and computer activities in conventional school and teacher in-service settings or as informal science education offerings at science camps, museum lectures, and other venues. Five thematic areas are in development or definition. Magnetic Carpet Ride and Goldilocks Star are publicly attractive names for education modules that address underlying ATST science issues in a manner not previously handled by science education.

1. <u>Magnetic Carpet Ride</u>: This will cover the basics of magnetism as it has been discovered and explored in solar physics, which is the principal scientific rationale for ATST. Solar researchers

use the Magnetic Carpet metaphor to describe the fine-scale, rapidly changing structure of the global solar magnetic field. NSO has developed a preliminary plan for a curriculum that explores the basics of magnetism as it has been discovered and explored in solar physics, and aspects of how it has been traditionally taught that apply to the proposed ATST Project. This project has been developed over the last two years by the E&O Program officer and would be vetted through the NSO science team presently.

2. Goldilocks Star: This activity turns the natural interest in seeking habitable planets — "not too hot, not too cold, but just right" — into a better awareness of the need to study and understand our Sun. This would be an integrated curriculum aimed at middle- and high-school students and combining aspects of biology, physics, and chemistry. The anticipated product would be materials and in-service training for a range of hands-on and computer activities that can be done in conventional school settings or as informal science education offerings (science camps, museum lectures). This project has been developed over the last two years by the E&O Program Officer and would be vetted through the NSO science team presently.

3. Hawaiians and the Sun: With cultural leadership from Hawaiian elders and educators, this would portray how native peoples perceived and interacted with the heavens in general (e.g., navigation) and the Sun in particular. This would combine elements of social studies and astronomy. This is a new concept that would not be advanced until the ATST EPO office can form a team of local elders and educators to guide the project.

4. Sizing Up Your Solar System: NSO is developing a 1:250 million-scale model of the solar system that includes math exercises on ratios and map scales using the relative sizes of the Sun and planets. The exercises are scaled to the Earth or Sun = 1 (for whatever unit is being used) so the students compute small, easily handled numbers even while working on astronomical scales. Other exercises include model building and art. The exercises include studying the solar interior and conveying a taste of the mystery that remains about how the solar dynamo and convective systems work. NSO has been developing the solar system model since 2003 and recently presented early lesson plans at the National Aeronautics and Space Administration's (NASA) "Living With a Star" education conference.

5. The Optics Bench: Derived from existing hands-on optics activities, the Optics Bench would introduce students and visitors to the basics of optics as used in solar observing and include basic physics and engineering contexts. Lesson plans and low-cost duplicates would be developed so the E&O office can take activities to classrooms and so teachers can replicate them. Highlights would include the NSO's AO work. This is a new activity based on existing science museum "cookbooks." ATST would investigate employing local high school shop classes to enhance local involvement.

1.5 CURRENT ENVIRONMENTAL SETTING FOR PROPOSED ATST PROJECT

HO is wholly contained within Pu‘u Kolekole. The Kolekole volcanic center is located in East Maui on the southwest rift of Haleakalā, adjacent to the deeply eroded and spectacular summit depression. Alkalic lava flows in this area belong to both the post-shield stage Kula series as well as to the initial phase of the rejuvenated stage Hana series. The observatories are largely built on ankaramitic picro-basalts and some basanites (UH IfA, 2005), found at http://www.ifa.hawaii.edu/haleakala/LRDP/. Geological field studies completed for the LRDP describe the HO property as an asymmetric volcanic cone whose slopes are steeper at the western and northwestern sides, while the eastern and southern slopes are gentler. Much of the northern slope — most of which is occupied by the Air Force Maui Space Surveillance Complex (MSSC) — is flattened and has been disturbed. The central crater of Kolekole is described as a flattened bowl of ponded ankaramite lava, spatter and pyroclastic ejecta. More than one eruptive vent was present on Kolekole. The primary vent was likely in the approximate position of the present day Panoramic-

Survey Telescope and Rapid Response System (Pan-STARRS) observatory, and one prominent likely secondary event is within the wide depression near the western border of the property (UH IfA, 2005). Presently, facilities located within HO (Fig. 1-2) observe the Sun, provide a world-class telescope for education and research outreach to students all over the world, use lasers to measure the distance to satellites, track and catalogue man-made objects, track asteroids and other natural potential space threats to Earth, and obtain detailed images of spacecraft. It is a principal site for optical and infrared surveillance, inventory and tracking of space debris, and active laser illumination of objects launched into Earth’s orbit, activities that are all crucial to the nation's space program

In addition to the facilities located at HO, two ahu (altar or shrine) are also located within the HO property. A Native Hawaiian master dry-stack mason constructed an east- and a west-facing ahu in 2005, both signifying a sacred ceremonial site. The east ahu was dedicated as Pā ele Kū Ai I Ka Moku and the west ahu was dedicated as Hinala‘anui. Native Hawaiians practicing cultural traditions are welcome to utilize the existing ahu sites. See Section 3.2- Cultural, Historic, Archeological and Resources for more information.

1.5.1 Local and Regional Perspective

In 1961, the 18.166 acres of land were designated and assigned to the IfA for scientific purposes, under EO 1987 by then Governor Quinn. UH IfA is responsible for managing and developing the land. Other agencies established adjacent facilities through EO during the same period.

Historical Uses

Table 1-2 lists a facility history for scientific events that occurred beginning in the spring of 1951 when Grote Reber conducted radio astronomy experiments at Haleakalā.

Table 1-2. Facility History at Haleakalā High Altitude Observatory Site.

Facility	Date	Event
"Reber Circle"	1951	Grote Reber, one of the pioneers of radio astronomy, experimented with radio interferometry using a large steel and wood truss antenna. Site abandoned approximately one year later.
none	1955	Dr. Walter R. Steiger of the UH Department of Physics conducted a site survey study near the summit of Haleakalā to determine the suitability of the location for a solar observatory.
none	1961	EO 1987 from Hawai'i's Governor Quinn to UH set aside 18+ acres of land on the summit of Haleakalā to establish the HO site. UH responsible for managing and developing land.
Mees Solar Observatory (MSO)	1957 to 1976	In preparation for the International Geophysical Year, the UH was approached by Dr. C. Kenneth Mees of Eastman Kodak to locate and operate a Baker-Nunn satellite-tracking facility on Haleakalā. In 1964, the MSO facility was named for Dr. C. Kenneth Mees.
	1964 to Present	NSF initially funded - and in later years NASA funded - the C.E. Kenneth Mees Solar Observatory, which began astronomical studies of the solar corona and chromosphere.
Airglow and Zodiacal Light Programs	1962	Airglow and Zodiacal Light program initiated in the old blockhouse in which Grote Reber had once housed his equipment.
University of Hawai'i Institute for Astronomy (IfA)	1967	The University of Hawai'i founded the Institute for Astronomy. The IfA's primary research activities include the study of galaxies, cosmology, stars, planets, and the Sun. At this point in time, the IfA's assets included the Waiakoa Laboratory in Kula, the Mees Solar Observatory, and the newly constructed Zodiacal Light observatory at the summit.
Airglow Facility	1972	Airglow program equipment moved to new facility.
Lunar and Satellite Ranging Observatory (LURE)	1974 to 2004	LURE, which was operated by IfA under contract to the NASA Goddard Space Flight Center, supported the NASA Space Geodesy and Altimetry Projects, has provided NASA with highly accurate measurements of the distance between LURE and satellites in orbit about the Earth, and which was involved in the NASA Crustal Dynamics Project. This project was replaced by the Pan-STARRS test-bed (PS-1) in 2006.
Cosmic Ray Neutron Monitor Station	1991 To 2007	Cosmic Ray Neutron Monitor Station, the only such station in the world, operated in association with the University of Chicago Enrico Fermi Institute and the Faulkes Telescope Facility.
Multi-color Active Galactic Nuclei Monitor Project (MAGNUM)	1998 to 2008	The University of Tokyo, the National Astronomical Observatory of Japan, and the Australian National University have installed a 2-meter telescope in the 9-meter North dome of the LURE complex to support the MAGNUM Project.

Table 1-2. Facility History at Haleakalā High Altitude Observatory Site (cont.).

<table>
<tr><th>Facility</th><th>Date</th><th colspan="2">Event</th></tr>
<tr><td>Faulkes Telescope Facility (FTF)</td><td>2004</td><td colspan="2">The Faulkes Telescope Facility at HO houses the largest educational outreach optical telescope in the world in support of astronomy research and education for grades K-college in Hawaiʻi and the United Kingdom. The FTF on Maui is known as the FTF North and its twin in Australia is known as FTF South.</td></tr>
<tr><td rowspan="9">Presently known as the Maui Space Surveillance Complex (MSSC)</td><td>1963</td><td colspan="2">Construction begins on the Advanced Research Projects Agency (ARPA) Maui Optical Station (AMOS), designated in 1977 as Maui Space Surveillance System (MSSS).</td></tr>
<tr><td>1965</td><td colspan="2">AMOS satellite tracking facility achieves first light.</td></tr>
<tr><td>1967</td><td colspan="2">ARPA designated MSSS site for Western Test Range midcourse observations, with the University of Michigan (UM) conducting operations and maintenance at the site. About 40 scientists, engineers and technicians worked for UM, about half traveling to the summit on any given day.</td></tr>
<tr><td>1969</td><td colspan="2">Routine missile tracking operations began under new contractors AVCO Everett Research Laboratory (AVCO) and Lockheed Missiles and Space Company. AVCO adds about 40 additional personnel for research and development, about half at the summit at any given time.</td></tr>
<tr><td>1977</td><td colspan="2">The twin 1.2-meter telescope at AMOS is dedicated to the Maui Optical Tracking and Identification Facility, known now as the MSSC, for daily routine satellite tracking operations. No new personnel were required.</td></tr>
<tr><td>1980</td><td colspan="2">Construction begins at MSSS on Ground-Based Electro-Optical Deep Space Surveillance System (GEODSS). Three new domes are built and approximately 10,000 square feet of office and laboratory space on the south side of MSSS.</td></tr>
<tr><td>1982</td><td colspan="2">The GEODSS, with three 1-meter telescopes becomes one of three operational sites in the world performing ground-based optical tracking of space objects. It employs about 15 operations and maintenance personnel.</td></tr>
<tr><td>1995 to Present</td><td colspan="2">One part of the MSSC is the MSSS, a facility combining operational satellite tracking facilities with a research and development facility. This also includes the Dept. of Defense’s (DoD) largest telescope, the Advanced Electro-Optical System (AEOS). Over the years the Air Force operation has grown to include a total of approximately 125 civilian and military personnel housed at the Kihei Research and Technology Park and approximately 115 more based at MSSS.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="2">Panoramic-Survey Telescope and Rapid Response System (Pan-STARRS)</td><td>2006</td><td>PS-1 South</td><td rowspan="2">These facilities house a 1.8-meter wide-field optical imaging system equipped with a 1.44-billion pixel charge-coupled device camera. This unique combination of sensitivity and field-of-view will address a wide range of time-domain astronomy and astrophysical problems in the Solar System, the Galaxy, and the Universe.</td></tr>
<tr><td>2009</td><td>PS-2 North</td></tr>
</table>

Existing Uses

Table 1-3 lists existing astronomical research facilities for advanced studies of astronomy and atmospheric sciences at HO. These facilities are discussed in more detail in Section 3.1-Land Use and Existing Activities.

Table 1-3. Existing Facility Uses at Haleakalā High Altitude Observatory Site.

<table>
<tr><th>Facility</th><th colspan="2">Primary Function</th></tr>
<tr><td>U.S. Air Force Maui
Space Surveillance Complex</td><td colspan="2">Presently, of the 18.166 acres, 4.5 acres are leased to the United States Army Corps of Engineers for the MSSC. MSSC conducts space surveillance and research activities for the DoD.</td></tr>
<tr><td>Ground-Based
Electro-Optical Deep
Space Surveillance System</td><td colspan="2">Another major part of the MSSC, which is one of three operational sites in the world performing ground-based optical tracking of space objects.</td></tr>
<tr><td>C. E. Kenneth Mees
Solar Observatory</td><td colspan="2">Emphasizes studies of the solar corona and chromosphere.</td></tr>
<tr><td>Zodiacal Observatory</td><td colspan="2">Houses the test-bed Scatter-free Observatory for Limb Active Regions and Coronae (SOLAR-C) Telescope Facility, both supported by UH IfA.</td></tr>
<tr><td rowspan="2">Panoramic-Survey Telescope and Rapid Response System</td><td>PS-1 LURE South</td><td rowspan="2">These facilities house a 1.8-meter wide-field optical imaging system equipped with a 1.44-billion pixel charge-coupled device camera. This unique combination of sensitivity and field-of-view will address a wide range of time-domain astronomy and astrophysical problems in the Solar System, the Galaxy, and the Universe.</td></tr>
<tr><td>PS-2 LURE North</td></tr>
<tr><td>Faulkes Telescope Facility</td><td colspan="2">Faulkes houses the largest educational outreach optical telescope in the world in support of astronomy research and education for grades Kindergarten through college in Hawaiʻi and the United Kingdom.</td></tr>
<tr><td>Haleakalā Amateur Astronomers</td><td colspan="2">The IfA dedicated a small building for the Haleakalā Amateur Astronomers to organize and host programs for professors and students at Maui Community College (MCC), K-12, Boy Scout groups, Akamai students, community members and others to conduct astronomy observations at HO.</td></tr>
</table>

Regional Scientific Events and Activities

Table 1-4 lists existing scientific events and activities in the Maui region.

Table 1-4. Regional Scientific Events and Activities.

Program or Activity	Description
Maui Community College Space Grant Program	The Maui Community College Space Grant Program is part of the University of Hawaiʻi Space Grant College Consortium, funded by a grant from NASA. The program promotes studies in areas concerned with the understanding, utilization, or exploration of space, and with the investigation of the Earth from space. Related fields of study include astronomy, engineering, adaptive optics, computer sciences, geology, meteorology, oceanography, physics, social sciences, and the life sciences. The program offers opportunities to conduct research or participate in internship projects by providing fellowships (monetary awards) to support students working on approved projects.
Maui Economic Development Board, Inc. (MEDB) - Akamai Internship Program	The Akamai Internship Program offers community college students and undergraduates that are attending college in Hawaii or that are from Hawaiʻi but studying on the Mainland an opportunity to get involved in high-tech research and industry. Each student is matched with a mentor and is integrated as a member of the mentor's group with daily guidance.
Maui Economic Development Board - Women in Technology Program	The Women in Technology Project is a Statewide workforce development initiative of the Maui Economic Development Board, funded in part through grants from the U.S. Departments of Labor, Agriculture and Education.
Haleakalā Amateur Astronomers	The Haleakalā Amateur Astronomers organize and host programs for professors & students at MCC, K-12, Boy Scout groups, Akamai students, community members and others. Observations and programs are frequently conducted at HO.
Maikalani Advanced Technology Research Center (ATRC)	The Maikalani ATRC is the University of Hawaiʻi IfA offices and research space mid-level facility. It is comprised of meeting rooms, and office space as well as four high-tech laboratories with isolated slabs for vibration dampening that allows various instruments to be assembled, fielded and tested prior to going on the summit. Community outreach is ongoing and include activities such as guiding Boy Scout troops through earning the Astronomy Merit Badge; two schools on Maui and one on Oʻahu are paired with schools in Brazil for the Science Teaching with Astronomical Robotic Telescopes (START) program; workshops for students and teachers; coordinating a live feed of observations from the Faulkes Telescope North. Scientific talks take place once per month with as many as 40 community members in attendance.
Maui High Schools and Maui Community College (MCC)	Science curriculum development in collaboration with IfA and science teachers is ongoing. Maui High School is also involved in the START program. MCC, as driven by the needs of the community, is also developing a 4-year Applied Engineering Technology Bachelor of Applied Science (BAS) program. MCC also participates in the above-mentioned Akamai Program.

1.5.2 Reference to Related Existing or Planned Projects in Region

Existing Projects at HO and Directly Adjacent Neighbors

Currently there are no existing projects at HO or within the areas directly adjacent to HO.

Recently Completed Projects at HO and Directly Adjacent Neighbors

The U.S. Army Corps of Engineers, on behalf of the Air Force Research Lab (AFRL), constructed an addition to the AEOS structure in 2007 that houses a Mirror Coating Facility for the AEOS primary mirror. A Federal Environmental Assessment was prepared and accepted for the project (AFRL, 2005).

The Maui Television Broadcast site on Pu'u Kolekole, located near the entrance to HO, was decommissioned after the relocation of broadcast towers to the 'Ulupalakua Ranch site. The site was cleaned up of structures and returned to a natural state. This project was completed in February 2009.

Planned Projects at HO and Directly Adjacent Neighbors
Currently there are no planned actions within the reasonably known future at HO. There are also no known planned actions within the areas directly adjacent to HO.

Planned Projects at HALE, Park Road Corridor
The only known project along the Park road corridor is a chip sealing project that was not completed in 2009. The project is planned for the upper two miles of road, involving a top coat of gravel and asphalt from the Leleiwi Overlook to the Haleakalā Visitor Center parking lot.

Public Projects
None.

Private Projects
The existing State Land Use District for the proposed ATST Project is designated as Conservation District, General Subzone. The 18.166 acres of HO land are within the Conservation District lands; therefore, no private projects are planned in the existing areas that constitute the General Subzone of conservation lands around the summit of Haleakalā. Section 1.7.2-State Land Use Law, Chapter 205, Hawai'i Revised Statutes, further describes the Conservation District.

1.6 COMPLIANCE WITH GOVERNMENT AGENCIES

1.6.1 Federal National Environmental Policy Act

This EIS is prepared pursuant to the NEPA of 1969, as amended, Title 42, United States Code §4321 et seq., the implementing regulations of the CEQ (40 CFR Parts 1500-1508). The purposes of this Act are: *"To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality."*

1.6.2 State of Hawai'i Environmental Laws

This EIS is prepared pursuant to the State of Hawai'i Chapter 343 HRS, State Environmental Review Law, and Title 11, Chapter 200 HAR, EIS Rules, in that the proposed ATST Project may potentially meet one or more of the significance criteria for effects on Conservation District Land.

1.6.3 Department of Land and Natural Resources

HAR 13-5-31(1) (Permit and Applications) requires an EIS to accompany the required CDUA. A copy of the EIS would be submitted with the CDUA. A copy of the LRDP will also be submitted with the CDUA per the request made by DLNRs Office of Conservation and Coastal Lands (OCCL, 2006) (Ref. letter: MA 06-47). The OCCL is responsible for overseeing approximately two million acres of private and public lands that lie within the State Land Use Conservation District. The CDUA will require a public hearing and a Board of Land and Natural Resources (BLNR) permit. The BLNR is composed of seven members, one from each land district and two at large, and the Chairperson, the executive head of the Department. Members are nominated and, with the consent of the Senate, appointed by the Governor.

1.6.4 Approvals and Permits

The proposed ATST Project would require a number of State and Federal Permits and approvals prior to construction. Most of those permit and approval applications that historically have needed iterative consultations, agency review, or formal concurrence, have already been initiated. However, the Conservation District Use Permit (CDUP) application requires an appended Final EIS. In addition, a SUP from HALE to operate commercial vehicles on the Park road during construction and operation of the proposed ATST Project is required. The environmental compliance required to support the issuance of the SUP is being combined with NSF's environmental compliance for the proposed ATST Project. Anticipated permits and approvals required for the proposed ATST Project are shown in Table 1-5.

Table 1-5. Anticipated Permits and Approvals Required for the Proposed ATST Project.

	PERMIT, CONSULTATION, OR CONCURRENCE	REGULATORY AGENCY	STATUS
Federal	Air Quality Consultation	U.S. Environmental Protection Agency	None
	Consultation in accordance with Section 7, Endangered Species Act (ESA)	U.S. Fish and Wildlife Service	Consultations completed. Biological Assessment Document under Informal Consultation issued stating that action would not likely have adverse effects on Federally endangered species. Consultation will be revisited if Park road repairs are needed.
	Consultation in accordance with Section 106 of the National Historic Preservation Act (NHPA)	DLNR, State Historic Preservation Office, Advisory Council on Historic Preservation	Consultations in progress.
	Special Use Permit (SUP)	U.S. Dept. of the Interior, National Park Service	Pending; environmental compliance underway.
State of Hawaiʻi	Conservation District Use Permit (CDUP)	Dept. of Land and Natural Resources	Consultation initiated; EIS and a management plan to be submitted with CDUA.
	National Pollutant Discharge Elimination System Permit and Water Quality Consultation	State of Hawaiʻi Department of Health, Clean Water Branch	Application for permit to be submitted if construction is approved.
	Individual Wastewater System (IWS) Approval	State of Hawaiʻi Department of Health, Wastewater Branch	Wastewater system final design in progress.
	Oversized and Overweight Vehicles on State Highways Permit	Department of Transportation, Highways Division (DOT)	Contact Maui District office for appropriate truck permit/traffic coordination.
	Determination under the Coastal Zone Management Area (CZMA)	State of Hawaiʻi Office of Planning	Request for determination to be submitted.

The proposed ATST Project received a comment letter from the State of Hawai‘i Dept. of Health suggesting that the Army Corps of Engineers (ACE) be contacted pursuant to the Federal “Clean Water Act”. In a telephone inquiry to Peter Galloway of the ACE, the ATST Project representative was informed that a Water Quality Certification is not likely to be required based on the location and nature of the project. A follow-up letter was sent by Mr. George Young, Chief, Regulatory Branch, in which he stated that after reviewing the DEIS and based on the information provided and other information available to their office, they have “…determined that these areas consist entirely of uplands and that the project would not involve any discharge of fill material into waters of the United States; therefore, Dept. of the Army (DA) permits will not be required.” (ACE, 2009).

1.7 STATE OF HAWAI‘I LAND USE CONFORMITY

1.7.1 Chapter 343, Hawai‘i Revised Statutes, Environmental Impact Statements

Chapter 343, HRS, Section 343-5, Applicability and requirements, lists the following line items project-relevant scenarios requiring an assessment under the State environmental review process:

1. Propose any use within any land classified as conservation district by the State land use commission under Chapter 205, State Land Use Law.
2. Propose any use within any historic site as designated in the National Register of Historic Places or Hawai‘i Register as provided for in the National Historic Preservation Act (NHPA) of 1966, Public Law 89-665, or chapter 6E.

1.7.2 State Land Use Law, Chapter 205, Hawai‘i Revised Statutes

In 1961, the State Land Use Law (Act 187), codified as HRS, Chapter 205, established the State Land Use Commission (LUC) and granted the LUC the power to zone State lands into one of four districts: Agriculture, Conservation, Urban, and Rural. Act 187 vested the DLNR with jurisdiction over the Conservation District. The DLNR formulated subzones within the Conservation District (Fig. 1-12; OCCL, subzone maps) and regulates land uses and activities therein. Conservation District Subzone designations regulated by the DLNR are Protective, Limited, Resource, General, and Special. Since 1964, the BLNR has adopted and administered land use regulations for the Conservation District.

The existing State Land Use District for the proposed ATST Project is designated as Conservation District, General Subzone. The objective of the General Subzone is to designate open space where specific conservation uses may not be defined, but where urban use would be premature. During the past few years, the OCCL within the DLNR has administered CDUPs for numerous potential uses, among them astronomical facilities on Haleakalā. The proposed ATST Project would be located in the area of the Conservation District that has been set aside for astronomical research (§13-5-25: Identified land uses in the General Subzone, which is applicable from R-3 Astronomy Facilities, (D-1) Astronomy facilities under an approved management plan); and many facilities conducting astronomy and advanced space surveillance already exist within HO.

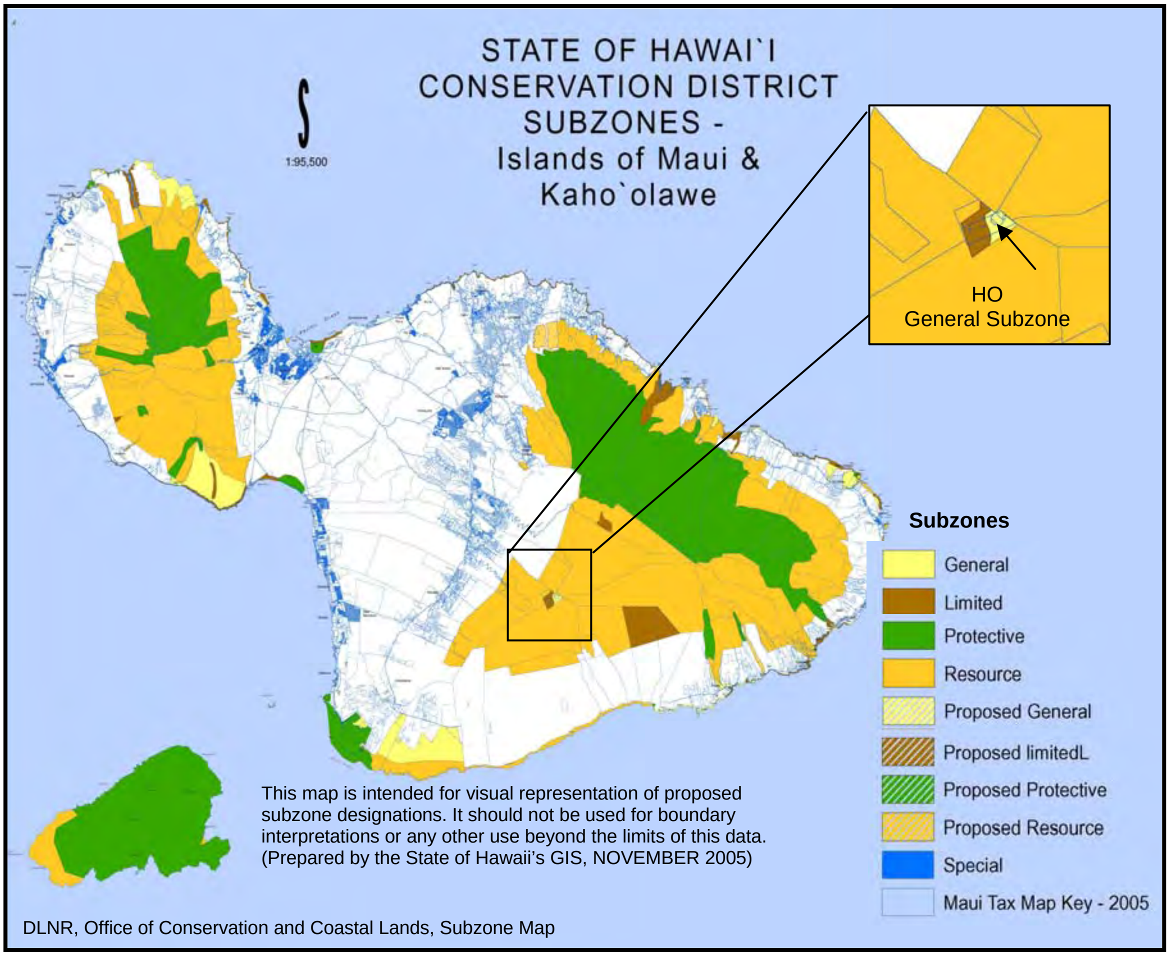


Figure 1-12. State of Hawai'i Conservation District Subzones

1.7.3 Coastal Zone Management Act, Chapter 205A, Hawai'i Revised Statutes

The Coastal Zone Management Area (CZMA) as defined in Chapter 205A, HRS, includes all the lands of the State. The subject parcel is not within the Special Management Area, pursuant to the County of Maui Planning Department map entitled Island of Maui Showing Special Management Area. This map is provided by the County of Maui Geographic Information Systems (GIS) Program Office of the Managing Director, dated July 2002, and is located in the Zoning and Administration Enforcement Division of the Planning Department, Wailuku, Maui, Hawai'i. The map clearly indicates that the proposed ATST Project that would be located in the HO complex would not be in the CZMA.

1.7.4 Hawai'i State Plan, Chapter 226, Hawai'i Revised Statutes

The Hawai'i State Plan, Chapter 226, HRS establishes a set of goals, objectives and policies that serve as long-range guidelines for the growth and development of the State. The Plan is divided into three parts: Part I-Overall Theme, Goals, Objectives and Policies, Part II-Planning, Coordination, and Implementation; and, Part III-Priority Guidelines.

The elements of Part II and Part III of the State Plan pertain primarily to the administrative structure and implementation process of the Plan. As such, comments regarding the applicability of Parts II and III to the proposed ATST Project are not appropriate. The sections of the Hawaiʻi State Plan Part I directly applicable to the proposed ATST Project are listed below and discussed in Sections 2.0, 3.0, and 4.0 of this EIS.

Part I of HRS 226, The Hawaiʻi State Planning Act, contains six sections that apply most directly to the proposed ATST Project. These are:

1. §226-6 Objectives and policies for the economy — in general.
2. §226-9 Objective and policies for the economy — Federal expenditures.
3. §226-10 Objective and policies for the economy — potential growth activities.
4. §226-12 Objective and policies for the physical environment — scenic, natural beauty, and historic resources.
5. §226-13 Objectives and policies for the physical environment — land, air, and water quality.
6. §226-21 Objective and policies for socio-cultural advancement — education.

1.7.5 Department of Health Environmental Planning Office

The State of Hawaiʻi Department of Health's Office of Environmental Quality Control (OEQC) implements Hawaii's EIS law (HRS 343), which was patterned after the NEPA requirements. The HRS law requires that government give systematic consideration to the environmental, social, and economic consequences of proposed development projects prior to allowing construction to begin. The law also assures the public the right to participate in planning projects that may affect their community. The preparation of environmental documentation for the proposed ATST Project is a joint Federal and State process; and, therefore, this EIS follows OEQC requirements for publishing a determination on the need for an EIS and ultimately acceptance or non-acceptance of the EIS. Through OEQC, the proposed ATST Project applicant makes available documents for review and comments and publicizes the public comment processes or public hearings where appropriate. In addition, publication in "The Environmental Notice" of an acceptance or non-acceptance determination by the Accepting Authority would delineate a 60-day legal challenge period for the proposed ATST Project.

1.7.6 Department of Land and Natural Resources

The DLNR is an integral part of the environmental review process for the proposed ATST Project. Since HO is on Conservation District lands, the proposed ATST Project is required to apply for permit for non-conforming use of conservation lands. The permit application process will require extensive environmental, biological, cultural, and historic review by various agencies, followed by public hearings and BLNR approval.

1.8 COUNTY OF MAUI COMMUNITY PLAN

The Makawao-Pukalani-Kula Community Plan (County of Maui, 1996) includes a policy that states: "Encourage Federal, State and County cooperation in the preparation of a comprehensive Haleakalā summit master plan to promote orderly and sensitive development which is compatible with the natural and native Hawaiian cultural environment of Haleakalā National Park."

The proposed ATST Project conforms to the LRDP for HO, which is the UH contribution to any summit master plan. There are more than twenty-five separate agencies with interests and facilities in the summit area of Haleakalā. IfA has taken the lead at the summit in preparing a LRDP for the coming decade, and the proposed ATST Project was an integral part of the IfA plan. The LRDP has specific protocols and measures that ensure orderly and sensitive development that is designed to be compatible with the intended land-use and purposes for the 18.166 acres of land under the auspices of IfA.

1.9 AGENCY NOTIFICATION AND COLLABORATION

The NSF and its collaborating agencies began the process of informal consultation with Federal and State agencies in May 2005, along with State of Hawaiʻi elected officials, island community groups, and relevant commercial interests (Table 1-6).

Details about agency collaboration and consultation throughout the EIS process can be found in Section 5.0-Notification, Public Involvement, and Consulted Parties. Numerous formal and informal consultations took place with Federal and State agencies; State of Hawaiʻi elected officials, Maui community groups, and relevant commercial interests to ensure full disclosure and information. These included, but were not limited to discussions and correspondence with the Advisory Council on Historic Preservation (ACHP), the Department of the Interior (DOI), the Federal Aviation Administration (FAA), the NPS, HALE, the U.S. Fish & Wildlife Service (USFWS), and the Hawaiʻi DLNR, the Office of Hawaiian Affairs (OHA), and MCC.

Table 1-6. Agency Consultation.

Elected Officials	U.S. House of Representatives: Congressmen Neil Abercrombie, Ed Case	
	U.S. Senate: Senators Daniel Akaka, Daniel Inouye	
	Hawai‘i State Governor Linda Lingle	
	Hawai‘i State Senate: Senators Rosalyn Baker, Mele Carroll, J. Kalani English, Chris Halford, Kyle Yamashita	
	County of Maui Mayor Alan Arakawa	
	County of Maui Council Members: Robert Carroll, Mike Molina, Charmaine Tavares	
Federal	Advisory Council on Historic Preservation, Council on Environmental Quality	
	U.S. Air Force Maui Optical Supercomputing Site	
	U.S. Coast Guard	
	U.S. Department of Energy	
	U.S. Department of Interior, Fish and Wildlife Service	
	U.S. Department of Interior, National Park Service and Haleakalā National Park	
	U.S. Environmental Protection Agency, Pacific Islands Contact Office, Region 9	
	Federal Aviation Administration	
	National Trust for Historic Preservation	
	National Weather Service/ National Oceanic and Atmospheric Administration (NOAA)	
State of Hawai‘i	Department of Accounting and General Services Public Works	
	Department of Accounting and General Services Public Works, Information and Communications Services Division	
	Department of Transportation	
	Dept. of Health, Clean Water Branch	
	Dept. of Health, Office of Environmental Quality Control	
	Dept. of Health, Wastewater Branch	
	Department of Business, Economic Development and Tourism, Office of Planning, Land Use Division	
	Dept. of Hawaiian Homelands, Land Management Division (Non-Homestead)	
	Dept. of Land and Natural Resources, Division of Forestry and Wildlife	
	Dept. of Land and Natural Resources, Island Burial Council	
	Dept. of Land and Natural Resources, Land Division	
	Dept. of Land and Natural Resources, Maui Na Ala Hele Advisory Council	
	Dept. of Land and Natural Resources, State Historic Preservation Division	
	Office of Hawaiian Affairs	
	Kaho‘olawe Island Reserve Commission	
	Maui Community College	
	University of Hawai’i Institute for Astronomy	
County of Maui	Chief of Police	Dept. of Parks and Recreation
	Cultural Resources Commission	Dept. of Planning
Maui Commercial Organizations	Boeing LTS	Maui Electric Company, Inc.
	Hawai‘i Telecom	Raycom Media, Inc.
	Maui Economic Development Board	Sandia Laboratories

Table 1-6. Agency Collaboration (cont.)

Island Community Groups		
Maui	Alu Like, Inc.	Keokea Hawaiian Homes
	A'o A'o O Na Loko I'a O Maui	Kilakila o Haleakalā
	Dept. of Hawaiian Homelands	Kipahulu Community Association
	Dept. of Hawaiian Homelands Grants Review Advisory Committee	Kula Community Association
	Fishpond Ohana	Lokahi Pacific
	Friends of Moku'ula	Malu'ohai Residents Association
	Friends of Polipoli	Maui Outdoor Circle
	Hawaiian Community Assets, Inc.	Na Kupuna O Maui
	Hawaiian Homes Waiehu Kou 1	Na Leo Pulama
	Historic Hawai'i Foundation	Na Po'e Kokua
	Hui Ala Nui O Makena	Native Hawaiian Educational Council
	Hui Kako'o 'Aina Ho'opulapula	Papa Ola Lokahi
	Hui No Ke Ola Pono	Paukukalo Hawaiian Homestead Community Association
	Hui of Hawaiians	Punana Leo O Maui
	Ka Imi Na'auao 'O Hawai'i Nei	Queen Lilioukalani Children's Center
	Kamehameha Schools Alumni	Royal Order of Kamehameha I
	Kamehameha Schools	Sierra Club
	Kawaihapai Ohana	The Nature Conservancy
Hawai'i	Hawaiian Civic Club of Hilo	Kanu o ke 'Aina Learning 'Ohana
O'ahu	Council for Native Hawaiian Advancement	Royal Hawaiian Academy of Traditional Arts
	Hawai'i Maoli	The Friends Of 'Iolani Palace
	Hui Kako'o 'Aina Ho'opulapula	The I Mua Group
	Na Ku'auhau'o Kahiwakaneikopolei	

1.10 PUBLIC DISCLOSURE AND INVOLVEMENT

During the course of planning for the proposed ATST Project within HO or in the course of preparing studies or submitting applications for various approvals for the project, agencies, individuals, and organizations were notified, contacted, or consulted. Details of public and agency disclosure and involvement regarding the proposed ATST Project consisting of pre-assessment notification letters, agency and media announcements, documentation distribution lists, and public scoping meetings can be found in Section 5.0-Notification, Public Involvement, and Consulted Parties. The public was encouraged to comment during required disclosure periods and comments during the scoping process can be found in Vol. III-Appendix A-Pre-DEIS Public Comments. Additional public disclosure and involvement throughout the EIS and permitting process would be approached using similar methods.

1.10.1 Draft Environmental Impact Statement Public Involvement

The Draft Environmental Impact Statement (DEIS) was made public on September 8, 2006, to coincide with notification in the OEQC "Environmental Bulletin". Notification was also published in the Federal Register on September 6, 2006 (Federal Register, Vol. 71, No. 172). Three public comment meetings were held and the public was encouraged to submit comments during the required 45-day public comment period. Details about the DEIS Public Comment Meetings can be found in Section 5.0-Notification, Public Involvement, and Consulted Parties.

Public comment hearings to the SDEIS will take place during the 45-day comment period. The public will gain be encouraged to submit comments during the comment period. Public comments and responses to the DEIS and the SDEIS will be included in the Final EIS.

1.10.2 Section 106 Public Involvement

During the intervening period between publication of the DEIS and preparation of this SDEIS, numerous meetings and consultations were held with the interested public and agencies to solicit input on cultural and historic issues pertaining to the proposed ATST Project. These meetings and consultations include, but are not limited to, discussions and input from the State Historic Preservation Division (SHPD), ACHP, OHA, students and faculty of MCC, HALE, the DOI, the Royal Order of Kamehameha I, Kula Community Association, and others. Details about Section 106 consultations can be found in Section 5.0-Notification, Public Involvement, and Consulted Parties, and public comments during the scoping process prior to publication of the DEIS can be found in Vol. III, Appendix A-Pre-DEIS Public Comments. Public comments and responses to the DEIS and the SDEIS will be included in the Final EIS.

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2.0 PROPOSED ATST PROJECT AND ALTERNATIVES

2.1 INTRODUCTION

The proposed Advanced Technology Solar Telescope (ATST) Project includes construction, installation, and operation at the Haleakala High Altitude Observatories (HO) site on the island of Maui, Hawaiʻi. It also involves obtaining a SUP from HALE to operate commercial vehicles on the Park road. This section describes the proposed ATST Project at the preferred site and one alternative site, as well as a No-Action Alternative. If approved, the proposed ATST Project would be constructed at one of two currently unutilized sites within HO. The preferred site is near the existing Mees Solar Observatory (MSO) facility and is referred to in the Environmental Impact Statement (EIS) as the Mees site**.** The alternative site would be at an identified and currently unutilized site within the HO boundary large enough to accommodate the telescope. This site is the previous location of a radio astronomy experiment, referred to at HO as Reber Circle and will be referred to as the Reber Circle site.

This section describes the development of the alternatives and process for identifying scientifically viable sites, construction activities and schedule, the final form the proposed ATST and its supporting facilities would take, and ATST operations. Furthermore, this section includes a discussion of sites considered but not carried forward for full analysis and evaluation, due to their failure to meet the purpose and need of the proposed ATST Project.

2.2 SITE SELECTION

2.2.1 Site Selection Chronology

The existing ground-based solar telescope facilities operated by the National Science Foundation (NSF) were built over a generation ago. The proposed ATST Project represents an opportunity to implement a unique astronomical resource that is expected to be useful and innovative for several decades to come. As such, the selection of the site is critically important. Thus, the site selection process was carried out with substantial solar research community oversight and input. An outline of the history of the site selection process is as follows:

> **1998 to 2000** – The requirements for a large aperture ground-based solar telescope to measure and understand solar magnetic fields and atmospheric structure were articulated in the National Academy of Sciences/National Research Council report entitled “Ground-Based Solar Research: An Assessment and Strategy for the Future”, 1998, and in the NSF and National Aeronautics and Space Administration (NASA) “Astronomy & Astrophysics Survey Committee Decadal Survey”, 2000. Twenty-two U.S. universities and solar institutions led by the National Solar Observatory (NSO) developed a proposal defining the scientific objectives as well as proposing a conceptual design and development effort for such a telescope. This effort included a set of site survey parameters needed to characterize an optimal ATST site. These included the fraction of time that the sky is clear, atmospheric seeing, sky brightness, and water vapor content. The ATST Science Working Group (SWG) was formed and included representatives from the partnering institutions as well as broad international representation. The SWG further refined the science objectives and quantified the necessary measurements of site parameters.

> **2000** – An SWG workshop was held in May to discuss the science drivers and flow them down to design requirements, including site properties. The initial membership of the ATST Site Survey Working Group (SSWG) was formed at the American Astronomical Society/Solar Physics Division Meeting at Lake Tahoe, Nevada in June. The membership included representatives of the major solar astronomical observatories. The panel also included experts in interpreting atmospheric seeing measurements, and experts in interpreting coronal sky brightness measurements.

2001 – The SWG produced the ATST Science Requirements Document (SRD) in 2001. The instrumentation to measure the seeing and the sky brightness was selected and development started. An initial list of 72 potential sites was prepared and the sites were evaluated on a broad set of criteria to identify six sites that were testable within the resource constraints of the survey. The criteria that formed the basis for the elimination of the other 66 sites are discussed in Section 2.2.2-Site Selection in Detail.

2002 – The deployment of the atmospheric seeing monitors was completed and data collection was initiated at the six sites designated for testing. The construction of the sky brightness monitors began. The SRD was publicly released by the SWG (March 2002) and included refinement of the seeing specifications required to meet scientific goals (September 2002). The site requirement goals needed to fulfill the scientific objectives (as stated in the SRD) were refined by the SSWG and finalized in October 2002 (ATST Project Document Specification 0006 Rev. A, available on the Internet at: http://atst.nso.edu/library/docs/SPEC-0006.pdf) (ATST, 2002). The development of procedures for analyzing the seeing data was begun.

2003 – The operation of the seeing monitors and analysis of the data continued at the six test sites. The sky brightness monitors were installed in May. A meeting of the SSWG and the SWG was held in October. This meeting concluded that: 1) three of the six sites tested did not fulfill the site requirement goals; 2) the seeing data analysis could be improved by explicitly including two additional measurements of seeing that provided information averaged over the entire atmosphere of the earth (because the seeing data was critical to the site selection process**;** and, 3) one additional year of data was needed, especially for sky brightness measurements. The decision was made to end the testing at three of the sites and continue for an additional year at the remaining three (Big Bear Lake, Haleakalā, and La Palma).

2004 – As a result of the NSF-funded Design and Development effort, the ATST consortium submitted a construction proposal to NSF in January. This proposal was reviewed, first by write-in reviewers and then by a panel convened by NSF. The proposal received excellent ratings in all aspects, including the careful attention devoted to selecting the proposed site. The seeing data analysis was improved and tests to verify the seeing results were successfully conducted. The operation of the seeing and sky brightness instrumentation continued at the remaining three sites, as did the data analysis. In October, the SSWG and the SWG reviewed the completed site survey data analysis and concluded that Haleakalā met the criteria for the primary science outputs — annual required hours of good seeing and dark skies. A final report (ATST, 2004) was produced and is available on the Internet at: http://atst.nso.edu/site/reports_final.html.

2005 – In January 2005, after six months of public review, UH IfA finalized its Haleakalā High Altitude Observatory Long Range Development Plan, which included conceptual descriptions of ATST and the two unused potential sites still available for facilities. Also in January, after review of the final site survey report, and Solar Observatory Counsel (SOC) recommendation, Association of Universities for Research in Astronomy (AURA) notified the NSF that Haleakalā met the criteria for the primary science output — annual required hours of good seeing and dark skies. AURA concluded that La Palma was deemed an acceptable site only for the highest resolution science outputs based on it meeting the requirement for hours of highest resolution seeing.

2.3 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

2.3.1 Site Selection in Detail

In order to determine which sites would meet the purpose and need of the proposed ATST Project, the SSWG was formed. The charge to the SSWG is as follows:

"The main objective of the ATST site survey is to ensure that the ATST is located at the best feasible site. The task of the SSWG is to advise the ATST Project Scientist on how to perform the ATST site test campaign. The goal of the site survey is to ensure that the ATST is located at a site that allows the ATST to meet its science requirements. The SSWG is composed of solar physics community members with a range of expertise that includes site testing and solar observing. The SSWG reports to the Project Scientist on a regular basis.

The SSWG will:

- *Develop, review and evolve a site-testing plan*
- *Specify site requirements based on science requirements stated in the ATST proposal*
- *Consult with the Project Scientist and ATST Science Working Group (ASWG) on site requirement specifications*
- *Recommend the initial sites to be tested*
- *Recommend site test procedures and equipment*
- *Review the data reduction methods*
- *Periodically monitor the results*
- *Prepare a report on the site survey results"*

The ATST SSWG Final Report (Vol. II, Appendix O) summarizes the work of the SSWG in the site selection process. The SSWG Final Report is one of the few comparative studies of solar-observing site characteristics to be carried out with consistent instrumentation and analysis methods and is further explained below.

The SSWG site selection process began with the development of a list of potential sites, with the only constraint being that the candidate sites be reasonably sunny (SSWG Final Report, p. 14). The list of candidate sites was then prepared, along with basic geographic and climate data for each site. The SSWG was then required to cull the list down from 72 to six candidate sites, because only six sites could be carried forward for testing, due to resource constraints associated with the cost of operating the testing regime for two years, and taking and analyzing the data of the SSWG survey (SSWG Final Report, p. 14).

The 72 candidate sites were discussed and debated among the SSWG members. Factors considered for each site during these debates included meteorological conditions such as cloud cover; annual precipitation; prevailing wind patterns; presence of aircraft contrails; site access; availability of utilities; and size of the site relative to the anticipated site plan for the proposed ATST facility. Anticipated costs of building on the site were not a factor in these considerations. At the conclusion of these debates, considerations of feasibility and observing conditions as well as, in some cases, changing environmental conditions (particularly drought) revealed in site visits, led to the reduction of the list to six remaining candidate sites (SSWG Final Report, pp. 1, 14-16).

The final list of six sites to be instrumented for detailed study represented a cross-section of geographical locales: continental mountain (Sacramento Peak), continental mountain lake (Panguitch Lake), peninsula mountain (San Pedro Martir), coastal mountain lake (Big Bear), Atlantic island mountain (La Palma), and Pacific island mountain (Haleakalā). Big Bear Lake, La Palma and Sacramento Peak were selected because they are homes to well-established and productive solar observatories. Because island sites often demonstrate atmospheric stability, three potential Hawaiian sites (Mauna Kea, Mauna Loa, and Haleakalā) were also evaluated. Mauna Kea was eliminated from further consideration because only one area within the Science Reserve was available, and it was revealed from a prior site survey to have poor daytime seeing. Mauna Loa was eliminated from further consideration because the plot size was too small to accommodate the proposed ATST Project. Panguitch Lake in Utah was chosen as one of the six candidate sites for further study because lake sites are known to have potentially good seeing characteristics. Further, the Panguitch Lake site is located at high-altitude. Finally, San Pedro Martir in Baja California was included since it is a peninsular mountain site in relative close proximity to large bodies of water, which promote less turbulence.

Sacramento Peak, with its very well-studied and known atmospheric conditions, served as a control site against which data from the other sites could be compared. This site was also considered to be a viable candidate based on scientific and feasibility criteria.

After the six candidate sites were identified, the SSWG incorporated a new technique of combined differential image motion and scintillation measurements to estimate the seeing characteristics over a range of heights above each candidate site (SSWG Final Report, p. 98). The site survey equipment to assist in site selection identification included “a multi-band miniature coronagraph to estimate sky brightness and water vapor content” (SSWG Final Report, p. 98). This resulted in a considerable database of information on the remaining six candidate sites as explained below.

A set of objective criteria was developed to determine which of the six candidate sites would meet the science requirements for the proposed ATST Project. These criteria flowed down from the science drivers articulated in the ATST Science Requirements Document (http://atst.nso.edu/files/docs/SPEC-0001.pdf), released by the ASWG (March 2002). Primary among these criteria were:

1. Two hundred (200) annual hours of excellent “seeing” conditions. (As noted in Section 1.0-Introduction, seeing is a term used by astronomers as a measure of the image quality with “excellent seeing” referring to conditions under which the images delivered through the atmosphere are very sharp and “bad seeing” referring to atmospheric conditions that blur the images.) (SSWG Final Report, p. 12); and,
2. Four hundred eighty (480) annual hours of low sky brightness (defined as less than 25 millionths of the brightness of the solar disk) immediately adjacent to the “limb” of the solar disk (SSWG Final Report, p. 14).

The seeing criterion is affected by turbulence in the Earth’s atmosphere at all levels. Since solar telescopes operate during the day, a dominant issue is turbulence driven by the solar heating of the ground near the telescope structure. The warm ground heats the air, creating turbulence at low elevation. It is vital that daytime astronomy, such as solar observations, take place in locations that limit these effects. The best way to reduce these “ground effects”, as they are called, is to build the telescope in windy (but not gusty) places near large bodies of water, both of which act to equalize air temperature. The shape of the topography around the telescope site also has a strong influence on the effects of wind and water in reducing ground effects.

The sky brightness criterion is important for studies of the tenuous outer most layer of the Sun’s atmosphere, the corona. The corona is intrinsically very faint, significantly fainter than the disk, or photosphere of the sun. Light from the photosphere scattered by dust or other aerosols in the Earth’s atmosphere makes the sky adjacent to the sun look bright. Accordingly, the brighter the sky, the more the difficult it is to study the faint corona, as the coronal light is overwhelmed by the scattered photospheric light.

Additional criteria considered by the SSWG included precipitible water vapor, dust levels, temperature extremes, the feasibility of construction and proximity to support facilities for telescope operations.

In order to assess the criteria, test towers were set up at each of the six sites (e.g., Figure 2-1). These towers were instrumented with devices that measure the overall quality of the seeing, the turbulence in the Earth’s atmosphere as a function of height above the ground (i.e., where the seeing is coming from), the sky brightness, dust levels, and meteorological conditions. These instruments collected measurements for 12 to 18 months at each site, allowing a uniform comparison of the sites with respect to the criteria listed above.

Based on the results of those tests at the six candidate sites, it became clear that the six candidate sites could be divided into two groups based on the observing conditions (SSWG Final Report, p. 1). The ASWG met in November of 2003 and recommended that because of the results, testing be continued only at the top ranking group of sites. The three remaining sites – Big Bear Lake (California), Haleakalā (Maui, Hawai‘i), and La

Palma (Canary Islands, Spain) – comprised the top ranking group and were tested for an additional year. After this additional testing, La Palma and Big Bear Lake were ultimately found to have demonstrated deficiencies in one or more of the primary scientific evaluation criteria (SSWG Final Report, p. 1). The notable characteristics and the deficiencies of the La Palma and Big Bear sites are outlined in more detail in Sections 2.3.3 and 2.3.4 below.

Figure 2-1. ATST Test Tower at Haleakalā High Altitude Observatory Site.

Based on the results of both the preliminary testing and the continued testing of the three remaining sites, Haleakalā met or exceeded the primary scientific evaluation criteria. La Palma was found to meet the requirement for hours of highest-resolution seeing, but was found to be deficient in meeting the required level for one of the primary science outputs — insufficient available hours of dark daylight sky close to the Sun's limb. Big Bear Lake was found to be deficient in meeting the required levels for both of the primary science requirements — insufficient hours of highest resolution seeing and insufficient available hours of dark daylight sky close to the Sun's limb. All three sites met the requirement of access to infrared wavelengths (Objective 3 in Section 1.4.3-Primary Objectives for the Project). Because siting the telescope at either La Palma or Big Bear Lake would substantially and irrevocably reduce the telescope's scientific output, and thus not meet the purpose and need of the proposed ATST Project, both were eliminated from further consideration.

2.3.2 Response to Public Comment Regarding Alternative Siting on Haleakalā

During the September 2006 draft EIS (DEIS) comment period, the public commented about the property outside HO and Haleakalā National Park (HALE) on the Southwest Rift Zone of Haleakalā, also known as the Saddle Area, as another potential, alternative construction site for the proposed ATST. In addition to the primary and alternative sites described in Section 2.4-Description of the proposed ATST Project at the Mees Site, a question was raised regarding the viability of a third unused site at HO. The existing infiltration basin and the area immediately to the east of it is the only other HO site large enough to host the proposed ATST as shown in Figure 2-2. This site, which was briefly considered, is restricted by the established lease boundaries of the U. S. Air Force and the Federal Aviation Administration (FAA) and also by the proximity of existing utility equipment that serves other facilities. Thus, it was rejected as a viable alternative. An even more significant drawback to this site, however, is that its use would compromise the effectiveness of the infiltration basin, a topographic depression at the western boundary of HO that is the main repository for stormwater runoff at Kolekole (Vol. II, Appendix L-Stormwater Master Plan for HO, Figure 3-10-Existing Stormwater Drainage Paths at HO). Since adoption of the erosion prevention practices of the SWMP, the infiltration basin has performed well to limit erosion at the site from unconfined flow along the boundaries of Kolekole. It was determined that reconfiguration of the entire stormwater system for the proposed ATST Project would be impractical and detrimental to the environment at HO and, therefore was not carried forward for further consideration.

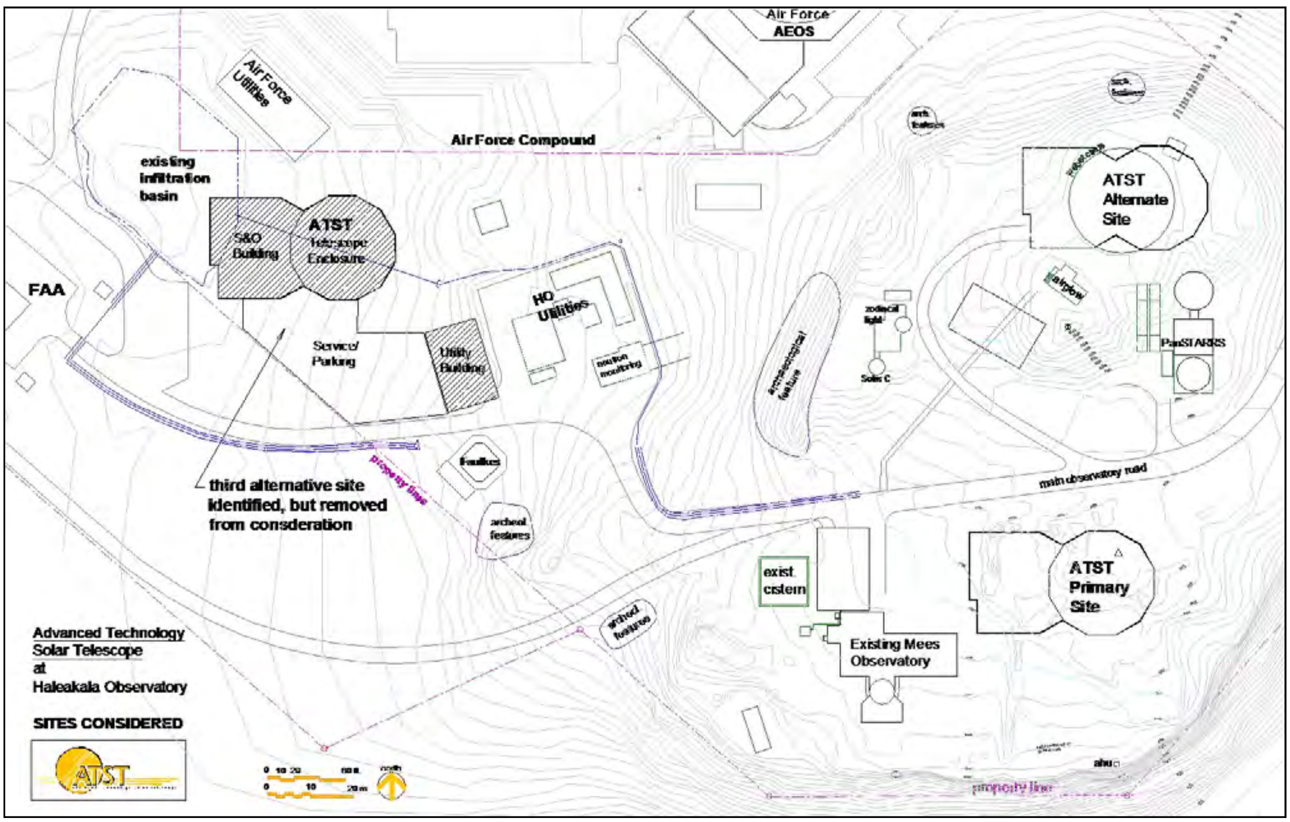


Figure 2-2. HO Infiltration Basin Site – Eliminated From Consideration.

Another comment was raised regarding the viability of the Saddle Area, which currently hosts broadcasters and other Federal, State and private facilities. This area is located within a State of Hawaiʻi Conservation District. However, the only property on Maui with a designated land use for observatory purposes is the HO site. HO was established in 1961 by Governor Quinn under Executive Order 1987, which set aside 18.166

acres of land at the summit of Haleakalā in a place known as Kolekole to be under the control and management of the University of Hawaiʻi. The Saddle Area is located outside HO and within the Conservation District and does not have a designated land use for observatory purposes. Under these constraints, this site could not be considered as an alternative site for the proposed ATST Project. In addition, because the Saddle Area is both lower and downwind from the facilities at HO, the “seeing” quality for the scientific requirements could not be met unless the facility was considerably taller than the proposed 143 feet. Visibility from the Saddle Area to populated areas on Maui would not have the terrain blocking that the primary Mees site enjoys. Therefore, the proposed ATST Project may be far more visible to most Maui residents, if located at the Saddle Area than at the preferred Mees site. For these reasons, this alternative was not carried forward for further consideration.

An additional public comment was raised about using advanced space technology and considering space-optics, e.g., a space-based solar telescope. However, the ATST is designed to measure and understand the influence of the outer solar atmosphere on the interplanetary space between the Earth and the Sun. Virtually all of the Sun’s dynamic effects on the Earth can be traced back to solar magnetic fields and the ATST would measure these outer fields for the first time.

The technology simply does not exist anywhere for doing this measurement from space. While the Japanese/American/British SOLAR-B/Hinode mission looks on the disk of the Sun for solar flares, its mission is complementary to the goals of the ATST. We are many decades away from having the technical capability of launching a solar telescope with the necessary 4-meter mirror, like the proposed ATST, into space to measure these coronal magnetic fields. Meanwhile our global communications and the impact of solar changes on terrestrial climate remain a risk for human civilization while we wait to understand solar cycle variability. We simply cannot afford to wait another generation or more to learn how, why, and when the Sun changes — as it does and will. For these reasons, this alternative was not carried forward for further consideration.

2.3.3 La Palma, Canary Islands, Spain

The Roque de los Muchachos Observatory (ORM) on the Canary Island of La Palma[1] (Fig. 2-3) is an astronomical complex operated by the Instituto de Astrofisica de Canarias (IAC), hosting thirteen European observatories. The results of site testing of La Palma are summarized in Table 2-1. It was ranked second among the top three sites considered for ATST, as summarized on Table 2-1. ORM is named after the highest mountain on the island, Roque de los Muchachos, on which it sits at an elevation of approximately 7,900 feet above mean sea level. The astronomical compound is located in the north-central region of La Palma on the northern rim of the Caldera de Taburiente (the world’s largest volcanic crater). The complex can be accessed via paved roads in two directions. The main road, leading from the coastal city of Santa Cruz to the east of ORM, is in good condition albeit with a steep (12 percent) grade. This road is closed due to inclement weather conditions approximately ten times per year. A more reliable road meets ORM from the northwest and extends around the island. The Roque de los Muchachos Observatory is open to the public during the day and entry is controlled during the night via a manned gate.

La Palma - Physical Characteristics

As previously mentioned in Section 2.2-Site Selection, test towers were constructed at the six sites to collect data on the physical characteristics of each site. At ORM, this site was located in the location identified on Figure 2-4 as the proposed site for ATST. This site sits on an approximate 15 percent slope near the crest of the caldera, which creates both construction issues and visibility issues from the adjacent Caldera de

[1] ORM and the Teide Observatory, located on the island of Tenerife approximately 60 miles to the East of La Palma, constitute the European Northern Observatory consisting of institutions from 19 countries including Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Poland, Portugal, the Republic of Armenia, Russia, Spain, Sweden, Taiwan, Ukraine, the United Kingdom, and the United States (NASA, 2005).

Taburiente National Park. Other physical characteristics of the site are relatively favorable. Alternate sites at ORM are also possible for the proposed ATST Project siting, each exhibiting other constraints and benefits.

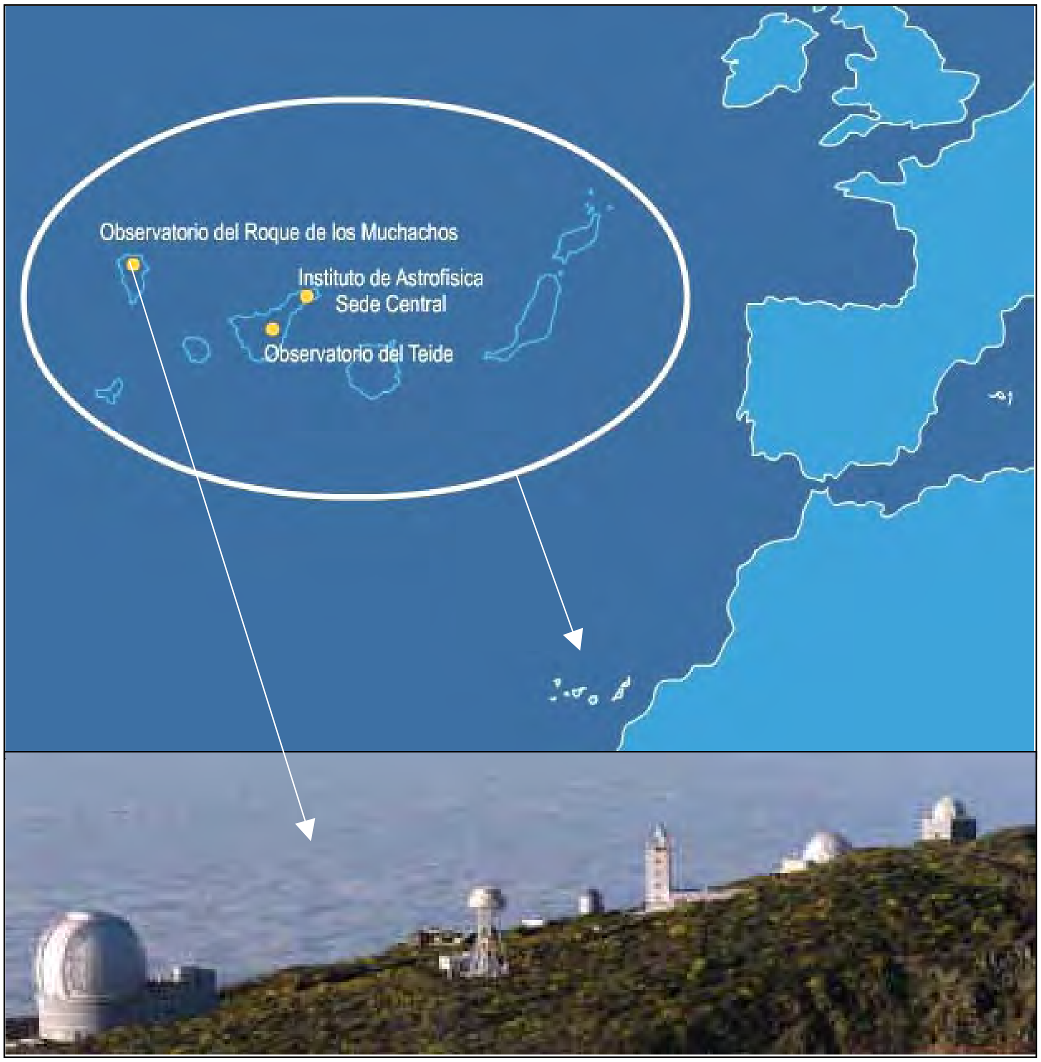


Photo from IAC website, Gallería de Imágenes.

Figure 2-3. Roque de los Muchachos Observatory, Canary Island, La Palma, Spain.

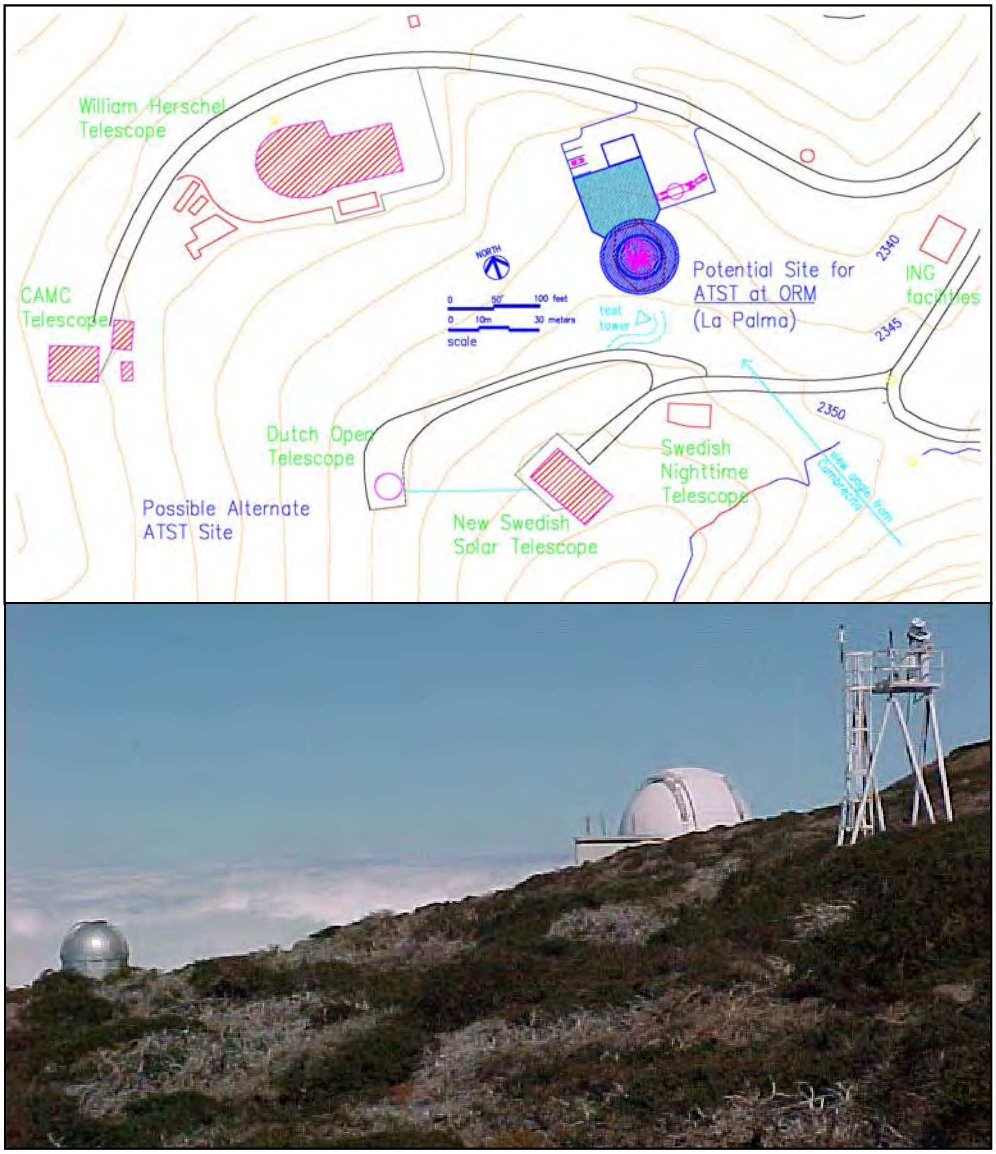


Figure 2-4. ATST Test Tower at Roque de los Muchachos Observatory.

La Palma - Environmental Issues

As previously stated, the La Palma site was tested for two years. During this period, this site was considered for site-specific design requirements, logistical requirements of bringing the project to La Palma and environmental effects that may result or that may be mitigated through planning, consultations, or design modifications. These occurred concurrently with site testing and continued into the initial planning phase. A complete preliminary assessment was conducted including a detailed consideration of utilities, access, construction requirements, seismicity, weather, physical features, and costs. This study is also available on the Internet at: http://atst.nso.edu/files/docs/RPT-0031.pdf. Six key environmental concerns were identified in consideration of the La Palma site for ATST.

1. *Visual Effects*
   The adjacent Caldera de Taburiente National Park is a popular tourist attraction with numerous hiking trails and scenic viewpoints. The view of the telescope from within the Caldera, and especially from a specific peak called the Cumbrecita, is a particular concern. By statute, the height of the ATST structure would have to be low enough that the rim of the Caldera shields it from public view from the Cumbrecita. The Spanish government has jurisdiction over the National Parks (Instituto Nacional para la Conservación de la Naturaleza [ICONA]) and the entire ORM property. ORM is in the Peripheral Protection Zone for the Caldera de Taburiente Park. A ruling by a Federal agency (ICONA), dictates that observatory structures will not be visible from the Cumbrecita.

   At the La Palma site, the telescope would be visible at Cumbrecita if it were constructed where the test tower was placed. However, moving the telescope farther downhill and further west, to place it behind a higher point in the caldera rim, could have addressed visibility if the height of the structure were not increased. The conditions at the site that were tested and characterized would probably pertain to a nearby site given that this would be a relatively minor relocation. However, ground level thermal considerations discussed below in the Technical or Scientific Restraints paragraphs (Turbulence, item 3) suggests that to achieve the same seeing quality at La Palma, an additional 10 meters (32.8 feet) of height would need to be added to the ATST building structure.

2. *Effect of Utility Infrastructure*
   The proper treatment and disposal of wastewater is of particular concern at ORM because the groundwater and streams farther down the mountain are considered to be ecologically sensitive.

3. *Topography*
   Due to the slope of the ORM complex and proposed and alternate sites considered for placement of the ATST facility, a considerable amount of earthmoving (cut and fill) would be required to create a suitable level surface for ATST infrastructure. The cut and fill approach would require the excavation of about 9,000 cubic yards of material, primarily composed of loose volcanic cinder and fractured volcanic rock.

4. *Intensity of Site Use*
   Increased traffic, personnel, and visitors, and their effect on the local environment, would be a concern.

5. *Endangered or Threatened Species*
   Although this was an initial concern, studies showed that there are no endangered or threatened species of animals or plants in the area affected by the proposed site.

6. *Cultural Resources*
   Although this was an initial concern, studies showed that there are no known archaeological or culturally important features in the area that would be affected by construction of the proposed ATST Project.

La Palma - Logistics

The government of Spain owns the ORM compound. The international scientific community established an Agreement on Cooperation in Astrophysics to allow development and observations at ORM. Each institution enters into a signatory agreement with the IAC, thereby becoming a fully participating member of the International Scientific Community adhering to stipulated protocols set forth by this committee. Each project negotiates the terms, site uses, and compensation (such as percentage of observing time) afforded to Spain in return for providing the site. While siting ATST at ORM would not require a new land acquisition or lease, official authorization would require unanimous consent of the International Scientific Committee in accordance with the provisions of the Protocol on Cooperation in Astrophysics.

Construction at ORM would also require a building permit issued by the Municipality of Garafia. The permitting process would take approximately six to eight months and, aside from preparation costs, a fee is charged amounting to approximately four percent of the projected building construction cost.

La Palma - Technical or Scientific Constraints

Viability is determined independently of logistics, feasibility, political preferences, environmental effects constraints, or socioeconomic conditions. Viability, in the spirit of the National Environmental Policy Act (NEPA), is determined based on whether a site would reasonably meet the project purpose and need. There are four key constraints in meeting the purpose and need as stated in Section 1.4-Project Summary.

1. *Dust*

   The air at the La Palma site contains substantial amounts of dust due in part to high altitude and windblown Saharan dust. The presence of this dust has two effects: 1) scattered light from the airborne dust increases the sky brightness, and 2) dust collects on the telescope and its optics, reducing their performance and increasing scattering. The dust issue cannot be mitigated and directly affects the operational capability of the ATST, particularly for studies of the corona. Dust measurements made at La Palma and Haleakalā are summarized in Vol. II, Appendix J(3)-Haleakalā vs. La Palma Dust Comparison. The specific ramifications of substantially higher dust content are:

   a. More frequent cleaning of the optical surfaces resulting in more rapid degradation of the optical coatings,

   b. More frequent recoating of the optics. Re-coating requires removal and transport of the delicate and expensive optics to an aluminizing chamber and subsequent reinstallation in the telescope,

   c. Increased down time of the facility because of the recoating required and increased risk to the optical components. It is impractical to maintain spares of all of the optics, so a catastrophic event associated with cleaning or re-coating would result in a protracted down time for the entire telescope, likely extending for a year or longer; and,

   d. Cleaning and recoating optics increases the annual operations cost and risk and decreases the observing efficiency by reducing the total amount of time available for science.

2. *Sky Brightness*

   The solar corona, the outermost region of the solar atmosphere, is composed of extremely diffuse and hot gas. The corona is very faint relative to the solar photosphere, the apparent surface of the Sun. High quality observations of the corona are then extremely difficult because light from the photosphere must be blocked from entering the telescope. Photospheric light is scattered by dust particles in the earth's atmosphere (and on the telescope's optics) makes the sky adjacent to the corona of the Sun appear bright and swamps the coronal light. Successful coronal observations therefore require a dark daylight sky. During periods of elevated dust levels, the atmosphere above La Palma results in a sky brightness that precludes coronal observations. The abrasive Saharan silica dust has an unknown effect on mirror optical coatings but would certainly increase scattering of light from the optics. As there is no significant record of solar coronal observing done from La Palma, it is unclear whether the low-scattering condition of the coated mirror optics could be maintained even at times other than the periods of extreme Saharan dust-induced telescope closure. High dust levels are present during about three months of the year, making it impossible to obtain simultaneous coronal measurements with space-based experiments, one of the primary considerations in the Astronomy Decadal Survey.

   The sky brightness frequently exceeds the maximum level that can enable observations of the corona. Specifically, sky brightness requirements are only met at La Palma less than 480 hours per year, the threshold established by the SSWG as derived from the science goals (SSWG Final Report,

Fig. 10.21). This factor alone would render the La Palma site as insufficient to meet the coronal science goals of ATST.

3. <u>*Turbulence*</u>

   Turbulence in the Earth's atmosphere coupled with temperature variations in the column of air above the telescope blurs the telescope's images. This phenomenon is familiar to anyone who has seen shimmering images over a campfire or a hot highway. In the parlance of astronomy, this results in "bad seeing." Although the seeing above La Palma is generally good, in order to mitigate the bad seeing introduced by ground level turbulence, a La Palma ATST would have significant height requirements. The telescope could be situated above the ground level turbulence by establishing the height of the telescope approximately 10 meters (32.8 feet) above the nominal height in the current design. This would place the center of the telescope at 38 meters (124 feet 8 inches) above the ground, and the overall height of the structure would be 53 meters (173 feet 10 inches) (SSWG Final Report, Appendix 13.10). The 10 meters (32.8 feet) of height above the nominal height in the design would result in a site-specific construction cost increment of over $4M above that required for the nominal design and degraded telescope performance due to increased wind-induced telescope vibration resulting from a lower resonant frequency. The telescope and its support pier can be thought of as one tine of a tuning fork. A longer tine produces a lower frequency tone at its resonant frequency, whereas a shorter one produces a higher pitched tone. In order to maximize the telescope's mechanical performance, one wants a stiff structure with a high resonant frequency. Reducing the resonant frequency of the telescope mount reduces its ability to track the Sun's motions without jitter introduced by vibrations from wind buffeting and coupling of other vibrations due to systems in the building, nearby traffic, etc. The effect of this degraded performance is to blur the images due to telescope vibration. So, increasing the height of the telescope above the ground layer turbulence in order to improve the image quality would have the attendant effect of reducing the image quality from vibrations.

4. <u>*Atmospheric Stability*</u>

   In order to study the temporal evolution of active regions on the photosphere or gas motion in the corona and chromosphere (the atmospheric layer between the photosphere and the corona), the atmospheric conditions of the telescope site must be stable over the time periods on which the evolution occurs. This requires long periods of low turbulence, clear and dark skies.

La Palma offers excellent high elevation "seeing" capabilities (rating a *PASS*, as shown on Table 2-1), which could be realized by increasing the height of the telescope to reduce turbulence (but at the expense of compromised mechanical performance and financial cost). This potential excellent seeing, however, is offset by sky brightness, facility closures during prime dust periods (particularly in the summer months), the requirement for closures for maintenance and cleaning of the mirrors as a result of dust accumulation, risk of damage to the optics, and degraded telescope performance. These factors cannot be mitigated.

La Palma was deficient in meeting the required level for one of the primary science criteria — insufficient available hours of dark daylight sky close to the edge of the Sun's limb (the "limb" of the Sun is defined as the edge of the Sun's disk). These findings are summarized in Table 2-1.

Table 2-1. La Palma Annual Hours of Acceptable Seeing and Sky Brightness.

Requirement	La Palma
200 annual hours of excellent seeing	225 - *PASS*
480 annual hours of sky brightness less than 25 millionths of the brightness of the solar disk	384 - *FAIL*

La Palma - Conclusion

As explained in Section 1.4.3-Primary Objectives for the Project, there are three primary objectives of the ATST telescope that must be met:

Objective 1: The ability to efficiently observe the solar atmosphere at or near the diffraction limit of the telescope (in other words when turbulence in the atmosphere is minimal).

Objective 2: The ability to efficiently observe the faintest outer layers of the solar atmosphere, the corona, adjacent to the very bright photosphere.

Objective 3: The ability to observe the solar atmosphere at wavelengths from visible through mid-infrared wavelengths.

These three broad objectives define the purpose of the proposed ATST Project. By establishing the height of the telescope at 38 meters (124 feet 8 inches) above the ground level, turbulence could be mitigated and Objectives 1 and 3 could be met to an adequate level. Objective 2, however, *could not be met* and would result in the coronal science objective being irrevocably compromised. Thus, the coronal science objectives for the proposed ATST Project would be effectively rendered unattainable.

In addition to its adverse and irrevocable atmospheric effect on coronal science, dust from the Sahara would add substantially to telescope down time, both for protecting and cleaning telescope optics and components. The risk of damage to the primary mirror and other optical surfaces due to the required frequency of handling the optics for protection, cleaning, and recoating is of concern. Given the degrading effects that Saharan silicates could produce on a soft optical coatings and the resulting effect on scattered light, building and maintaining a coronagraph, or other instruments with exposed mirrors and lenses, is problematic at the La Palma site. The required height of the facility to overcome the disturbed atmospheric ground layer would impact the performance of the telescope and is incompatible with view plane restrictions at the site.

These La Palma site-specific constraints and requirements result in impacts on the science capability and efficiency, the construction, operation, and maintenance of the facility, and increase project and operational risk. They further result in unique site-specific costs while delivering significantly reduced science output. Given the site-induced constraints on the fraction of time available for solar science, ignoring the impacts on building and operating the facility, it has been determined that siting the telescope on La Palma would alter the objectives and goals of the Federal project now under consideration in such a way as to no longer reasonably meet the purpose and need. Combining the loss of solar science and the impacts on the risks for the success of the project and the operations of the facility leads the NSF to determine that La Palma is not an acceptable site for the proposed ATST Project and an unreasonable site. Hence, it is not considered further in this evaluation.

2.3.4 Big Bear Lake, California

Big Bear Solar Observatory (BBSO) is shown in Fig. 2-5 with its ATST test tower. The results of site testing at Big Bear Lake are summarized in Table 2-1. BBSO is located in the mountains near San Bernardino on the north shore of Big Bear Lake in southern California. Three towns are within ten minutes of BBSO, including Big Bear Lake, Big Bear City, and Fawnskin. Various California State highways access this region; all are well maintained and adequate for any type of vehicle. The New Jersey Institute of Technology operates BBSO, which is located at the end of a narrow causeway running about 800 feet into Big Bear Lake. The test tower for ATST, as discussed in Section 2.2-Site Selection, is also located on this causeway.

Two sites in the vicinity of BBSO were considered for this project: (1) on a widened section of the existing causeway or (2) on a branch off the causeway with a site at the end. In either case a predominant wind from the west would give preference to a western position. There is also an onshore support compound adjacent to the lake and causeway with space for additional development for ancillary facilities.

Figure 2-5. Big Bear Solar Observatory and Test Tower.

Big Bear Lake - Physical Characteristics

The proposed project considered at Big Bear Lake was therefore to create a new telescope site either on the existing manmade causeway or by branching from this causeway into the lake. This would require developing a cofferdam around the site, dewatering pumps to keep the site dry, and extensive dredging and excavation. The seismic risk at this site is high and heightened by development on a lakebed. Seismic loads in both the building structure as well as the telescope and support equipment were considered in the evaluation of the site-specific design requirements.

Big Bear Lake – Potential Environmental Effects Issues

The Big Bear Lake site was evaluated for two years during onsite testing. Also considered were the site-specific design and logistical requirements of bringing the project to BBSO, and environmental effects that may result or that may be mitigated through planning, consultations, or design modifications. A complete initial study was conducted, including a detailed consideration of utilities, access, construction requirements, seismicity, weather, physical features, and costs. This study is available on the Internet at: http://atst.nso.edu/files/docs/RPT-0031.pdf. Four key environmental concerns were identified in consideration of the Big Bear Lake site for ATST.

1. *Wildlife*

   Big Bear Lake supports a wide variety of wildlife, one specific example being the bald eagle, a former endangered species that is currently listed as threatened. Surveys have shown that the north shore area is reportedly not in the designated nesting or perching area for the bald eagles known to frequent the area.

2. *Fishing*

   Big Bear Lake is considered a premier fishing lake for rainbow trout, bass, and other game fish.

3. *Cultural and Archaeological Resources*
   The lake is not likely to contain many cultural and archaeological resources; however, the onshore area may require surveys.

4. *Visual Resources*
   The existing observatory is a prominent feature seen from all areas of the lake, and because of its long-standing presence, it is accepted by local residents. However, the required size, height, and color of the new observatory may be an aesthetic concern.

Most of these issues could be mitigated or would otherwise not be considered significantly adverse.

Big Bear Lake - Logistics

This existing causeway and entire lake area is owned by the Big Bear Municipal Water District. The onshore support compound and buildings are owned by the California Institute of Technology. Land and existing space would remain in the ownership of these two entities; however, new leases or an amendment to existing leases would be required with both groups.

To construct ATST at Big Bear Lake, approval would be required by at least five government authorities:

1. San Bernardino County Building and Safety Division – building permit and conditional use permit.
2. U.S. Army Corps of Engineers – Section 404 of the Federal Clean Water Act permit for the discharge of dredged or fill-materials into U.S. waters, which includes Big Bear Lake.
3. Big Bear Municipal Water District – Shore Zone Alternation Permit required for any alteration to the lakebed or shoreline.
4. California Regional Water Quality Control Board – certification ensuring that any discharge into the lake complies with established water quality standards, as stipulated under Section 401 of the Federal Clean Water Act.
5. California Department of Fish and Game – consultation and review to ensure effects on wildlife in the area and recreational uses of the lake are minimized. A similar consultation at a Federal level may also be required.

Big Bear Lake - Technical or Scientific Constraints

As explained under the La Palma discussion (Section 2.3.1-La Palma, Canary Islands, Spain), viability is determined by whether the site would reasonably meet the purpose and need of the project. The La Palma discussion further summarizes the key objectives defining this purpose and need. Table 2-1 identifies the results of the testing done at the Big Bear Lake site. Based on the studies and evaluations, there are two key constraints in meeting the project objectives:

1. *Sky Brightness*
   The dark daylight brightness typically exceeds the maximum level required for observations of the solar corona (SSWG Final Report, Fig. 10.21). Specifically, sky brightness requirements are only met at Big Bear Lake far less than 100 hours per year, thus not meeting the 480 hours per year observational threshold set by the SSWG. This factor alone would render the Big Bear Lake site insufficient to meet the coronal science goals of ATST.

2. *Uninterrupted Observing Time*
   High quality observations depend in large part on uninterrupted blocks of time (at least a two-hour time duration) during which atmospheric conditions are stable and good (i.e., low turbulence, stable atmosphere, clear sky, scattering, further discussed in Vol. II, Appendix J(2)-Supplemental Discussion of the Constraints of Solar Science Development). An adequate observing scenario at a site that would meet ATST requirements would result in a *PASS*. Such periods are extremely rare at

Big Bear Lake (SSWG Final Report, Tables 10.2 and 10.5). This would reduce the potential for achieving any of the three project objectives listed under Section 2.3.1-La Palma, Canary Islands, Spain, and would virtually eliminate Objective 2 (coronal observations).

The two deficiencies for Big Bear Lake that would most impact the primary science output are insufficient hours of highest resolution seeing and insufficient available hours of dark daylight sky close to the Sun's limb. These unacceptable levels for high quality observations both for annual required hours of good seeing and dark skies are summarized in Table 2-2.

Table 2-2. Big Bear Lake Annual Hours of Acceptable Seeing and Sky Brightness.

Requirement	Big Bear Lake
200 annual hours of excellent seeing	136 - *FAIL*
480 annual hours of sky brightness less than 25 millionths of the brightness of the solar disk	2 - *FAIL*

<u>Big Bear Lake - Conclusion</u>

Similar to the situation at the La Palma site, the Big Bear Lake site exhibits sky brightness that exceeds acceptable levels for observing the solar corona. More specifically, sky brightness requirements are only rarely met at Big Bear Lake. This factor alone would render the Big Bear Lake site as insufficient to meet the coronal science goals of ATST. Furthermore it is quite rare to get uninterrupted stable conditions for high resolution observations at Big Bear Lake that enable the highest priority science of ATST (in other words, as shown with *PASS* or *FAIL* on Table 2-3). Both of these constraints render the Big Bear Lake site insufficient for meeting the ATST project purpose and need, and therefore the NSF has determined that Big Bear Lake is not an acceptable site for the proposed ATST Project and an unreasonable site. The Big Bear Lake site is not considered further in this SDEIS.

2.3.5 Summary of Site Selection Process

After the site selection process refined the original list of 72 potential sites to six, those six were instrumented for further, detailed study (Section 2.2.2). Based on the results of those tests, three sites were clearly deficient and were eliminated. The three remaining sites were studied in more detail — Big Bear Lake (California), Haleakalā (Maui, Hawai'i), and La Palma (Canary Islands, Spain). Upon review of the site survey final report, the NSF identified notable reductions of the primary science output were identified for two of the candidate sites, La Palma and Big Bear Lake. The two deficiencies that would most impact the primary science output are substantially insufficient hours of highest resolution seeing and insufficient available hours of dark daylight sky close to the Sun's disk. These unacceptable levels of hours for high quality observations at the Big Bear Lake and La Palma candidate sites are summarized in Table 2-3.

Table 2-3. Summary of Annual Hours of Acceptable Seeing and Sky Brightness.

Requirement	Big Bear Lake	Haleakalā*	La Palma
200 annual hours of excellent seeing	136 - *FAIL*	399 - *PASS*	225 - *PASS*
480 annual hours of sky brightness less than 25 millionths of the brightness of the solar disk	2 - *FAIL*	1004 - *PASS*	384 - *FAIL*

*Haleakalā is included in the table for reference, and as shown meets both the criteria for the primary science output — annual required hours of good seeing and dark skies.

The process for identification of scientifically viable sites set forth above was not intended to select one specific site. When the process started, it was unknown whether the application of the scientific criteria developed by experts in the field would ultimately result in the identification of one site, no sites, or multiple scientifically-viable sites. Because it was unknown which, if any, sites would meet the science requirements necessary to fulfill the purpose and need of the proposed ATST Project. NSF did not begin its formal environmental reviews under NEPA and the National Historic Preservation Act (NHPA) until after it was determined whether there were any scientifically-viable sites. It should be noted, however, that during the two years that on-site testing occurred at the various sites, potential environmental effects for project planning purposes were indeed evaluated and considered. Examples of that initial evaluation are set forth in the DEIS in Section 2.3.3 for the La Palma site and Section 2.3.4 for the Big Bear Lake site. The extensive process for identifying scientifically-viable locations for the proposed ATST Project outlined above resulted in two sites located within HO. Again, the result could have been that there were no scientifically-viable sites or multiple ones, but in this case, it turned out that the only scientifically-viable locations were within HO, which formed the basis for the two action alternatives carried forward in NSF's NEPA process.

Upon selection of Haleakalā as the proposed site, the procurement process was initiated in January 2005 to identify an environmental engineering company to provide support for the EIS process and related cultural studies and consultations. Several firms responded to this opportunity. After in-person visits to the companies, evaluation by a source-selection committee and negotiation, a contract was awarded in June 2005 and work began on the EIS and National Historic Preservation Act (NHPA) Section 106 historic/cultural resource investigations. A Cultural Resource Evaluation (Vol. II, Appendix F(1) was prepared and pre-consultation and scoping meetings were held.

2.4 DESCRIPTION OF THE PROPOSED ATST PROJECT AT THE MEES SITE

The proposed ATST Project would construct and operate a reflecting Gregorian-type telescope that would deliver images of the Sun and the solar corona to instrument stations mounted on the telescope and on a rotating platform located below the telescope. The proposed ATST facilities would include:

1. The observatory facility, which includes the telescope, its pier, and the rotating instrument platform,
2. The telescope enclosure,
3. The Support and Operations Building (S&O Building) adjacent to the observatory,
4. A Utility Building attached to the S&O Building by an underground utility chase,
5. Parking for the facility as a whole; and,
6. Modifications to the existing MSO facility.

The entire facility would include approximately 43,980 square feet of new building space (including the telescope enclosure), within a site footprint of 0.74 acres. Figure 2-6 shows the layout of the site of the proposed ATST Project and Figure 2-7 provides an aerial rendering.

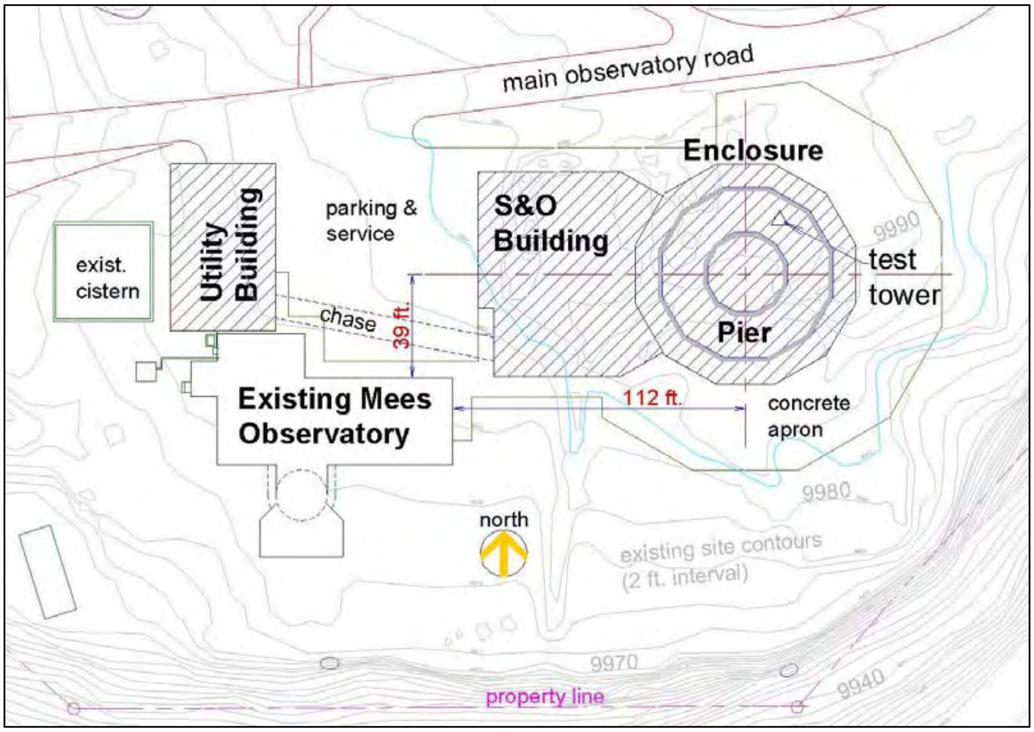


Figure 2-6. Proposed ATST Project at the Mees Site.

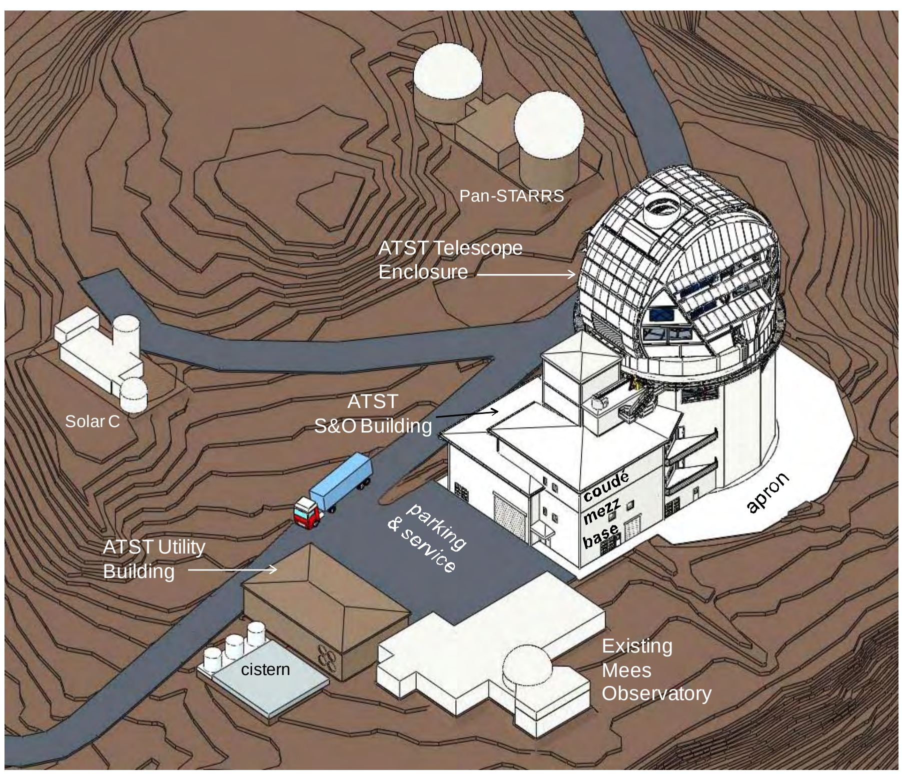


Figure 2-7. Aerial Rendering of Proposed ATST Project.

2.4.1 Features of Infrastructural Design

This section discusses the design features of the proposed infrastructure. Supplemental information is provided in Vol. II, Appendix J(4)-Supplemental Description of ATST Equipment and Infrastructure.

To achieve the image resolution dictated by the science requirements, the primary light-collecting mirror (M1) of the telescope would require a minimum clear aperture diameter of 4 meters. The distance between the M1 and the secondary mirror (M2) — the overall length of the telescope mount — together with the M1 diameter and off-axis mounting, effectively establishes the swing radius and the required dimensional clearance of the telescope (in altitude and azimuth) and the size of the enclosure required to protect it. These parameters are fundamental to the determination of the necessary height and width of the telescope enclosure.

Following the selection of the Haleakalā site and the consideration of the typical variation of turbulence with height above the ground, the proposed height of the telescope — defined as the distance from ground level to the rotational center of the telescope — was established to be 28 meters (92 feet). This was determined to be the minimum height at which the image resolution required to meet the specified science goals could be achieved. This would dictate an observatory structure that is 43.5 meters (142.7 feet) in height and 25.6 meters (84.0 feet) in diameter.

The S&O Building would be a multi-story structure attached to the lower enclosure, which accommodates observing-related activities that require direct adjacency to the telescope. It would contain a large docking bay with a 20-ton crane, equipment and equipment storage, telescope maintenance facilities, offices and workrooms, laboratories, and the control room for the telescope. The S&O Building would also contain the large-scale platform lift (elevator) needed to move telescope parts between levels. The equipment in the building would include a hydrostatic oil pump, hydrostatic oil tank, helium compressor, vacuum pump, and liquid nitrogen tanks.

The Utility Building would be a rectangular, steel-framed, metal structure that would provide space for mechanical and electrical equipment that requires complete thermal and vibration isolation from the telescope. The Utility Building would be connected to the S&O Building by an underground utility chase. A preliminary list of the equipment to be housed in the Utility Building includes: a 300 KVA generator and associated automatic transfer switchgear, an 80-ton low-temperature chiller, a 15-ton very-low-temperature chiller, a 10-ton heat pump condenser unit, 2 ventilation fans, an air compressor, a vacuum pump, and 3 uninterruptible power supply units. Because this equipment generates significant levels of audible noise, sound-abatement devices would be built into the equipment, and the walls and roof of the Utility Building would incorporate effective sound blocking materials. An electrical transformer and 3 ice storage tanks would be located outside, adjacent to the Utility Building.

Additional facilities associated with the telescope facility would include the following. (See Vol. II, Appendix J(4)-Supplemental Description of ATST Equipment and Infrastructure for more details on these utilities features.):

1. A grounding field consisting of a series of shallow trenches around the facility and fanning out to the south of the S&O Building (Fig. 2-16) filled with conductive concrete or coke breeze (a granular material with high conductivity) to safely provide an electrical ground for the observatory, which is in an environment with a high risk of lightning strikes.

2. A wastewater treatment plant with a capacity of 1,000 gallons/day and an associated infiltration well, designed in compliance with Hawaiʻi Department of Health regulations (Fig. 2-16).

3. A stormwater management system including gutters, catchment drains, an underground tank, and pipes connecting it to the cistern at the MSO facility.

4. A new electrical transformer next to the Utility Building.

5. A diesel generator for use in case of power outages.

With the exception of the Utility Building, the rest of the proposed ATST facility would be white in order to reduce heat absorption, which would adversely affect telescope operations by heating the adjacent air and thereby introducing turbulence that would degrade the seeing. See Vol. II, Appendix J(4)-Supplemental Description of ATST Equipment and Infrastructure for further discussion on these features.

2.4.2 Potential Use of the Mees Solar Observatory Facility

The existing MSO facility is a 45-year-old concrete block structure of approximately 5,440 square feet. The building currently houses a telescope and connecting instrument rooms as well as offices, labs, a shop, kitchen, and restrooms. Early in the feasibility investigation for the Propose Action, it was suggested that utilizing some of the facilities in the existing MSO facility for the proposed ATST Project, would help reduce the need to construct new building space to support some of the construction and operational requirements. The IfA, the owner of the MSO facility, agreed to this potential shared use of building space, with the specific terms to be negotiated as the needs arise. This has allowed the ATST Project to reduce the construction of new enclosed building space, with commensurate reduction in the scope, duration, material delivery, site coverage and other parameters of the project that are inherently related to its overall scope.

The shop area of the existing MSO facility includes separate rooms for a generator and for material storage. This entire shop space would be reconfigured to serve as a general machine shop for both IfA uses and the proposed ATST Project. The generator would be removed (functionally replaced by a new generator in the Utility Building) and the partitions between the separate spaces would also be removed. The existing roof structure of the MSO facility shop area would require modification for a new higher roof with adequate dimension and structural strength to accommodate a 5-ton bridge crane. All of the demolition and reconstruction work would occur within the footprint of the existing building and on the north side of the building – away from the ua'u burrows to the south.

2.4.3 Construction Activities

The proposed ATST Project construction would involve land clearing, demolition, grading/leveling, excavation, soil retention and placement, construction, remodeling of the MSO facility, paving, and other site improvements.

Land Clearing
Minimal removal of vegetation would be necessary to clear the primary site for the proposed ATST Project. Existing vegetation is very sparse and no Federally-threatened ʻahinahina (Haleakalā silverswords, or Argyroxiphium sandwicense) or other protected species have been identified on the site (see Section 3.0-Description of Affected Environment). Land clearing would be done using bulldozers and other heavy machinery.

Demolition
Facilities to be demolished or removed would include:

1. The ATST test tower and foundations,

2. Tower and weather station belonging to IfA,

3. Driveway, parking area, and rock wall borders at the MSO facility,

4. MSO generator and other selective demolition at the MSO shop/utility area; and,

5. MSO facility underground cesspool. (Removal of the cesspool would require testing of the surrounding soil and possible remediation measures. Proper disposal of the cesspool, treatment of the soil, and all other aspects of this work would comply with applicable regulations of the EPA and the State Health Department.)

Demolition would be staged, beginning with the removal of the test tower and other on-site structures and continuing later with the interior work in the MSO facility after the proposed ATST structure is nearly complete. The exterior site demolition would require the use of bulldozers, dump trucks, bobcats, and other heavy machinery. The total duration of demolition activities conducted at different times during the course of the project would be approximately two months.

Grading/Leveling

The construction of the proposed ATST Project would require the creation of a level pad at least 20 feet wider in all directions than the base level footprint of the enclosure and the S&O Building. The critical nature of the structural bearing condition requires that the level area be achieved primarily by cutting or excavating rather than by a cut and fill approach. The proposed grade cut at this site would be at approximately the 9,980-foot contour elevation. This would be done using a bulldozer, backhoe, jackhammer, dump truck, and other standard heavy equipment. An estimated 2,500 cubic yards of soil and rock would be removed for leveling in order to prepare the site for construction. Figure 2-8 shows the extent of the leveling necessary for the proposed ATST Project. The duration of this activity would be approximately one month.

Excavation

Initial major excavation would include the required removal of rock and soil to accommodate the foundation systems of the telescope pier, the telescope enclosure, the S&O Building, the elevator and platform lift, the Utility Building, and the utility chase. This work would be done using bulldozers, backhoe, trencher, a truck-mounted augur for drilling down to bedrock, and a hydraulic hammer or jackhammers to break up large rock formations. Additional excavation would be needed in order to trench for utility lines, all of which would be installed underground. Approximately 2,150 cubic yards of soil would be excavated for construction purposes, for a total of 4,650 cubic yards when combined with the 2,500 cubic yards of soil removed during grading/leveling activities. The major structural excavation is expected to follow the leveling work and is anticipated to take approximately two months to complete.

Soil Retention or Repair Measures

Some soil retention and fill are likely to be advantageous to provide support for the extended apron around the base of the enclosure and at other non-structural fill areas. The retention would be achieved using on-site native rock to form a sloped rip-rap embankment. In some places, especially in the area where the existing cesspool is removed, there is an expected requirement for over-excavation, fill, and re-compaction. In this area, and anywhere else that fill would be required, every effort would be made to utilize existing on-site soil. Any required importation of outside fill would comply with sterilization procedures and other required precautions against unintentional importation of invasive biological species.

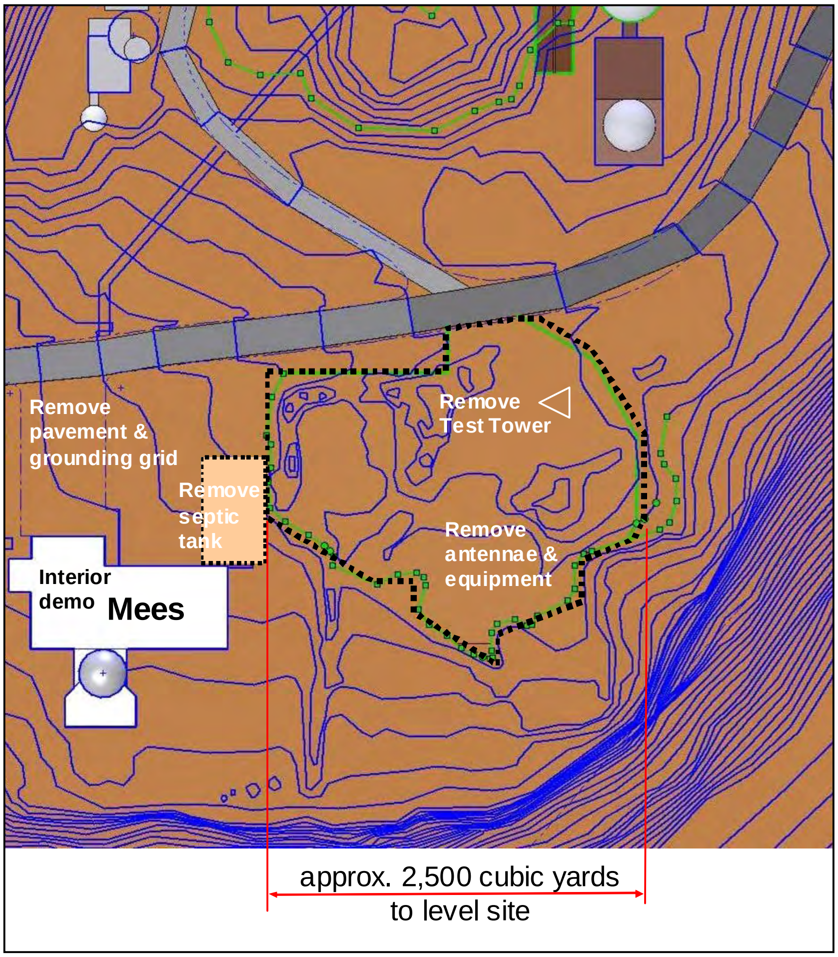


Figure 2-8.
Grading/Leveling Footprint.

Placement of Excess Soil and Rock

At an average volume of 20 cubic yards per truckload, approximately 250 truck trips would be necessary to relocate excess rock and soil. Native soils and rock would be spread on the hillside along the Main Observatory Road, approximately 328 feet west of the existing MSO facility. All native rock and soil removed from the site would be placed at locations within HO boundaries under supervision of a cultural monitor. The proposed placement areas are shown in Figure 2-9.

Primary Soil Placement Area: Open area southwest of the Faulkes Telescope

Prior to utilizing this area for staging, the material removed in the initial site leveling and structural excavation for the proposed ATST Project would be deposited in this location to a maximum thickness of about 6 feet at the east end, tapering down to level with the existing site at the west end near the Federal Aviation Administration (FAA) facility. This new fill would be configured to maintain the established stormwater management flow paths for HO (Vol. II, Appendix L-Stormwater Master Plan for HO). For example, material will be kept clear of the concrete drainage channel that follows the existing road on the north side. The embankment of the fill material along the north edge would be stabilized with native rocks sloped at an angle that would not result in erosion into the drainage channel. The slope of the new fill on the south side would allow continued vehicle traffic onto this area along the western end of the south side access road.

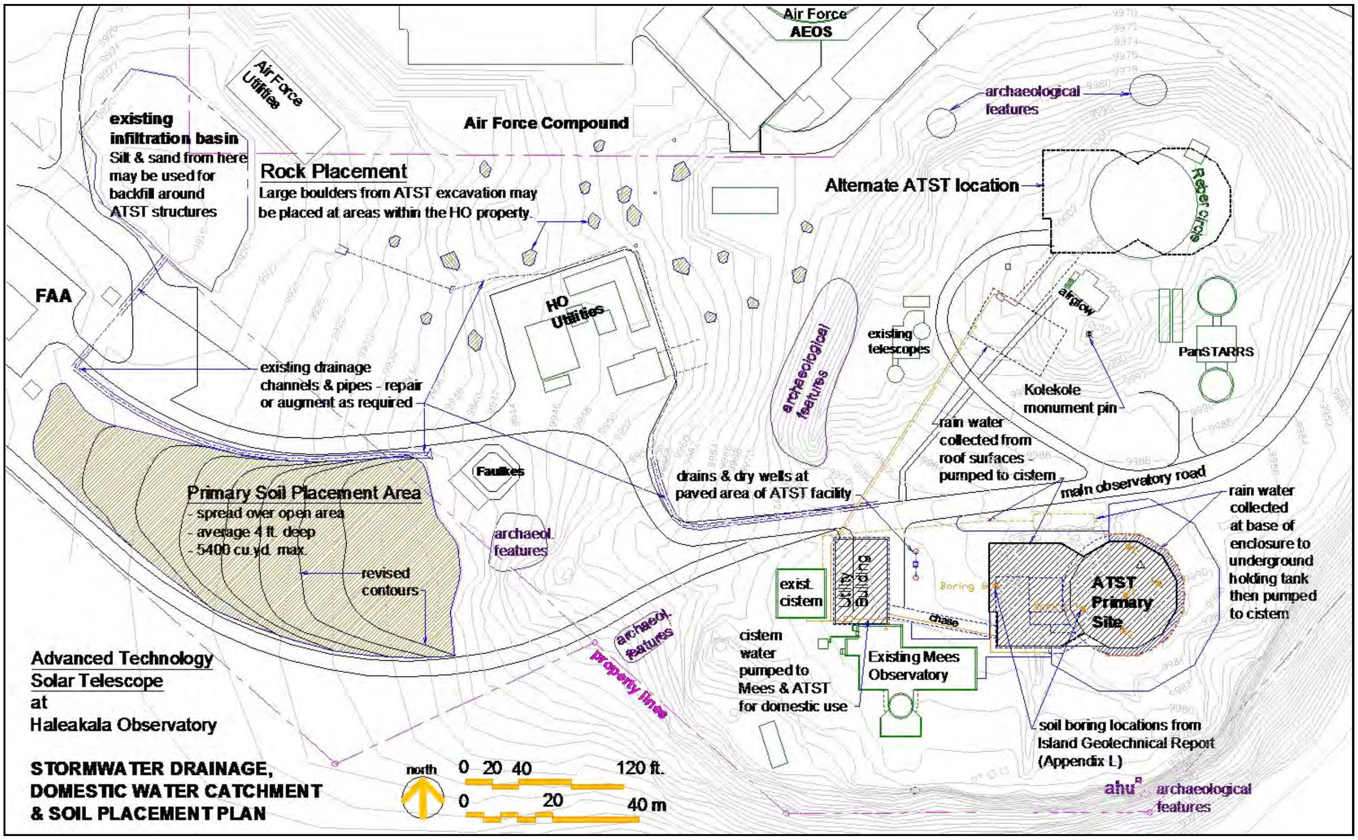


Figure 2-9. Soil Placement Plan, Stormwater, and Domestic Water Catchment.

Alternate Soil and Rock Placement Strategies

A significant percentage of the material that would be excavated from the site is expected to be in the form of large intact pieces of rock. Subject to approval by IfA, other HO tenants, and the Cultural Monitor, these large rocks may be placed at locations around the HO property. As an additional strategy for beneficial use of on-site soil material, sand and silt may be taken from the infiltration basin area to be utilized for backfill around the proposed ATST structures. This could potentially eliminate the need for imported backfill material and would also augment periodic removal of sand and silt that must be done to maintain the capacity and percolation of the infiltration basin to help reduce potential erosion.

Construction

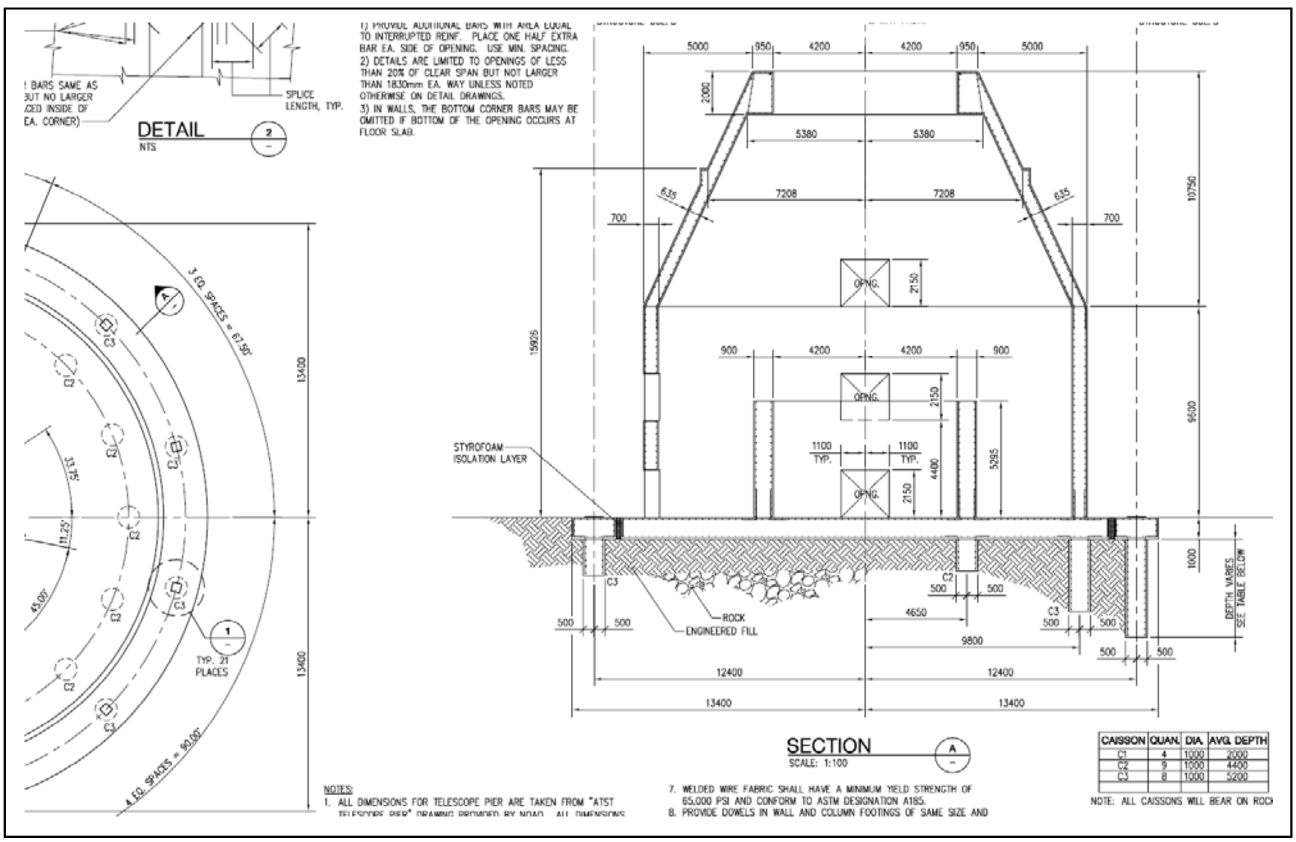
To determine the extent of excavation and underground work required for the proposed ATST Project, a preliminary design for the telescope and enclosure foundations has been established. After presenting the overall design in public meetings and publication of the DEIS, it is evident from subsequent descriptions of the foundations by concerned members of the community, that this aspect of the proposed ATST Project has not been well understood. This section is added to the S EIS in order to clarify the nature and dimensions of the proposed foundations.

To determine the bearing capacity of the natural rock and soil, a geotechnical investigation was conducted and a Soils Investigation (Vol. II-Appendix K) was prepared by Island Geotechnical Engineering, Inc. (http://atst.nso.edu/contracts/Reports/CON-0014_IslandGeotech.pdf). Subsequent to that, M3 Engineering and Technology, Inc., a firm knowledgable in the design of telescope facilities, was contracted to review the Soils Investigation and recommend an appropriate foundation system for the proposed ATST Project on Haleakalā.

Figures 2-10 and 2-11 are from the M3 report. http://atst.nso.edu/contracts/Reports/CON-0017_M3.pdf. Their recommndation is for a concrete mat foundation approximately 1 meter thick supported from the solid basalt layer that underlies the site. Because the basalt layer is sloping, poured concrete caissons (underground columns) extending from underneath the mat down to the solid basalt layer would be necessary in some locations. A total of approximately 21 caisssons would be required 1 meter (3 feet 3 inches) in diameter and of lengths varying from 2 meters (6 feet 6 inches) to a maximum of approximately 6 meters (20 feet). These caissons would be installed by drilling holes, using a truck-mounted auger, and then pouring concrete into the holes. No blasting or impact driving of piles would be done. Figure 2-12 shows the depth and location of the caissons in relation to the telescope pier, the enclosure, and the natural rock layer of the site.

In addition to this caisson/mat system, proposed ATST foundations would include relatively shallow (less than 1 meter deep) pad and strip footings for the building columns and walls. There would also be a utility tunnel 3 meters (10 feet) deep connecting the telescope enclosure to the utility building, and other utilities buried up to approximately 2 meters (6 feet) deep.

This is the extent of the anticipated underground installations for the proposed ATST Project. Concerns expressed by the community in public meetings, letters, and Internet sites describing a base that is five stories deep or foundations requiring blasting or pile driving are inaccurate.



1. All dimensions are in millimeters.
2. Caissons are drilled-and-poured, underground, concrete columns extending down to solid rock layer.
3. Abbreviations: Quan. – Quantity, Dia. – Diameter, Avg. – Average, Opng. – Opening, Eq. – Equal, Typ. – Typical.
4. Other abbreviations and technical terms refer to internal reinforcing steel and are not material to this EIS.

Figure 2-10. M3 Engineering, Inc. Drawing of Proposed Foundation System for Telescope and Enclosure.

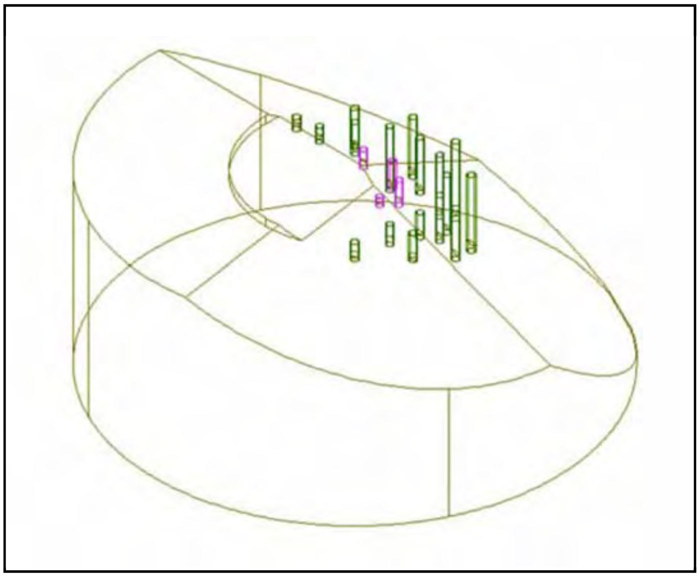


Figure 2-11. Diagram of Caissons on Rock Layer.

Shows an abstract depiction of a portion of the rock beneath the site and the approximate distribution of the required caissons.

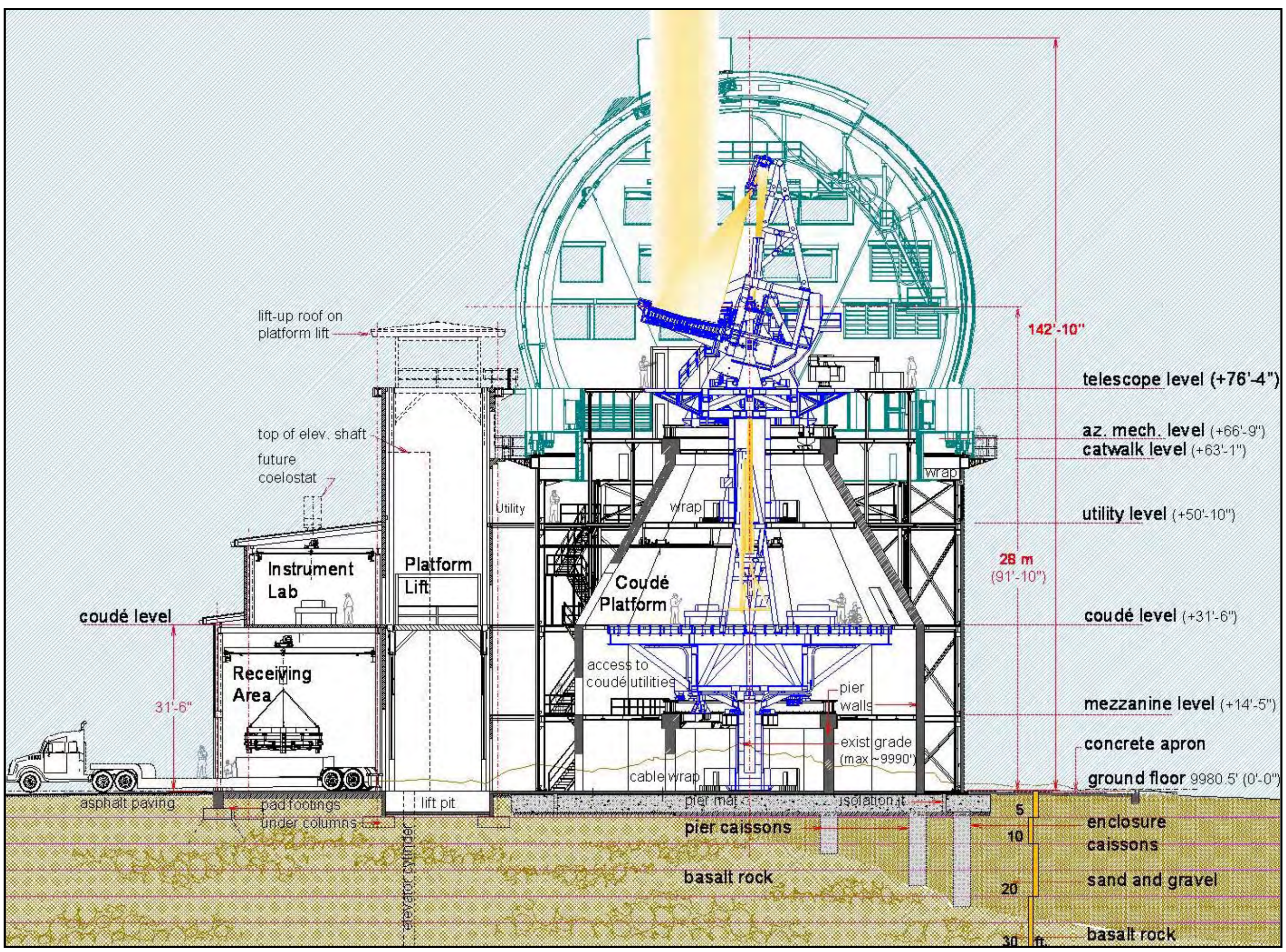


Figure 2-12. Proposed ATST Facility Section Drawing Showing Depth of Foundations in Relation to Building and Natural Rock

The buildings would be constructed of steel, poured-in-place concrete, pre-cast concrete panels, manufactured siding and roofing panels, insulation, standard utility materials, and standard interior finish materials. After excavation, facility construction would require the use of trucks, lifts, concrete pumps, welders, pneumatic tools, and a 160-ton capacity mobile lattice-boom crane.

During construction, there would be no fencing of the construction site or contractors' storage areas. The construction crane and other tall lifting devices would be lowered at night and when not in use to avoid creating a hazard to flying birds and for personnel safety in the potentially high-wind environment. Existing roads at HO would continue to be open for traffic for other HO facilities. If barricading roads becomes necessary, it would be temporary (less than a day) and would be prearranged with other HO facilities. Some temporary road widening may be necessary to allow through-traffic during construction. The access road that leads from north of the MSO facility down to the main staging area would be reopened for use during construction. This would require removing rock and soil that is currently placed at the entrance to the road as a surface water diverter. The diverter would be reconstructed after completion of the proposed ATST Project.

The foundations of the telescope and enclosure would be constructed concurrently with the excavation and concrete work required for the support facilities. The telescope pier would also likely be included in that early phase of work. The lower enclosure would be constructed concurrently with the steel erection and exterior construction work on the S&O Building. Following substantial completion of these activities, the on-site erection of the rotating upper enclosure would begin and would be completed over a period of approximately one year. Following this, the telescope mount would be erected, which is also anticipated to take approximately another year. These phases of construction would require the continued use of the staging areas, a large crane, and the other temporary construction facilities described above.

Staging

Contingent on agreement by the FAA property owner, the proposed primary staging area for the storage of construction materials would be the open area southwest of the Faulkes Telescope which is approximately 0.9 acres (Fig. 2-13). The majority of on-site construction materials and temporary facilities would be confined to this area. Contractors' trailers and storage containers, parking for large construction equipment and vehicles, lunch/break area for workers, roll-off dumpsters and other trash receptacles, portable toilets, and other temporary facilities normally needed for construction sites would be accommodated at this location. A large open area would be reserved for lay down and pre-assembly of large structural pieces or other staging activities that can be done away from the main site.

If the primary staging area described above is not available and another suitable on-site area could not be identified, the proposed ATST Project could still be constructed, although with some cost and schedule impact. The site space directly around the construction site would be utilized for staging and storage of only the essential construction facilities. Any activities requiring space-intensive staging would take place at the material manufacturers' facilities or other off-summit locations. On-site administrative space for contractors would be limited to shared work areas in one or two common job site trailers. Only the materials and assemblies required for immediate installation would be transported to the site, with no availability of space for advanced stockpiling or storage of future required materials. These restrictions would potentially add approximately 5 percent to the cost and schedule for building construction and on-site erection of the telescope mount and enclosure.

In order to limit construction traffic on the Park road and also to be able to continue work during petrel nesting periods at HO, the Project team has investigated the availability of off-site staging areas on Maui. The most likely possibilities are private ranch land properties in the Upcountry (Kula) area which would be leased from the owners for the duration of the construction period. While no specific site has yet been identified, the most likely possibilities are private ranch land properties in the Upcountry (Kula) area which would be leased from the owners for the duration of the construction period. Any such use of an off-site area for staging activities would comply with all applicable land-use regulations and all applicable permitting requirements.

Regardless of the off-site and primary on-site staging area strategy, space would also have to be reserved immediately adjacent to the construction site (Fig. 2-14). This would serve as maneuvering space for cranes and lifts, an unloading area for construction materials, a lay-down area for materials to be picked up by the crane, and a temporary parking area for concrete trucks and other vehicles. The areas identified at this site are the service area to the west of the S&O Building and the relatively flat area northeast of the enclosure and south of the road. The area south of the S&O Building and the MSO facility may also serve this purpose, if not otherwise occupied by the staging and storage requirements described above.

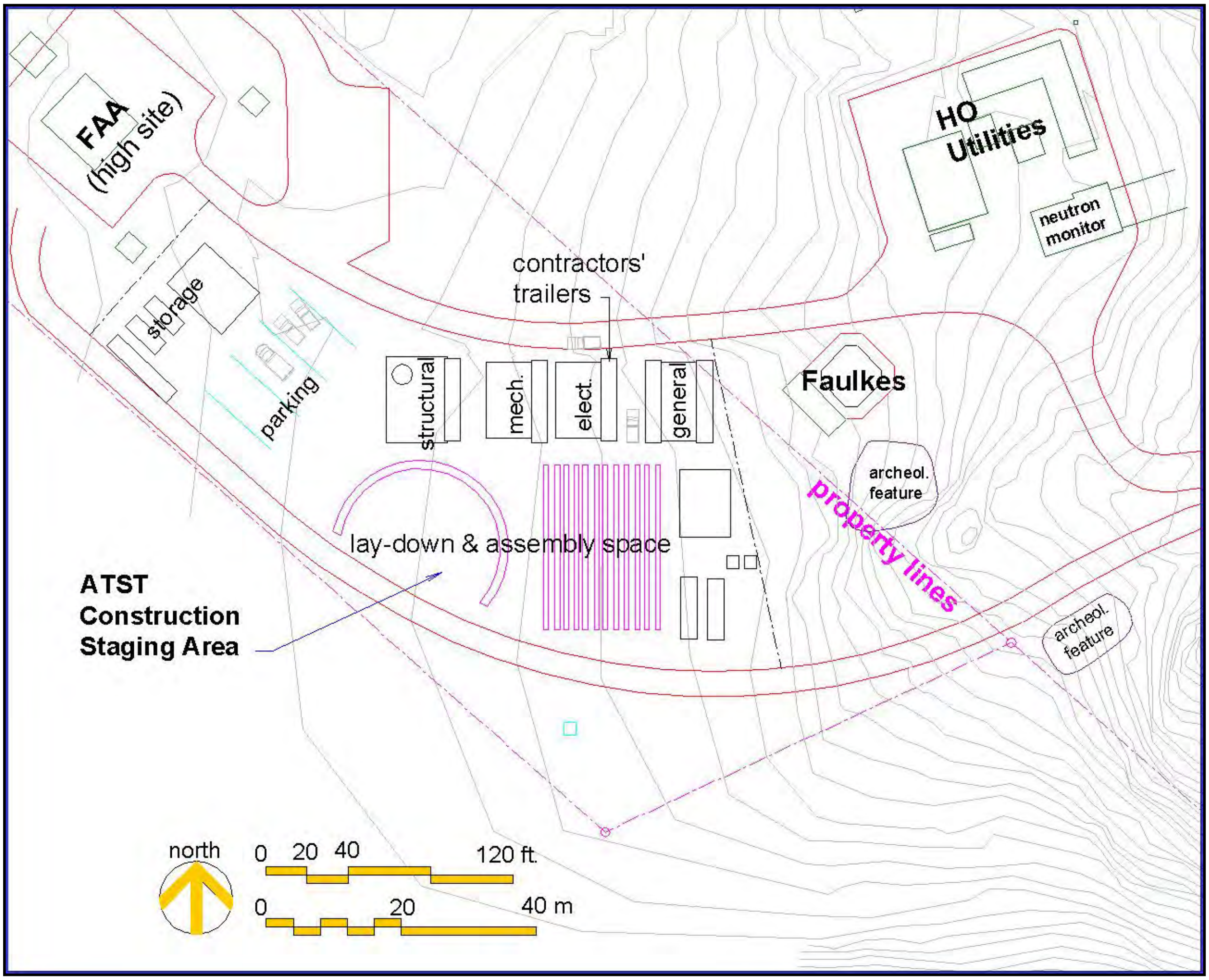


Figure 2-13. Construction Staging Area.

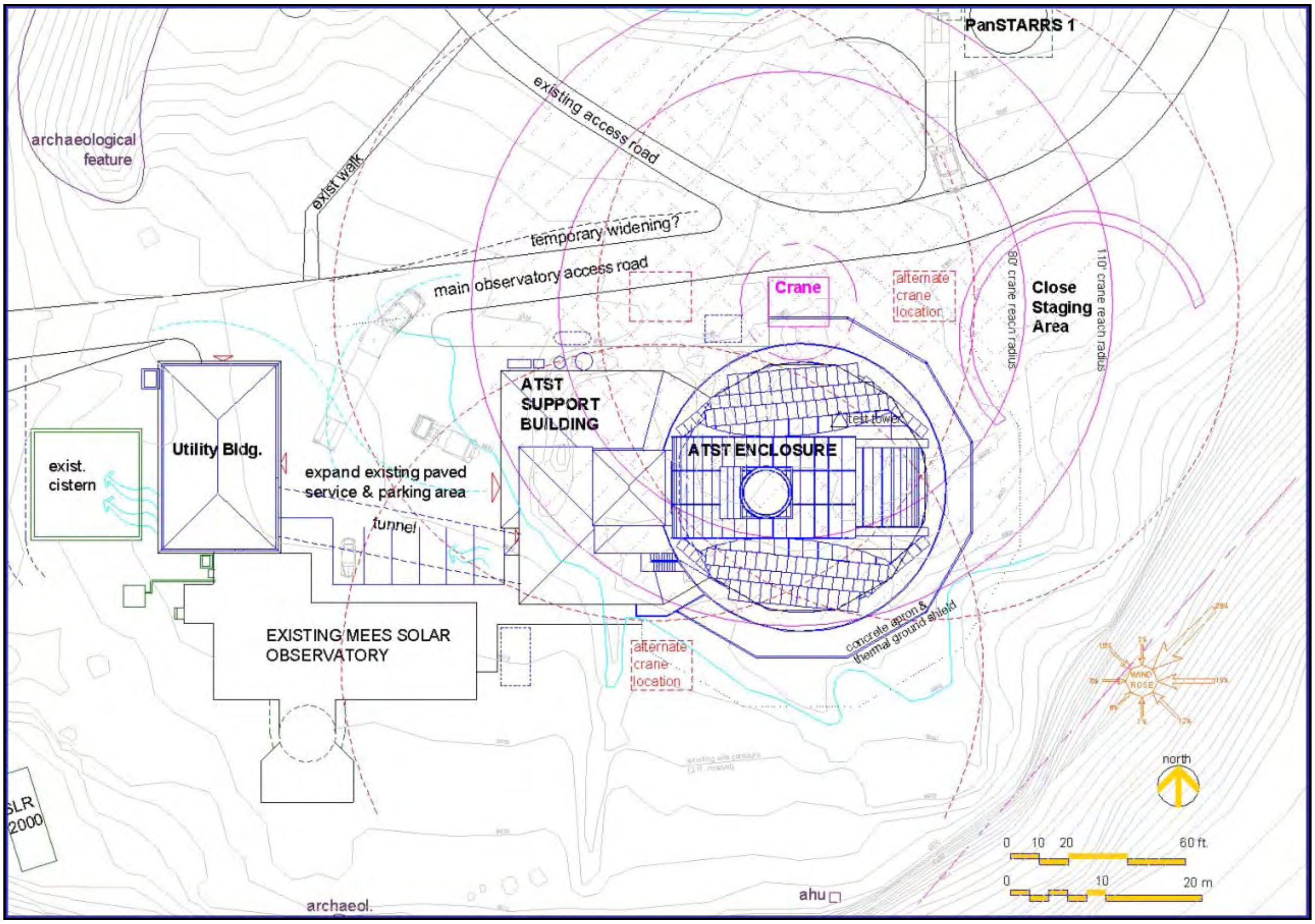


Figure 2-14. Staging Area in Close Proximity to Proposed Construction Site.

Construction Traffic

As a result of the public comment period that followed the publication of the DEIS and meetings with HALE, NSF agreed to assess the extent of construction traffic traversing through HALE. Early in the assessment process, HALE contracted with the Federal Highway Administration (FHWA) for field investigation and preparation of a study defining the current condition of the Park road and the extent of potential increased wear from construction traffic related to the proposed ATST Project. As a follow-up to that initial study, the FHWA recommended an additional Park road condition investigation. The NSF contracted for the FHWA to perform this additional work, which included borings of the existing pavement, Falling-weight Deflectometer testing, and more thorough assessment of the drainage structures along the Park road. A report was prepared by the FHWA summarizing the findings of both the initial and follow-up investigations. That report is included in Vol. II, Appendix P-FHWA HALE Road Report.

In cooperation with those studies, ATST Project engineers estimated the required use of the Park road by all vehicles during the course of construction, integration, and commissioning of the proposed ATST Project. This information was provided to HALE and FHWA for their reference in assessing potential effects. ATST project engineers have continued to refine that estimate based on logistical planning and discussions with contractors. The total number of truck and automobile trips that are anticipated to be required over the 7-year construction, integration, and commissioning phases of the proposed ATST Project is approximately 25,000, as listed and described in Table 2-4.

Table 2-4. Anticipated Major Use of the Road for Construction of the Proposed ATST Project.

Duration[6]	Activities[6]	Use of Park Road	Vehicle Class[4] FHWA	Vehicle Class[4] HI DOT
3 months	Contract start-up, mobilization, demolition and clearing	Delivery of trailers and excavation equipment – 8 flatbed trucks. Test tower, cesspool, and other items removed – 4 truckloads. Pick-up trucks, vans – 360 roundtrips. Passenger vehicles – 360 roundtrips.	9 5 3 2	3S-2 2D 2P or 2S P
3 months	[1]Major earthwork and leveling, utility trenching, testing as required	Exchange of equipment, approximately 6 large loads. Water for dust control – 30 tank trucks. Soil testing support – 3 trucks. Soil remediation support – 3 trucks. Pick-up trucks, vans – 360 roundtrips. Passenger vehicles – 360 roundtrips.	9 6 3 5 3 2	3S-2 3X 2S 2D 2P or 2S P
3 months	[1]Foundation excavation, drilling/pouring caissons, drilling for shafts, utility install	Drill rig and specialized equipment to site - 4 truckloads. Concrete for caissons - approximately 15 truckloads. Utility/electrical equipment pipe, cable - 5 truckloads. Pick-up trucks, vans – 360 roundtrips. Passenger vehicles – 360 roundtrips.	6 7 3 3 2	3X ----- 2S 2S or 2P P
3 months	Pouring foundations, placement of utilities	[2] Concrete delivery – 100 truckloads. Concrete waste removal – 3 truckloads. Rebar and embedded steel items - 5 truckloads. Utility materials – 6 truckloads. Pick-up trucks, vans – 360 roundtrips. Passenger vehicles – 360 roundtrips.	7 6 5 6 3 2	---- 3X 2D 3X 2S or 2P P
5 months	Pouring of telescope pier	Concrete delivery – 170 truckloads. 160-ton crane delivered and erected - 2 large trucks. Concrete pump and support – 6 trucks. Concrete waste removal – 5 truckloads. Rebar and embedded steel items – 10 truckloads. Scaffolding and concrete formwork – 30 truckloads. Pick-up, vans – 600 roundtrips. Passenger vehicles – 600 roundtrips.	7 10 7 7 5 7 3 2	---- 3-3 ---- ---- 2D ---- 2S or 2P P
3 months	Completing slabs, pits and other building concrete	Approximately 50 truckloads of concrete. Concrete waste removal – 2 truckloads. Rebar and embedded steel items – 5 truckloads. Pick-up trucks, vans – 360 roundtrips. Passenger vehicles – 360 roundtrips.	7 7 5 3 2	---- ---- 2D 2S or 2P P
5 months	Steel erection	Delivery of steel for building and lower enclosure - 10 flatbeds. [3] Ancillary materials and equipment – 10 truckloads. Pick-up trucks, vans – 600 roundtrips. Passenger vehicles – 600 roundtrips.	5 5 3 2	2D 2D 2S or 2P P
3 months	Roof and wall panel installation	Approximately 20 truckloads of materials. Ancillary materials and equipment – 20 truckloads. Pick-up trucks, vans – 360 roundtrips. Passenger vehicles – 360 roundtrips.	6 7 3 2	3X ---- 2S or 2P P
6 months	Dome framing, major utility equipment installation, S&O, building interior construction	Dome contractor's trailers and containers – 4 truckloads. Delivery of upper enclosure structure - 10 large, heavy, possibly wide loads on flatbeds. Delivery of platform lift and elevator - 4 large loads. Delivery of building fixtures and materials – 20 truckloads. Ancillary materials and equipment – 10 truckloads. Pick-up trucks, vans – 720 roundtrips. Passenger vehicles – 720 roundtrips.	9 12 4 9 7 3 2	3S-2 2S-1-3 B 3S-2 ---- 2S or 2P P

Table 2-4. Anticipated Major Use of the Road for Construction of the Proposed ATST Project (cont.).

Duration[6]	Activities[6]	Use of Park Road	Vehicle Class[4] FHWA	Vehicle Class[4] HI DOT
9 months	Enclosure work: cladding mechanical fit-up, testing	Delivery of enclosure cladding panels, plate-coil, and mechanical equipment - 20 large, heavy, flatbed loads. Ancillary materials and equipment – 10 truckloads. Pick-up trucks, vans – 1,080 roundtrips. Passenger vehicles – 1,080 roundtrips.	9 7 3 2	3S-2 ---- 2S or 2P P
12 months	Telescope and coudé rotator installation.	Telescope contractor's trailers and containers – 4 truckloads. Delivery of telescope assemblies to site - 20 large, heavy, often wide loads on flatbeds[5]. Construction crane other equipment disassembled and trucked away from site – 6 truckloads. Ancillary materials and equipment – 10 truckloads. Pick-up trucks, vans – 1440 roundtrips. Passenger vehicles – 1440 roundtrips.	9 12 7 7 3 2	3S-2 2S-1-3 ---- ---- 2S or 2P P
3 months	Finish site work: Paving of apron and service yard. Concrete walks, finish utilities.	Concrete delivery – 50 truckloads. Concrete waste removal – 3 truckloads. Rebar and embedded steel items – 5 truckloads. Asphalt paving materials and equipment – 10 truckloads. Water for dust control – 10 tank trucks. Pick-up trucks, vans – 360 roundtrips. Passenger vehicles – 360 roundtrips.	7 7 9 9 6 3 2	---- ---- 3S-2 3S-2 3X 2S or 2P P
6 months	Primary mirror and other optics coated and installed.	Delivery of primary mirror – 1 heavy, wide, slow moving flatbed. Delivery of coating chamber – 1 heavy, wide, slow, flatbed. Ancillary materials and equipment – 10 truckloads. Pick-up trucks, vans – 720 roundtrips. Passenger vehicles – 720 roundtrips.	12 10 9 3 2	2S-1-3 3-3 3S-2 2S or 2P P
2 years	Integration Testing and Commissioning	Delivery of materials – 204 truck trips. Pick-up trucks, vans – 2,920 roundtrips. Passenger vehicles – 2,920 roundtrips.	6 3 2	3X 2S or 2P P
Annually	Operational life of proposed ATST Project	Deliveries – 15 truck trips. Pick-up trucks, vans – 1,095 roundtrips. Passenger vehicles – 1,095 roundtrips.	6 3 2	3X 2S or 2P P

NOTES:
FHWA: Federal Highway Administration
HI DOT; State of Hawai'i Dept. of Transportation

[1] All excavated material is to remain on Haleakalā and would not be transported over the Park road.
[2] All concrete deliveries in this table assume 8 cubic yards of concrete per truckload.
[3] Ancillary equipment and materials includes: lifts, scaffolding, special equipment and related installation items.
[4] Vehicle class rating assumptions for vehicles are taken from FHWA Report (Table 11).
[5] The exact dimensions and weights of potentially wide and heavy loads would not be fully determinable until contracts with vendors and fabricators are in progress. Limitations on maximum loads would be stipulated in their contracts. For this analysis, the ATST engineers have estimated that the maximum width of a load would not exceed 10 m (32 feet 10 inches) and the maximum weight would not exceed 40 tons, plus the weight of the truck. These estimates were conveyed to the FHWA to be factored into the Park road study.
[6] Some of the activities described in the table have potential to generate noise or vibration between March and November. These activities would be curtailed or restricted during the 'u'au nesting and egg-incubation periods, as required by the mitigations defined in the USFWS Informal Consultation Document (Vol. II, Appendix M-USFWS Informal Consultation Document, 2007). The durations indicated here are approximations for the purposes of assessing the duration and intensity of the vehicular traffic and do not correlate to any specific calendar schedule.

Less than 800 of the anticipated vehicle-trips listed in Table 2-4 are by large trucks (FHWA class 5 and larger). The majority of the anticipated trips are by small pick-up trucks, vans and passenger vehicles, as required for the commuting of workers, small equipment or material deliveries, and passenger car traffic for inspection and supervision. During all phases of the proposed ATST Project, carpooling by workers to the summit would be mandated, to the maximum extent practicable, in order to minimize traffic effects and to address parking space limitations on the site.

Following the defined 5-year construction phase of the proposed ATST Project, the integration, testing and commissioning phase would extend for approximately two years, during which the anticipated traffic on the Park road would be limited to approximately 4 passenger vehicles per day, 4 pick-up trucks or vans per day and 2 truck deliveries per week. The total volume of large vehicle traffic (defined by the FHWA as Class 5 or larger) during the integration, testing and commissioning phase would be approximately 204 truck trips. Following that, and extending for the operational life of the project, the ATST-related use of the Park road would be approximately 3 roundtrips for a van shuttle per day, 3 roundtrips for passenger vehicles per day, 1 truck-trip per month for delivery of domestic water, liquid nitrogen, or diesel fuel for the generator, and 3 truck trips per year for occasional transportation of scientific instruments. Traffic during these phases is also included in Table 2-4.

HALE Entrance Station Clearance

During the investigation of potential road and traffic issues, the current configuration of the existing entrance station for HALE was identified as a restriction to wide truck loads. The conveyance of large unitary pieces of the ATST telescope, the primary mirror in its protective crate, and other constituent elements of the proposed ATST Project would require truck loads of up to 32 feet 10 inches in width. The HALE entrance station currently provides one paved driving lane approximately 12 feet wide on both the entrance and exiting sides, as shown in the top graphic of Figure 2-15.

Development by ATST engineers of alternative proposals for wider clearance and subsequent consideration by HALE staff identified a mutually preferred option to widen and improve the shoulder on the entry (uphill side) of the entrance station, as shown in the bottom graphic of Figure 2-15. This would consist of installing compacted fill and a gravel driving surface out to a maximum distance of approximately 12 feet beyond the existing paved roadway at the widest point, and tapering back to the roadway on each end, so as to provide a widened, drivable lane capable of supporting the widest and heaviest of the anticipated ATST loads. Other requirements of this project would include protecting underground utilities, relocating an existing light pole, upgrading utility pull boxes to withstand the anticipated loads, and other related work.

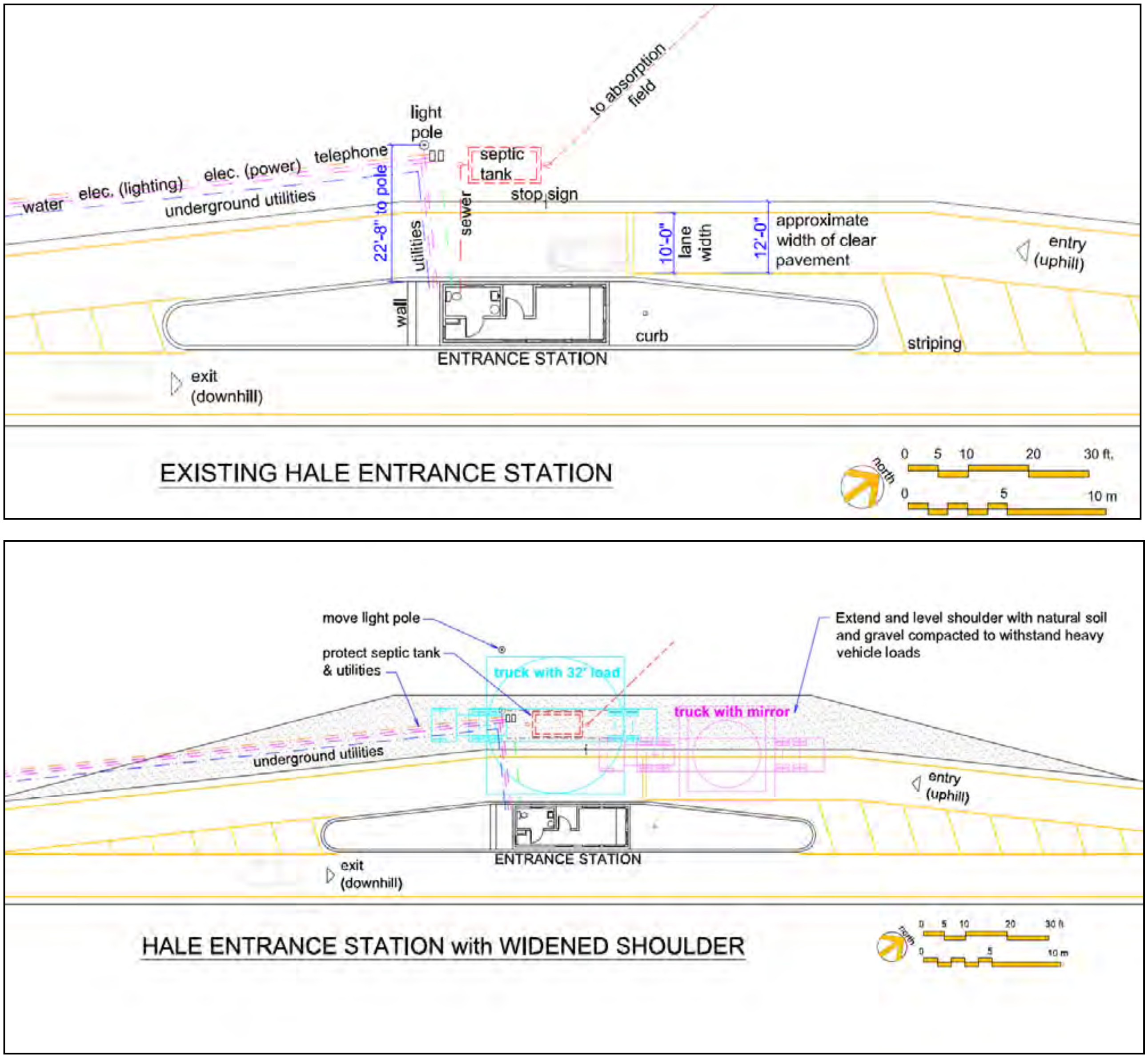


Figure 2-15. Existing HALE Entrance Station and Proposed Widened Shoulder.

Specific stipulations with regard to this entrance station work have been formulated by HALE staff and further elaborated by the ATST engineering team:

1. The ATST Project would assure that the septic system is adequately protected. Metal plate covers, grade beam structures or similar protective devices would be deployed. If protection proves impractical, relocation of the septic tank could be considered as an option.
2. The ATST Project would protect the existing utility man-hole covers, including the following measures:

   a) avoid direct axle loading on the covers,
   b) replace the existing covers with heavier gage steel; or,

c) reinforce the existing covers with additional steel bracing.

3. The ATST Project would ensure that the improved shoulder would be adequate for the heavy loads anticipated by ATST engineers.

4. Periodic maintenance of the widened shoulder area, such as recompaction, regrading, etc. as necessitated by settling, erosion, or washout, would be the responsibility of the ATST Project.

5. A barricade system, such as a gate, removable bollards or similar devices, would be installed by the ATST Project on the widened shoulder to deter Park visitors and staff from driving on it.

6. This area contains native plants and is nēnē (Hawaiian Goose) habitat. Widening of the shoulder would be completed outside the nēnē nesting season, which is November through March. Native plants would be protected when possible – HALE staff would work with the ATST Project team on this.

7. When the widened shoulder is no longer needed for the proposed ATST Project, it would be required to be fully restored and rehabilitated. The ATST Project would consult with HALE staff and would review and approve the final restoration/rehabilitation plan.

Best Management Practices

A variety of best management practices (BMPs) (required practices established in the LRDP and policies reflecting public consultation during the EIS process) would be implemented during construction, in order to prevent damage to the natural environment. These BMPs would include the following:

1. Implementation of the Stormwater Master Plan (SWMP), specific to HO, which is included as Appendix L. This would include all BMPs in Sections 3.1 and 3.2 of Appendix L for recommended construction practices and stormwater control.

2. During construction temporary diverters and hard surfaces would be utilized to direct surface water flow to the existing stormwater drainage system. As soon as possible, permanent gutters and leaders would be installed on the buildings to capture rainwater and direct it to the underground cistern.

3. Portable toilets with containment tanks would be utilized during early construction work. As soon as possible, a permanent wastewater treatment facility would be installed, which uses aeration and biologically accelerated treatment techniques that achieve effluent standards acceptable for infiltration back to groundwater.

4. Cultural resources monitoring during all leveling and excavation activities in order to prevent damage to undiscovered cultural resources.

5. Using native soils to fill holes upon completion of construction, and replanting grounding trenches, other excavated areas, and soil deposition areas with native vegetation to prevent erosion.

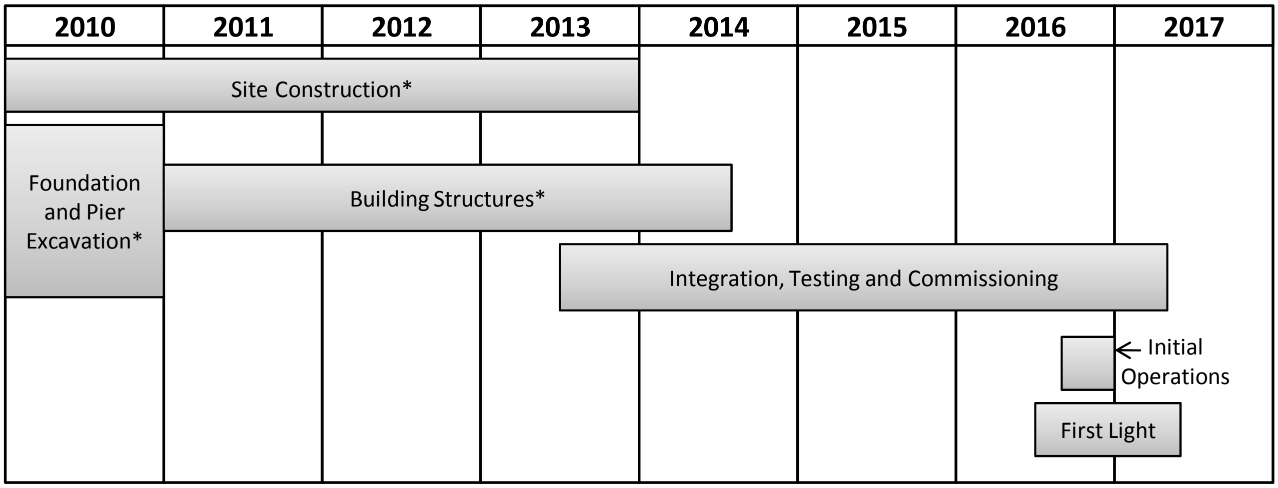
6. Scheduling deliveries of concrete and other materials at times that minimize conflict with tourist traffic on the Park road to Haleakalā.

7. Using signage at the project site and along the roadways to ensure vehicle, pedestrian, and bicycle safety during construction.

8. Dust control would be done by watering the disturbed ground using non-potable water trucked to the site by the contractor specifically for that purpose. Potable water would not be used for dust control.

Proposed Construction Schedule

If approved, the earliest possible construction start would be during the Federal fiscal year 2010, which is October 1, 2009 to September 30, 2010. Excavation and construction of the foundations and pier would take place in the first year of construction (2010) and erection of the enclosure and building structures would follow in the second, third, and fourth years (2011 to 2013). Once the enclosure is in position, the telescope mount would be installed and the majority of the remaining work would be inside the buildings and enclosure. The optics, control systems, and instrumentation would progress toward the end of construction and into integration, testing, and commissioning of the various systems and instruments. The final phase of construction would be the verification of the science and the transition into a fully operational system. The site would be in full operation during 2017. Figure 2-16 shows a graphic timeline of these activities.



*Tasks related to these activities that have potential to generate noise or vibration between March and November would be curtailed or restricted during the ‘u‘au nesting and egg-incubation periods, as required by the mitigations defined in the USFWS Informal Consultation Document (Vol. II, Appendix M).

Figure 2-16. Proposed ATST Construction Schedule.

2.4.4 Telescope Operation Activities

During the final stages of construction, including telescope and first-instrument commissioning, initial operation of the ATST would begin. The first scientific use of the facility would mark a shift in priorities from telescope commissioning activities to early scientific observational priorities. The management and science teams would work together for a smooth transition, starting with this first scientific use of the telescope. A ramp-up of full operational support would begin during telescope integration and continue through final commissioning of the first major science instrument.

As the facility is staffed for telescope operations, construction staff on site would begin to decrease. Additionally, as new instruments become operational, more facility staff would be hired to conduct operations. Estimates indicate that an operations staff of approximately 20 people would be needed for telescope commissioning. This would be slowly ramped up over the final year of commissioning to the full operations staffing level, currently estimated at approximately 30 to 40 personnel on Maui. As with other observatories at HO, the operations staff would be drawn from available local Maui personnel to the fullest extent possible.

Shift Schedule
The proposed daily schedule for operations would be dictated by solar observing hours from sunrise to sunset. Preparing the dome and telescope for observing would begin approximately one hour before sunrise and shutdown procedures would continue until approximately one hour after sunset. This observing day would likely be divided into two shifts of approximately six to eight persons to provide full support of observing activities. An eight-hour nighttime shift of four to six persons for maintenance work beginning approximately at sunset is also anticipated. These would make up the onsite crew. The remaining staffing

would work offsite on Maui or at the NSO offices which are currently sited in Sunspot, New Mexico and Tucson, Arizona.

Transportation

During operation, ATST-related Park road traffic to the summit of Haleakalā is expected to be relatively minimal. There would be a van shuttle for observatory employees scheduled for approximately three trips per day, back and forth between the base facility in the Kula/Waiakoa area and the facility at HO. Additionally, there would typically be two to four separate passenger cars per day driven by staff or visiting observers making a round trip to HO and back.

Commercial service-vehicle traffic to support the operation of ATST is estimated to be an average of two round trips per week of vehicles up to Class 5 size. These would primarily be small trucks and vans of maintenance and service personnel. The frequency of these service-vehicle trips would be sporadic, with multiple daily trips occurring when repair or maintenance activities are in progress and extended periods with no such trips. Larger commercial vehicles, Class 6 and above, primarily for delivery of water, liquid nitrogen and other utility commodities would make approximately one round trip per month to HO in support of ATST operations.

This operations-level traffic would follow the initial 7-year period of the project and continue for the operational life of the facility. It is expected to be significantly lower in volume than the traffic related to the 7-year construction, integration and commissioning traffic, as described in Table 2-4.

Hazardous Materials

Operations at HO facilities sometimes require the use, handling, storage, and disposal of hazardous materials. These activities are performed in compliance with 40 CFR §260-299, Solid Wastes, and the Resource Conservation and Recovery Act (U.S. EPA, RCRA). Facilities within HO maintain various hazardous materials and waste plans as required by Federal guidelines and/or facility protocols, which outline procedures for handling materials and carrying out response measures in the event of a release or spill. A Hazardous Materials Management Plan specific to the proposed ATST Project has been prepared and is included as Vol. II, Appendix D-ATST Hazardous Materials Management Program. Hazardous materials that would be used at the proposed ATST facility and their uses are shown in Table 2-5. The transportation of these materials associated with the proposed ATST Project also occurs along the Park road corridor and State roads leading up to the Park road. Transportation along these roads is, likewise, governed by the authorities set forth below.

The transportation of hazardous materials for the proposed ATST Project would be fully consistent with Title 49 CFR Parts 100-185 Hazardous Materials Regulations – Hazmat Transportation as prescribed by the Federal Department of Transportation. Only properly licensed companies and individuals would be contracted to transport hazardous materials. All materials would be in approved containers, clearly labeled as to the nature and quantity of material. Trucks would display diamond-shaped placards to identify hazardous materials as required. Material Safety Data Sheets (MSDS) for each hazardous material and/or chemical item transported would accompany all shipments. This information would be readily available to the first responders at the scene of any potential spill to determine appropriate measures for protection and safety of the public and the environment.

Table 2-5. Hazardous Materials.

Operation	***Hazardous Material***	***Volume***
Mirror stripping and cleaning (once every two years)	Green River (hydrochloric acid and cupric sulfate)	2.72 kilograms HCl 37 percent and 227 g CuSO4 5H2O, dissolved in 10 liters (2.5 gallons) of distilled water. None stored on site.
	Potassium hydroxide	16 oz KOH pellets, dissolved in distilled water. None stored on site.
	Nitric acid	3.2 kilograms (7 pounds) HNO3 70 percent, dissolved in distilled water. None stored on site.
	Total stripping/ cleaning effluent	Approximately 1,000 gals, plus wipes.
Mirror recoating	Aluminum	< 2 ounces. None stored on site.
	Silver	
	Silicon nitride	
	Nickel chromium	
Cooling/ heat transfer	Propylene glycol Dynalene HC® heat-transfer fluid	Total volume of the cooling system is approximately 2,400 gallons diluted to 30 percent solution. The heat-transfer fluid propylene glycol or Dynalene HC®, is delivered in concentrated form. Approximately 10 gallons of this concentrate would be stored on site.
Maintenance of telescope hydrostatic bearing system	Synthesized hydrocarbon-based hydraulic oil	1,400 gallons would be utilized and contained within the piping, tank, and other elements of the system installed in the enclosure and in the S&O Building
Cooling instruments	Compressed (liquid and gaseous) helium and nitrogen	Approximately 1,000 gallons of liquid nitrogen would be stored and utilized on site. Less than 100 gallons of liquid helium would be utilized on site.
Generator fuel	Commercial grade 1 diesel fuel	Approximately 200 gallons. Stored in on-site tank.

As described in Vol. II, Appendix D-ATST Hazardous Materials Management Program, prior to transport, the materials would be prepared per:

1. 40 CFR 262.30 package per DOT 49 CFR 173, 178, and 179.
2. 40 CFR 262.31 label per DOT 49 CFR 172.
3. 40 CFR 262.32 mark each package in accordance with DOT 49 CFR 172 and 172.304.
4. 40 CFR 262.33 Placard or offer Placard to initial transporter in accordance with DOT requirements.

Transportation of the mirror stripping, cleaning and recoating materials and the effluent from this process would occur approximately once every two years. Transportation of the heat transfer fluid concentrate would occur as needed for replenishment of the system, approximately once per year. None of the mirror coating materials or heat transfer fluids is defined as hazardous under Title 49 CFR Federal Department of Transportation. Liquid nitrogen and helium would be transported to the ATST facility on a periodic basis approximately four times per year. In the event of accidental release to the outside air during shipment, these elements would immediately vaporize presenting no ecological or life-safety hazard. Synthesized hydrocarbon-based oil is expected to be transported to the site only during the construction phase for the initial fill of the system. The self-contained hydrostatic oil system is not expected to require any significant replenishment during operation. Diesel fuel for the generator would be transported to the site approximately once per month to refill the tank following periodic testing or use of the generator during power outages. Transportation of all these materials would be in containers and vehicles fully compliant with Title 49 CFR and other applicable regulations. Containment of spills during the transport of any of these materials would be in accordance with the ATST Hazardous Materials Management Program (Appendix D) and the written requirements of the MSDS documentation accompanying the shipment. Given these safeguards and the relatively benign nature of these materials, their transport presents minimal potential for effects to the public, the natural environment, or cultural resources.

Utilities

Stormwater Management. Rainwater on roof and building surfaces and on the concrete apron around the enclosure would be collected and utilized as a source of domestic water for observatory operations. Gutters and rainwater leaders at the roof eaves and catchment drains around the enclosure would be piped to an approximately 40,000-gallon underground holding tank in the vicinity of the enclosure. From there it would be pumped to the existing on-site 64,000-gallon cistern that currently serves the MSO facility. This additional captured water would augment the existing domestic water supply, currently replenished by water captured from the MSO facility roof (UH IfA, 2006).

The combined capacity of the underground holding tank and cistern (104,000 gallons total) would be adequate to capture all the rainwater flowing off of the roof and building surfaces of the existing Mees facility and the proposed ATST Project during the maximum defined 5-year rainfall event (8 inches in 24 hours, see Table 3 in Appendix M). In the infrequent case of rainfall events greater than that (for reference, the 25-year defined event is 10 inches in 24 hours), the additional rainwater would be allowed to overtop the cistern and would be distributed over a broad area of the natural cinders to maximize percolation and minimize erosion-causing run-off.

The surface of the paved service yard to the west of the S&O Building would be contoured to direct surface water flow to the existing stormwater drainage system. The slope would generally be away from the buildings and northwestward, toward the existing concrete drainage channel north of the main access road. The drainage channels and culverts would be cleared of sediment and repaired as required to ensure adequate capacity to convey the surface water flow from the service yard to the existing main infiltration basin for the HO complex. An assessment of and management plan for the existing HO surface drainage system and the infiltration basin is in Vol. II, Appendix L-Stormwater Master Plan for HO. The placement of excess soil from the proposed construction would be done so as not to result in blockage of the existing drainage system or erosion onto roadways or drainage channels.

Wastewater Management. An individual treatment plant adequate to process the domestic wastewater from both the proposed ATST Project and the MSO facility would be provided. This would be a small individual treatment plant (less than 1,000 gallons per day) installed underground. This plant would utilize aeration and biologically accelerated treatment to achieve effluent standards (biological oxygen demand, total suspended solids, and pH levels) acceptable for infiltration directly to ground. Effluent would be disposed of in an on-site infiltration well (Fig. 2-17). The specification of the treatment plant and its related piping/discharge system would be based on the anticipated utilization of the facility and the applicable regulations of the State of Hawai‘i Department of Health.

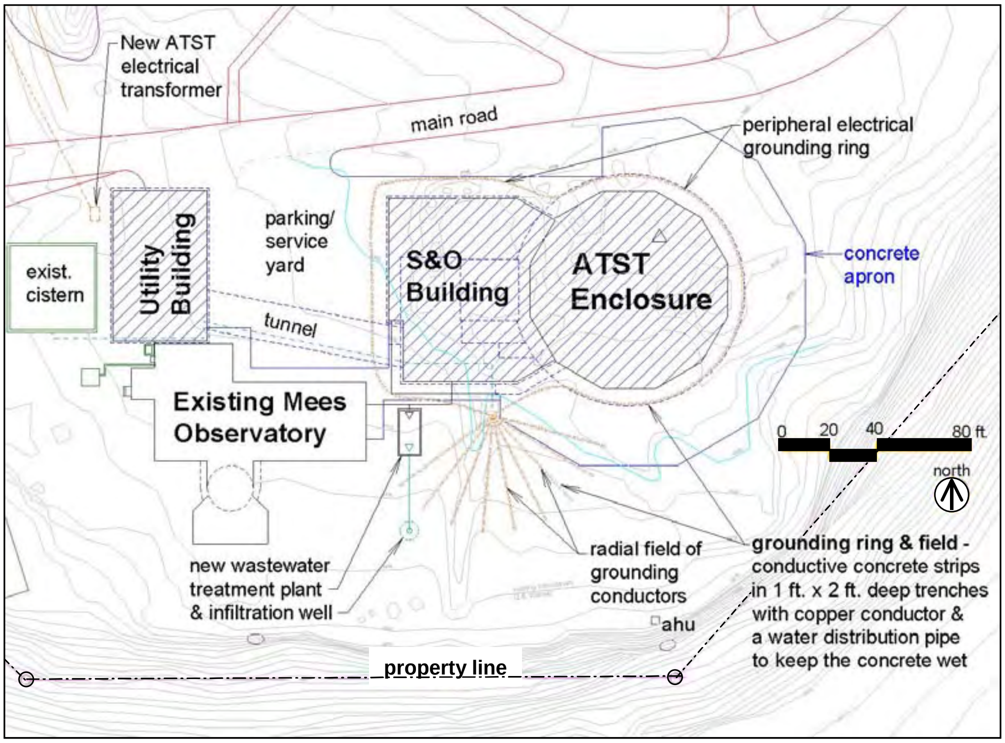


Figure 2-17. Site Plan Showing Wastewater and Grounding Systems.

Domestic Water Supply. Appropriate systems for treatment, piping, and pumping the cistern water for use in the S&O Building would be provided. The cistern water would be used directly for the domestic fixtures of the proposed ATST Project and would be required to meet basic potability standards. Water for human consumption would be provided separately through commercial bottled sources.

Grounding and Lightning Protection. The grounding system for the proposed ATST Project would employ several methods to achieve a safe effective electrical ground connection to the very dry, high-resistance volcanic soil. A series of shallow trenches would be dug that extend peripherally around the entire facility and branch out to form a grounding field in the area to the south of the S&O Building (Fig. 2-17). The trenches would be approximately 1 foot wide by 2 feet deep. The bottom half of the trench would be filled with conductive concrete, which is like normal concrete except that it contains a high concentration of a conductive aggregate material, such as iron or carbon fibers. These aggregates would be completely encapsulated in the cured concrete and would not migrate into the surrounding natural soil.

The total volume of concrete required would be approximately 30 cubic yards. Embedded within the concrete would be a continuous metal ground cable near the bottom and a perforated plastic pipe near the top. A gravity-fed water distribution system would be connected to the perforated pipe to keep the concrete wet (approximately 30 percent saturated) at all times. The water distribution system would use no more than 25 gallons per day of potable water from the collected rainwater pumped into the cistern.

As an alternative to the use of conductive concrete, coke breeze, a black granular material with high electrical conductivity may be specified in the future final design of this system. Coke breeze is a chemically stable substance consisting of sand-sized particles of coke, the processed coal that is used in smelting iron ore. The only potential health hazard of coke is from long-term exposure (inhalation or eye-contact) to airborne coke dust. In the proposed underground installation this hazard would not be present. If coke breeze were utilized, the bottom and sides of the trenches would be lined with jute matting or other durable, flexible fabric to contain the material and allow it to be completely removed in the future. The same grounding cable and water distribution system would be contained within the coke breeze.

The top of the trenches would be covered with native soil to blend into the surrounding terrain. The metal grounding cable would be connected to the steel framework of the building, to the ground leads and protective covers of equipment, and to the main ground bus in the Utility Building.

This proposed system is based on best-proven practices at existing observatories and other critical facilities at high lightning risk sites. During final facility design, a grounding consultant would be retained to fully consider the site conditions, to evaluate the proposed system, and to recommend potential refinements.

Electricity. Electrical power for the proposed ATST Project would be provided by connection to the MECO substation on HO. The maximum peak electrical demand of the proposed ATST Project is estimated to be 960 kVA. The current reserve capacity of the main power line to Haleakalā is estimated by MECO to be approximately 1900 kVA. The ATST project team has been in cooperative contact with MECO engineers who would incorporate the power requirements of the proposed ATST Project into their overall systems planning process, along with other potential future HO needs. A MECO-funded study has been conducted to identify economizing strategies for the proposed ATST Project such as ice storage to reduce peak-hour power consumption. During the night, mechanical chillers would be used to freeze tanks of water. Operation of the chillers could then be minimized during the day, as the tanks of ice would be used to cool the heat transfer fluid that cools the enclosure.

The power line for the proposed ATST Project would generally follow the path of existing service lines in order to minimize excavation of previously undisturbed soil. The proposed route is southward from the MECO substation across the MSSC facilities to the proposed location of the Utility Building. The new service would utilize existing conduits and pull boxes wherever possible. New ducts and boxes would be installed where the capacity or condition of those existing are insufficient. All service lines would be underground and routed around identified archeological features.

To provide electrical power in the event of service outages the proposed ATST Project would include a 300 kVA diesel generator to provide for safe shutdown of the telescope and enclosure and for maintaining power to critical systems. Other than during power outages, this generator would normally only be operated for a short period approximately once a month for testing.

Solid Waste Management. The non-hazardous solid waste (office refuse, food waste, etc.) from operation of the proposed ATST Project would be collected and transported off site regularly for proper disposal in a landfill. The volume is expected to be approximately three standard 30-gallon trash containers per week. Recyclable material in the solid waste (office paper, cardboard, aluminum cans, etc.) would be separated out and taken to an appropriate recycling center.

Communications. The existing facilities at HO are currently served by a microwave link for data transmission. The U. S. Air Force facility is served by a fiber link. Telephone service for all facilities is provided by Hawaiian Telcom, which has spare fiber lines already in place to the summit. The proposed ATST Project would require connection to those existing data/communications service lines. No upgrade to the current capacity of the lines is anticipated to be necessary. Connection would be made at the closest convenient point and new lines would be placed in the path of existing lines and in adjacent roadways in order to minimize excavation of previously undisturbed soil. Arrangements would be made with the commercial provider to lease the necessary capacity. The hardware to implement the connection and the service agreement with the commercial provider would be supplemental to the existing communications connections.

The proposed ATST Project would require data connectivity of approximately 1 Gigabit per second and transmit data from Haleakalā to locations throughout the world via the Internet. Communications off the summit will use existing fiber optic cables owned by Hawaiian Telecom that stretch from Haleakalā to the Maui High Performance Computing Center in Kihei. Data will also be transmitted to the ATST base facility on Maui using the same fiber optic cables. The location of the Maui base facility and ATST data repository has not been determined.

2.5 DESCRIPTION OF THE PROPOSED ATST PROJECT AT THE REBER CIRCLE SITE

As an alternative to the Mees site described in Section 2.4 above, the NSF proposes to construct the proposed ATST Project on another site within HO boundaries. This proposed site is the previous location of a radio astronomy experiment referred to as Reber Circle (Fig. 1-4). The principal area of this site is currently unutilized and is the only other area identified at HO that would be large enough to accommodate the proposed ATST Project.

The site is northeast of the preferred Mees site and about 6 meters (20 feet) higher in elevation. It is currently bounded by the two Panoramic-Survey Telescope and Rapid Response System (Pan-STARRS) facilities (PS-1 and PS-2) to the south, the Airglow facility to the south, and the Zodiacal Light facility to the southwest. As discussed in Section 2.3-Alternatives Eliminated from Further Consideration, the site selection process for the proposed ATST Project determined that Haleakalā is the only reasonable location for the proposed ATST Project, and the Reber Circle site would fulfill all the science criteria as well as the Mees site adjacent to the MSO facility. Environmental conditions for both the Mees site and the Reber Circle site at HO are discussed in Section 3.0-Description of Affected Environment.

Most of the critical construction characteristics of the project would be the same for the Reber Circle site as for the Mees site. The following sections and descriptions will discuss only those aspects that are unique to the Reber Circle site.

2.5.1 Features of Infrastructural Design

The proposed design of the telescope and instruments is the same as described for the Mees site.

The control dimensions at the proposed Reber Circle site for the location of the center of the telescope pier are as shown in Figure 2-18. The dimensions are taken from an existing survey monument pin called “Kolekole”, which is a primary reference datum for much of the development at HO. This locates the center of the telescope approximately 7.9 meters (26 feet) due east of the center of the Reber Circle concrete ring. This telescope center point also establishes the center of the enclosure and the relative location of the S&O Building, which is attached to the west side of the enclosure. The detached Utility Building would be located to the southwest as shown in Figure 2-19.

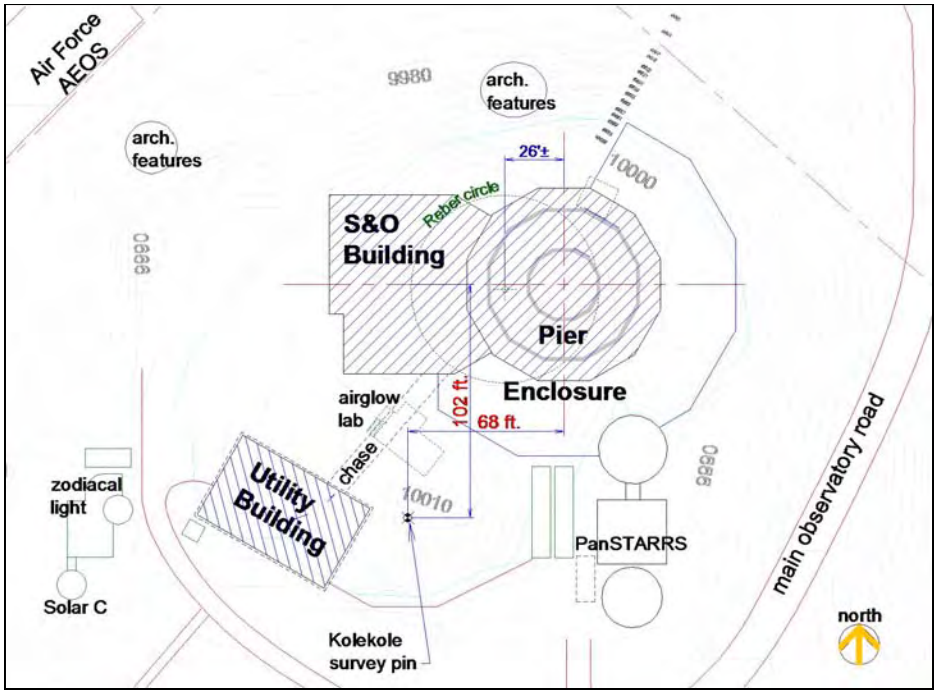


Figure 2-18. Site Layout of Proposed ATST Project at the Reber Circle Site.

The S&O Building would have the same exterior dimensions and the same interior spaces as described for the Mees site. Figure 2-19 shows the proposed relationship of the telescope enclosure, S&O Building, and Utility Building to the topography of the Reber Circle site and to the existing adjacent structures.

While the Utility Building would be located in a different spot relative to the S&O Building and Telescope enclosure, it would have the same exterior dimensions and would house the same equipment as described for the Mees site.

All the same facilities would be constructed at the Reber Circle site as at the Mees site. However, at the Reber Circle site, a new above ground fuel storage tank to support the back-up generator would be required, which would comply with all applicable EPA and safety regulations. The proposed location and capacity for this tank has not yet been determined. It could be integral with the base of the generator or installed at a suitable exterior location near the Utility Building.

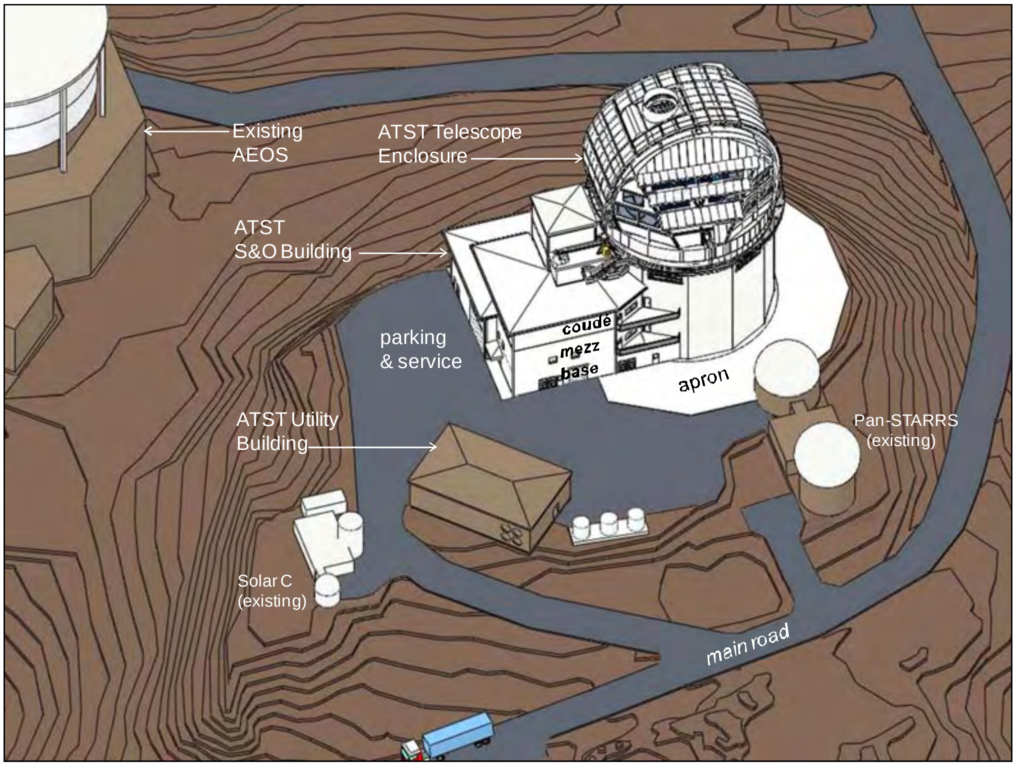


Figure 2-19. Aerial Rendering of Proposed ATST Project at the Reber Circle Site.

2.5.2 Potential Use of Existing MSO and Airglow Atmospheric Facilities

Mees Solar Observatory Facility

The use of the Reber Circle site would likely still require modifications and use of the MSO facility. The proposed Reber Circle site is approximately 121.9 meters (400 feet) north and uphill from the existing MSO facility and shared use of that building to support the proposed ATST Project would be less convenient. However, this site would also be more constricted by topography and adjacent structures than is the Mees site. Areas for additional shop space or other indirect support functions would not likely be available at the Reber Circle site. As such, the project would still propose to modify the existing shop in the MSO facility to allow it to serve the needs of both IfA and the proposed ATST Project.

It may not be feasible to remove the existing MSO facility generator at this site, which would limit the amount of total modified shop space available. The on-site shop space for the proposed ATST Project would therefore be somewhat smaller and farther away than would be the case with the Mees site. The long-term effect on the proposed ATST Project would be some loss of man-hour efficiency due to the occasional need for work activities to move from one facility to the other. Also, because the shop would be somewhat smaller, work would more often have to be done at the proposed ATST Project base facility or at another off-site location.

The other potential shared uses for the MSO facility are the same as described for the Mees site.

Airglow Atmospheric Facility

The existing UH Atmospheric Airglow instrument platform is a 57-year-old concrete block structure of approximately 300 square feet. Should the proposed ATST Project be constructed at the Reber Circle

Alternative Site, the UH Atmospheric Airglow instrument platform would be removed to provide sufficient building space.

2.5.3 Construction Activities

As at the Mees site, project construction would involve land clearing, demolition, grading/leveling, excavation, soil retention and placement, construction, remodeling of the MSO facility, and paving. Most of these activities would be approximately the same in duration and quantity as at the Mees site, with the following exceptions.

Demolition and Removal

Demolition techniques and equipment would be the same as used at the Mees site. The following facilities would be demolished in order to make room for the proposed ATST facilities at the Reber Circle site:

1. The Reber Circle (concrete ring and steel track in deteriorated condition). This would be done in accordance with the data recovery plan for Reber Circle (Vol. II, Appendix B(1)-Data Recovery Plan for Site 5443).
2. The existing Airglow Observatory.
3. A small abandoned rock utility building northeast of Reber Circle.
4. A section of the existing access road and a paved pedestrian path.
5. Selective demolition at the MSO shop/utility area.

Grading/Leveling

The existing topographical features at this site consist of a level pad previously created for the Reber Circle project, the adjacent sloping terrain around this level area, and a small peak south of the existing Airglow Observatory (Fig. 1-2). The proposed ATST Project would require a level pad significantly larger than the existing one. This would be 20 feet wider in all directions than the base level footprint of the enclosure and the S&O Building, plus additional level areas for the Utility Building and a service yard. The critical nature of the structural bearing condition requires that the level area immediately around the telescope be achieved primarily by cutting rather than by a cut and fill approach. At the Reber Circle site, the proposed grade cut would be down to approximately the 9,996-foot contour elevation.

Approximately 5,000 cubic yards of soil and rock would be displaced during the leveling phase in order to prepare the site for construction. The proposed placement area for this material would be the Primary Soil Placement Area, as described above for the Mees site. At an average volume of 20 cubic yards per truckload, approximately 250 truck trips would be necessary to relocate excess rock and soil.

Excavation

Excavation techniques would be approximately the same as those for the Mees site structures, using the same types of equipment. There could be more use of hydraulic hammers and jackhammers than at the Mees site, because preliminary geotechnical investigations indicate that there is more subsurface rock at this site.

Approximately 7,150 cubic yards of soil and rock would be excavated from the Reber Circle site during construction (Fig. 2-20), of which approximately 5,000 cubic yards would be removed for leveling and approximately 2,150 cubic yards in excavation for caissons, pad foundations, the tunnel and utility trenches. The amount of material removed for leveling would be approximately twice what would be required at the Mees site. This is primarily because no level area currently exists at the Reber Circle site for the Utility Building and service yard, as was the case at the Mees site.

Placement of Excess Soil and Rock

Excavated soils would be placed in the Primary Soil Placement Area, as discussed above for the Mees site. This placement area would accommodate a calculated maximum of about 5,400 cubic yards of material, which likely would not be sufficient for all the soil and rock that would be required to be removed from the proposed Reber Circle site. For this site, other approved placement areas within HO would have to be found. All native rock and soil removed from the site would be placed in a culturally appropriate manner at locations within HO boundaries.

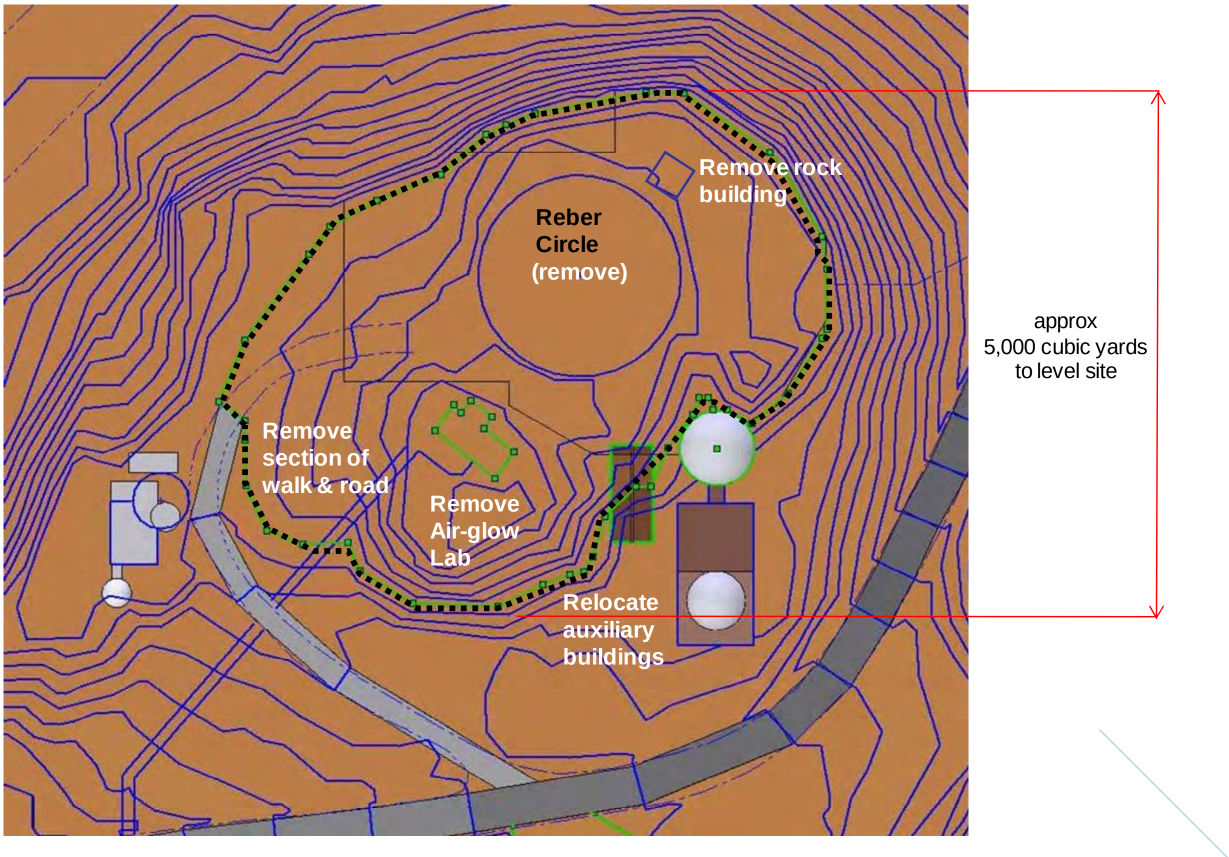


Figure 2-20. Excavation Footprint for the Reber Circle Site.

Construction

Construction techniques, equipment and materials would be the same as for the Mees site. The Utility/Ventilation Tunnel would essentially be the same as described for the Mees site, except the tunnel would be approximately 36 feet shorter.

Staging

As described for the Mees site, staging and storage space would be required immediately adjacent to the construction site. The areas available, however, for close-in staging and maneuvering are much more limited at this site due to the topography and the adjacent structures. More assemblies would have to be staged remotely and fewer space-intensive activities could be conducted simultaneously at the site. This would result in a less efficient construction operation and a proportionally longer schedule.

Construction Traffic

The extent and nature of the traffic required for construction of the proposed ATST Project at the Reber Circle site is expected to be the same as characterized in Section 2.4.3 and Table 2-5 for the Mees site construction.

Best Management Practices

The same BMPs (required practices established in the LRDP and policies reflecting public consultation during the EIS process) would be implemented during construction at the Reber Circle site as would be during construction at the Mees site.

Construction Schedule

The construction schedule for the Reber Circle site would be approximately the same as that for the Mees site, although there may be some minor effects to the schedule associated with the greater amount of leveling excavation required and the limited area available for staging.

2.5.4 Telescope Operation Activities

All proposed ATST operations would be the same at the Reber Circle site as at the Mees site.

2.6 No-Action Alternative

Under the No-action Alternative, both the Mees site and the Reber Circle site areas would remain in their current undeveloped state and continue to not be utilized within the Conservation District of HO. The No-Action Alternative would limit solar astronomy to current technologies and delay critical observational tests of sophisticated theories and models. Since existing instrumental capabilities at facilities such as the MSO facility are no longer sufficient to take this next step toward understanding the fundamental physical processes that govern the behavior of the Sun, and because no facilities capable of observing the magnetic phenomena in the solar atmosphere at the required level of detail, knowledge of the direct effects of solar activity on life on Earth would not be forthcoming.

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3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

This section is an overview of the baseline physical, biological, social, and economic conditions that occur within the Region of Influence (ROI) of the proposed ATST Project, as well as other areas. These baseline conditions are referred to as the affected environment because the proposed ATST Project could potentially affect them. This section is organized by resource area. The ROI is defined at the beginning of each resource section as it applies to that resource. For example, the ROI for geology may be relatively contained to the Hakeakalā High Altitude Observatories (HO) complex; however, the ROI for air quality or socioeconomics may be much larger. As applicable, each section includes a background on how the resource is related to the proposed ATST Project and a general overview of relevant legislative requirements governing the resource. This section also is a discussion of the general conditions of the resource within the ROI.

The affected environment of the Proposed ATST Project is primarily on land that was designated and assigned to the University of Hawai`i (UH) in 1961 for scientific purposes by Governor Quinn's Executive Order (EO) 1987. The 18.166 acres of land assigned to IfA is located on State of Hawaiʻi land (shown on the Tax Map Key [TMK] of Fig. 1-5) within a Conservation District (Fig. 1-12). The property boundaries for HO are wholly within Puʻu Kolekole near the summit of Haleakalā. The EO land is about 0.3 mile from the highest point in Haleakalā National Park (HALE), which is known as Puʻu Ulaʻula Overlook. The Kolekole cinder cone lies just to the southwest of the topographic apex of the Southwest Rift Zone of Haleakalā. The rift zone forms a spine separating the Kula Forest Reserve from the Kahikinui Forest Reserve, both of which are pristine lands along the rift zone. The environment at Kolekole has been extensively studied for many years and has been well characterized.

The affected environment of the Proposed ATST Project also includes portions of HALE. The primary area affected by the proposed ATST Project includes the Park road corridor, specifically, a 50-foot corridor along the Park road measured from the mid-point of the road extending out 25 feet on each side. The Park road corridor is included because a Special Use Permit (SUP) is required by HALE to operate commercial vehicles within the Park.

3.1 LAND USE AND EXISTING ACTIVITIES

The ROI for determining the affected environment for this section includes HO, the adjacent FAA facilities, and the Park road corridor.

In 1961, the State Land Use Law, Act 187, which has been codified as Hawai`i Revised Statutes (HRS), Chapter 205, established the State Land Use Commission (LUC) and granted the LUC the power to zone all lands in the State into three districts: Agriculture, Conservation, and Urban (the Rural District was added in 1963). Act 187 vested the Department of Land and Natural Resources (DLNR) with jurisdiction over the Conservation District, which was able to formulate subzones within the Conservation District, and to regulate land uses and activities therein. Since 1964, the Board of Land and Natural Resources (BLNR) has adopted and administered land use regulations for the Conservation District and has made major changes to the regulations in 1978 and 1994.

The objective of the Conservation District is to conserve, protect, and preserve the important natural resources of the State through appropriate management and use in order to promote their long-term sustainability and the public health, safety, and welfare. The potential use(s) of Conservation District lands are numerous. During the past few years, the DLNR's Office of Conservation and Coastal Lands (OCCL) has administered Conservation District Use Applications (CDUAs) for: open ocean aquaculture projects; telescopes on top of Haleakalā and Mauna Kea, major power line projects on scenic ridges, telecommunication facility projects, single family residences, Parks; and, Commercial Forestry projects.

The Conservation District has five subzones: Protective, Limited, Resource, General and Special. Omitting the Special Subzone, the four subzones are arranged in a hierarchy of environmental sensitivity, ranging from the most environmentally sensitive (Protective) to the least sensitive (General); the Special Subzone is applied in special cases specifically to allow a unique land use on a specific site.

These subzones define a set of “identified land uses” which may be allowed by discretionary permit. The OCCL can only accept a permit application for an identified land use listed under the particular Subzone covering the subject property. Most of the identified land uses require a discretionary permit or some sort of approval from the DLNR or BLNR. Major permits are required for land uses which have the greatest potential effect and a State environmental assessment and/or an EIS is required (and may also require a Public Hearing); minor permits are required for land uses which may have fewer effect, decision making is delegated to the Board Chairperson (and may not require a Public Hearing) or to the OCCL for other minor uses.

In accordance with Title 13 Chapter 5, HAR, the proposed ATST Project on would be consistent with Conservation District land use requirements requiring a Conservation District Use Application (CDUA). All land uses pursuant to HAR 13-5-30 must be an identified land use and require that a CDUA be filed with the DLNR and approved by the BLNR prior to its initiation.

The proposed ATST Project is consistent with the intention that conveyed the HO area to the UH by Governor’s Executive Order (EO) 1987. This area of the Conservation District has been set aside for “…Haleakalā High Altitude Observatory site purposes only.” Many facilities conducting astronomical research and advanced space surveillance already exist within HO (Fig. 1-2).

3.1.1 Land Use for the Proposed ATST Project

The proposed ATST Project is an identified use in the General Subzone (Fig. 1-12) and would be consistent with the objectives of the General Subzone of the land. The objectives of the General Subzone (HAR Chapter 13-5-14) are to designate open space where specific conservation uses may not be defined, but where urban uses would be premature.

The proposed ATST Project is in close proximity to other previously developed facilities for astronomy and advanced space surveillance. No changes to the identified land use within HO would occur to complete the proposed ATST Project. Subdivision of land would not be utilized to increase the intensity of land use in the Conservation District.

HALE was initially established as a unit of Hawaiʻi National Park on August 1, 1916. Hawaiʻi National Park had three units: the Summit area of Haleakalā on Maui, Kilauea Volcano on Hawaiʻi Island and portions of Mauna Loa on Hawaiʻi Island. The Park was established “as a public park or pleasure ground for the benefit and enjoyment of the people of the United States…and [to] provide for the preservation from injury of all timber, birds, mineral deposits, and natural curiosities or wonders within said park, and their retention in their natural condition as nearly as possible.”

On September 13, 1960, Congress authorized the establishment of HALE as a separate unit of the National Park System. This effectively redesignated the units of Hawaiʻi National Park as two new national parks: HALE on Maui and Hawaiʻi Volcanoes National Park on Hawaiʻi Island. These parks were to be administered in accordance with the National Park Service Organic Act of 1916, which created the National Park Service. Thus, the purpose of HALE is further reflected in a key provision of the Organic Act, which states “to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.”

Since 1960, HALE has had several boundary expansions which enable the National Park Service to continue its conservation work and meet its guiding mission of preservation. The pristine rainforest of Kipahulu Valley was authorized for addition to the Park on March 26, 1951. The Kipahulu coastal area of ʻOheʻo was authorized for addition to the park on January 10, 1969. The adjacent coastal area of Puhilele was added to the Park in 1998. Kaʻapahu was added to Haleakalā National Park in February 1999. On October 20, 1964, the Wilderness Act authorized the designation of a large portion of Haleakalā as "Wilderness". Today of its 30,183 acres, 24,719 acres are designated wilderness.

3.1.2 Existing Activities

Park Road Corridor

The Park road corridor falls along the last 10.6 miles of the Haleakalā Highway, which is a 37-mile road from central Maui's main town of Kahului to the summit of Haleakalā. Along its entire course, the highway climbs to approximately 10,000 feet from sea level, attaining this height in a shorter distance than any other road in the world, and provides access to the Haleakalā Crater. (NPS, 2008b, p. 2)

The corridor along the Park road is owned and managed by the NPS. It begins at the Haleakalā National Park boundary at the northwestern corner of the park and ascends the northwest slopes of the Haleakalā Crater with a series of switchbacks. Hosmer Grove, Park Headquarters Visitor Center, Halemau'u Trailhead, Leleiwi Overlook, Kalahaku Overlook, Haleakalā Visitor Center (or Pa Kaʻoao Observation Station), and Pu'u' Ula'ula Overlook are all accessed from the road. Significant vehicular and bus traffic traverse the Park road each year. In 2007, there were 248,224 vehicular visits and approximately 3,650 buses that traversed the Park road; in 2008, there were 205,977 vehicular visits and approximately 6,570 buses (FHWA, 2008)

Existing access into and out of HO is exclusively via HALE (Fig. 3-1) and then through the entrance to the HO complex just past Puʻu ʻUla ʻUla. There is no general public access to HO and "AUTHORIZED ENTRY ONLY" is posted on the sign (Fig. 3-2) located at the entrance to the facilities. Native Hawaiians, however, are welcome at any time to enter HO for cultural and traditional practices, as the sign also indicates.

An unimproved access road known as Skyline Drive (Fig. 3-1) originates 0.5 mile away from HO at the Saddle Area. It traverses the Southwest Rift Zone, ultimately leading to the Spring State Recreation Area (also known as Polipoli State Park), which is located at 6,200 feet above sea level (ASL) within the fog belt of the Kula Forest Reserve (DLNR, Hawaiʻi State Parks). Its entire length is located on State land within the Forest Reserve. A locked gate near the Saddle Area restricts vehicle access to the road from the Haleakalā summit to only those holding DLNR permits. Hikers, hunters, and bicyclists use the unpaved road. There are sections of this trail that have a steep grade and soft cinder roadbed that will not support standard construction truck traffic, only smaller vehicles with four-wheel drive.

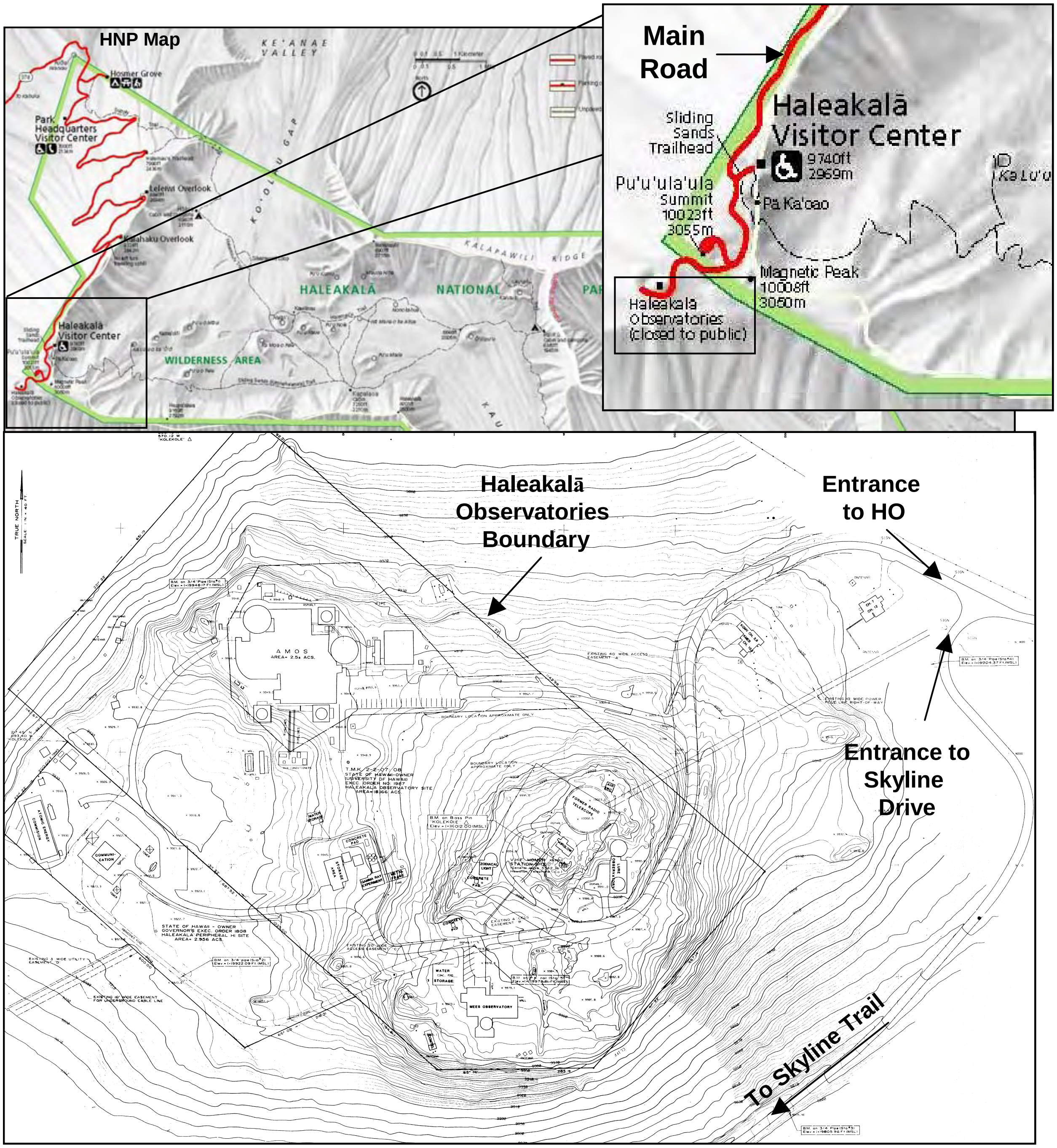


Figure 3-1. Existing Access to HO.

Figure 3-2. Sign at Entrance to HO.

HO Facilities

Presently, facilities located within HO (Fig. 1-2) observe the Sun, provide a world-class telescope for education and research outreach to students all over the world, use lasers to measure the distance to satellites, track and catalogue man-made objects, track asteroids and other natural potential space threats to Earth, and obtain detailed images of spacecraft. It is a principal site for optical and infrared surveillance, inventory and tracking of space debris, and active laser illumination of objects launched into earth orbit, activities that are all crucial to the nation's space program.

Over the past 45 years, HO has experienced managed growth of scientific research within its boundaries (UH IfA, 2005). The major IfA facility at HO is the Mees Solar Observatory (MSO) facility. IfA has operated the MSO facility since 1964. The scientific programs at the MSO facility emphasize studies of the solar corona and chromosphere. The former Lunar Ranging Experiment (LURE) facility was utilized from 1972 until 1993. LURE was operated by IfA under contract to the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center, had supported the NASA Space Geodesy and Altimetry Projects, provided NASA with highly accurate measurements of the distance between LURE and satellites in orbit about the earth, and was involved in the NASA Crustal Dynamics Project.

IfA has a support staff that serves the MSO facility. Services include administration, personnel and purchasing support, as well as vehicle and building maintenance functions. The support staff serves a total of 17 technical, scientific, and engineering staff on Maui. A support facility located at HO consists of an office building, electronics lab, and vehicle maintenance shop. IfA also operates a modest dormitory facility at HO, primarily for use by MSO observers.

The Panoramic-Survey Telescope and Rapid Response System (Pan-STARRS) (PS-1) observatory was dedicated on June 30, 2006, and is within the footprint of the former LURE observatory. The testing of extremely high resolution camera imagery will lead to development and deployment of a small, economical, four-telescope system for observing the entire available sky several times each month to discover and characterize Earth-approaching objects, both “killer asteroids” and comets, that might pose a danger to our planet. The Pan-STARRS (PS-2) was housed in the former MAGNUM observatory and became operational in early 2009.

The University of Tokyo, the National Astronomical Observatory of Japan, and the Australian National University previously installed a 2-meter (6.6-foot) telescope in the 9-meter (29.5-foot) north dome of the LURE complex to support the Multi-color Active Galactic Nuclei Monitor (MAGNUM) Project. This project was decommissioned in 2008. A second Pan-STARRS facility (PS-2) became operational in 2009 and utilizes the former MAGNUM facility.

The Faulkes Telescope Facility (FTF) was originally built by the Dill Faulkes Educational Trust and became operational in 2004. Ownership was assumed by the Las Cumbres Observatory Global Telescope Network, Inc. (LCOGT) in 2005 and continues to be a joint effort with IfA. The goal of this facility is to give students and teachers in Hawaiʻi and the United Kingdom (UK) access to a research grade telescope. With its 2-meter diameter primary mirror, this telescope (along with its twin in Australia) is the largest telescope designated solely for educational use in the world. This 2-meter (6.6-foot) telescope is operated remotely over the Internet, without need for permanent on-site operational staff. Control centers at Maui Community College and in the UK provide for remote operations.

The IfA also allocates sites on Haleakalā for optical and infrared experiments and observations carried out by the Air Force Research Laboratory (AFRL), which is the host command having responsibility for the MSSC. One part of the Maui Space Surveillance Complex (MSSC) is the Maui Space Surveillance System (MSSS), a state-of-the-art electro-optical facility combining operational satellite tracking facilities with a research and development facility. The MSSS houses the largest telescope in the Department of Defense (DoD) inventory, the 3.67-meter (12-foot) Advanced Electro-Optical System (AEOS), as well as several other telescopes ranging from 0.4 to 1.6 meters (1.3 to 5.2 feet).

Another major part of the MSSC is the Ground-Based Electro-Optical Deep Space Surveillance System (GEODSS), which is one of three operational sites in the world performing ground-based optical tracking of space objects. The main telescope has a 102-centimeter (3.3-foot) aperture and a 2-degree field-of-view and is used primarily to search the deep sky for faint (+16 magnitude), slow-moving objects. The auxiliary telescope has a 38-centimeter (15-inch) aperture and 6-degree field-of-view, and does wide area searches of lower altitudes where objects travel at higher relative speeds. The telescopes are able to “see” objects 10,000 times dimmer than the human eye can detect.

Federal Aviation Administration Facilities

The Federal Aviation Administration (FAA) operates and maintains a rectangular 2.96-acre property along the southwest boundary of HO, which is referred to as the Haleakalā Peripheral Hi Site. This property was originally granted to the Civil Aeronautics Authority (predecessor to the FAA) in 1957 through an Executive Order from the Governor of the Territory of Hawaiʻi. The site is dedicated to remote air/ground interisland and trans-Pacific communications to and from aircraft. A small support building on the rectangular site contains transmitter and electronic equipment, in support of multiple dipole antennas on two towers to the East of the support building. The towers are located approximately 800-feet West of the MEES Solar Observatory, at a lower elevation, e.g., the tops of the towers are slightly below the highest natural topography at HO to the East and North. The antennas on the towers transmit at 50 Watts in both the Very High Frequency (VHF) and Ultra-High Frequency (UHF) radio bands, and receive voice communications on the same frequencies from transiting aircraft at altitudes from 8,000 to 50,000-feet. Other antennas on towers of various heights around the site support communications between other Federal and State agencies.

3.2 CULTURAL, HISTORIC, AND ARCHEOLOGICAL RESOURCES

> *"Haleakalā is the sacred home of our Sun, and the ancient Path to Calling the Sun as depicted in its ancient name: Ala Hea Ka Lā. Why is this critical to our survival? The Sun's energy is the source of all life, and governs our most basic rhythm of day and night. Ancient cultures have venerated its being and we as a human race follow its course without thought and are insignificant in respect of its power. However, our Native Hawaiian Culture praises its existence, until this very day the sun is praised for its cycle."*
> ("E Mālama Mau Ka La'a", Page 8, Haleakalā's Importance.)

Cultural, historic and archeological resources were evaluated within the ROI, which, for these resources, falls within both the HO and relevant areas within HALE, including the Park road corridor. Cultural resources contain significant information about a culture and are tangible entities or cultural practices (NPS-28). For NPS resource management purposes, tangible cultural resources are defined as "districts, sites, buildings, structures, and objects for the National Register of Historic Places and categorized as archeological resources, cultural landscapes, structures, museum objects, and ethnographic resources". Ethnographic resources is defined in NPS-28 as: a site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. (NPS-28). Archeological resources are defined as "any material remains or physical evidence of past human life or activities which are of archeological interest, including the record of the effects of human activities on the environment." (NPS-28). They have the "potential to describe and explain human behavior." (NPS-28). Historic resources include districts, sites, structures, or landscapes that are significant in American history, architecture, engineering, archeology or culture (NPS-28). Each of these resources within the relevant ROI was evaluated in the subsections below.

All of the areas within the ROI are within the boundaries of the Crater Historic District, which is listed on both the State Inventory of Historic Places SIHP (SIHP 50-50-11-12-1739) and on the NRHP listed on November 1, 1974. All eligible cultural, historic, and archeological resources within the Crater Historic District, even if not formally listed, are nevertheless required to be protected and preserved as though they were formally listed on the NRHP.

Several assessments were conducted to evaluate the presence of cultural, historic and archeological resources within the ROI, and the results of these assessments are discussed below.

3.2.1 Cultural Resources

Initial Cultural Resource Assessments

The "Cultural Resources Evaluation for the Summit of Haleakalā" (CKM, 2003) was conducted in 2003 of the entire HO property for the LRDP. The 2003 evaluation concluded that, "Kolekole, known as the summit of Haleakalā, or 'Science City' as it is sometimes referred to, is a very sacred place for the Kanaka Maoli (Native Hawaiian), past and present." (CKM, 2003). The summit was thought of as "the Piko (navel), the center of Maui Nui O Kama (the greater Maui), and legends abound about the gods and goddesses that dwelled there in mythological times." (CKM, 2003). The summit is still revered by the Kanaka Maoli in present times and some people express feeling "the 'essence' of Haleakalā" when visiting there and numerous publications have been produced setting forth peoples' "feelings of being 'one with the gods' at the summit." (CKM, 2003). The study concluded that, "Hawaiian's history, from the beginning of their ancient culture, shows that they consider lava, cinders, rocks and other material from the land sacred because it was created by Pele (Goddess of the Volcano)." (CKM, 2003). "The 'essence' being the rock, cinders, and ash, which are the Kinolau (supernatural forms taken by Pele)." (CKM, 2003)

A subsequent cultural resources study, "Cultural and Historical Compilation of Resources Evaluation and Traditional Practices Assessment" was conducted in 2006 as part of the environmental compliance process for the proposed ATST Project (Vol. II, Appendix F(1).

Supplemental Cultural Impact Assessment

As a result of specific concerns by the commenting public to the cultural and historical evaluation that was included in the September 2006 draft EIS (DEIS), Cultural Surveys Hawaiʻi, Inc. (CSH) was commissioned to conduct a Supplemental Cultural Impact Assessment (SCIA) for the proposed ATST Project (Vol. II, Appendix F(2). The SCIA was performed in accordance with the guidelines for assessing cultural impacts as set forth by the Office of Environmental Quality Control (OEQC) (OEQC, 1997) and was intended to supplement the initial DEIS Cultural Resource Evaluation (Vol. II, Appendix F(1). The primary purpose of the SCIA was to widen community outreach and gather additional information on "the Traditional Cultural Property of Haleakalā" as an additional means to assess the potential effects of the proposed undertaking on Native Hawaiian traditional cultural practices and/or beliefs. In preparation of the SCIA, an additional effort was made to gather supplementary information, community input and knowledge of the summit area. Table 3-1 lists individuals in the community who were consulted by CSH staff. Table 3-2 lists consultation with residents of the Kahikinui Homestead Community Board meeting held on March 17, 2007 by CSH staff. Table 3-3 lists consultation with students enrolled in the Maui Community College (MCC) Hawaiian Studies Program by CSH staff. The complete commentary of these consultations can be found in Vol. II, Appendix F(2) in Section 6-Community Contacts and Consultations.

The SCIA contains considerable additional historical perspective on Haleakalā. It discusses in great detail the symbology of the mountain, the mountain's role in the history of Maui Island as a living entity, as well as the archeological record. The information provided is intended to educate the reader regarding the spiritual sacredness and cultural relationship of Hawaiians to Haleakalā as a whole and to the summit area in particular.

Haleakalā Summit as a Traditional Cultural Property

There are several reasons why the summit of Haleakalā is a cultural resource in and of itself. It is eligible for listing on the National Register of Historic Places (NRHP) as a "Traditional Cultural Property" (TCP) through consultation with the SHPD under Criterion "A" for its association with the cultural landscape of Maui and this is reflected in the number of known uses, oral history, *mele* and legends surrounding Haleakalā. The term, "Traditional Cultural Property" is used in the NRHP to identify a property "that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that, (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (DOI, 1994). The summit is also eligible under Criterion "C" because it is an example of a resource type, a natural summit, a source for both traditional materials and sacred uses. The value ascribed to Haleakalā as a TCP can be expressed in five distinct attributes, solidifying the role of the summit as a place of value. First, Haleakalā summit is considered by Kanaka Maoli, as well as more recent arrivals to Hawaiʻi, as a place exhibiting spiritual power. Second, the summit of Haleakalā is significant as a traditional cultural place because of practice. For both Hawaiians and non-Hawaiians who live and visit here, the summit is a place of reflection and rejuvenation. Third, the *moʻolelo* and *oli* surrounding the summit present a cluster of stories suggesting the significance of Haleakalā as a TCP. Fourth, some believe that the summit possesses therapeutic qualities. Finally, the summit provides an "experience of place" that is remarkable.

In recognition of the cultural importance of Haleakalā, Native Hawaiian stonemasons erected the West and East *ahu* (altar or shrine) for ceremonial use by Kanaka Maoli (Figs. 3-3 and 3-4) at HO in 2005 and 2006, respectively. Each *ahu* represents a sacred ceremonial site. A *Hoʻomahanahana* (dedication or "warming" offering) for each *ahu* was held. The West-facing *ahu* is named *Hinalaʻanui* and the East-facing *ahu* is named *Pāʻele Kū Ai I Ka Moku*. Although the purpose of this construction was to restore structures previously existing on Haleakalā, the original structures were not necessarily in the particular locations where the new *ahu* were erected. As mentioned in Section 3.1.2-Existing Activities, Native Hawaiians practicing cultural traditions are welcome to utilize these sites.

Table 3-1. Supplemental Cultural Impact Assessment Community Consultations.

Name	Affiliation	Contacted	Personal Knowledge
Ms.Wallette Pelegrino	Cooperative Education Program Coordinator- Maui Community College	Y	S
Ms. Rose Marie Duey	Alu Like, Inc.	D	N
Ms. Rose Marie Duey	Kamaʻāina	Y	S
Ms. Sheila Ople	Aʻo Aʻo O Na Loko Iʻa O Maui	U	
Ms. Vanessa Medeiros	Dept. of Hawaiian Homelands	N	
Mr. Hinano Rodrigues	Dept. of Land and Natural Resources, SHPD	Y	Y
Mr.Akoni Akana	Executive Director,Friends of Moku'ula	D	
Mr. Patrick Ryan	Fishpond Ohana	Y	N
Mr. Brian Jenkins	Friends of Polipoli, President	Y	Y
Mr. Jim Wagele	Hawaiian Community Assets, Inc.	A	
Mr. Clifford Naeʻole	Hawaiian Cultural Advisor, Ritz-Carlton Resorts	A	
Kekealani Ishizaka	Hawaiian Homes Waiehu Kou 1	A	
Ms. Blossom Feiteira	Hui Kakoʻo ʻAina Ho'opulapula and Na Po'e Kokua	U	
Mr. Edward Ayau	Hui Malama I Na Kupuna o Hawaiʻi Nei	A	
Ms. Julie Oliveira	Hui No Ke Ola Pono	Y	N
Mr. Don Atai	Hui o Vaʻa Kaulua	A	
Ms. Kehaulani Filimoeatu	Hui of Hawaiians	Y	N
Ms. Roselle Bailey	Ka Imi Na'auao ʻO Hawaiʻi Nei	Y	Y
Mr. Norman Abihai	Kahikinui Homesteaders Community President	Y	S
Ms. C. Mikahala Kermabon	Kahikinui Resident	Y	N
Mr. Quintin Kiili	Kahikinui Resident	Y	N
Mr. Aimoku Pali and Mrs. Lehua Pali	Kahikinui Resident	Y	S
Mr. Earl Mo Moler	Kahikinui Resident	Y	S
Ms. Donna Sterling	Kahikinui Resident	Y	S
Ms. Chad Newman	Kahikinui Resident	Y	N
Mr. Charlie Lindsey	Kahoʻolawe Island Reserve Commission	Y	N
Dr. Rod Chamberlain	Kamehameha Schools Oahu Campus	Y	N
Ms. LeeAnn Delima	Kamehameha Schools Maui Campus	Y	N
Ms. Dancine Takahashi	Kamehameha Schools Alumni	Y	N
Robin Newhouse	Keokea Hawaiian Homes	U	
Mr. Alan Kaufman	Kula Community Association President	Y	Y
Ms. Uilani Kapu	Kuleana Kuʻikahi LLC	Y	Y
Ms. Kamaile Sombelon	Lokahi Pacific	D	
Mr. Lui Hokoana	Maui Community College and Hawaiian Civic Club	A	
Mr. Stan Solamillo	Maui County Cultural Resource Commission	Y	N
Ms. Patty Nishiyama	Na Kupuna O Maui	A	

Key: Y=Yes N=No A=Attempted, with no response
S=Some knowledge of project area D=Declined to comment U=Unable to contact

Table 3-1. Supplemental Cultural Impact Assessment Community Consultations (cont.).

Name	Affiliation	Contacted	Personal Knowledge
Ms. Lei Ishikawa	Na Leo Pulama	A	
Ms. Ohua Morando	Na Pua Noʻeau	Y	N
Mr. David Keala	Native Hawaiian Educational Council	U	
Ms. Velma Mariano	Paukūkalo Hawaiian Homestead Community Association	U	
Mr. Nainoa Thompson	Polynesian Voyaging Society	A	
Ms. Kili Namauu	Punana Leo O Maui	Y	
Ms. Iris Mountcastle	Queen Liliʻuokalani Children's Center	D	
Kahu Poʻo Iki Clarence Solomon	Royal Order of Kamehameha	A	
Aliʻi Sir William Garcia Jr. CK	Royal Order of Kamehameha Office of the Ku'auhau Nui	Y	N
Mr. Leslie Kuloloio	Hawaiian Cultural Practitioner	Y	Y
Mr. Stanley H. Kiʻope Raymond	Hawaiian Language Professor, Maui Community College	Y	Y
Mr. Sam Kaʻai	Hawaiian Cultural Practitioner		
Pastor Wayne Carroll	Pastor, Kahana Door of Faith/ Hawaiian Cultural Practitioner	Y	
Mr. Ke’eamoku Kapu	Hawaiian Cultural Practitioner	A	
Mr. Kaʻiʻini (Kimo) Kaloi	U. S. Department of the Interior Office of Hawaiian Relations	Y	S
Mr. Perry O. Artates	Hawaiian Homes Waiohuli	A	
Uwekoolani Family	Kamaʻāina	Y	N
Cecilia K. Hapakuka	Kamaʻāina	U	
Kali Hapakuka	Kamaʻāina	Y	N
Michael Purdy	Kamaʻāina	Y	N
Merton Kekiwi	Kamaʻāina	Y	N
AK Kahula	Kamaʻāina	N	
Clyde Kahula	Kamaʻāina	Y	N
Lisa Marie Kahula	Kamaʻāina	U	
Jacob Mau	Kamaʻāina	U	
Ms. Gordean Bailey	Kamaʻāina	Y	N
Mr. Tim Bailey	Kamaʻāina	Y	Y
Mrs. Cathleen Natividad Bailey	Haleakalā National Park Wildlife Biologist	Y	Y
Mr. Walter Kanamu	Living Indigenous Forest Ecosystem (LIFE)	N	Y
Mr. Kawika Davidson	Kahikinui Game and Land Management, Kama’aina	Y	Y
Mr. George Kaimiola	Kamaʻāina	N	
Mr. Kaponoai Molitau	Cultural Advisor for the Kahoʻolawe Island Reserve Commission	A	
Mr. Ethan Romanchak	Kamaʻāina	Y	S

Key: Y=Yes N=No A=Attempted, with no response S=Some knowledge of project area D=Declined to comment U=Unable to contact

Table 3-2. Kahikinui Homestead Community Board Meeting Consultation.

Name	In Attendance or Via Phone
Mr. Norman Abihai, President	In Attendance
Mr. Quintin Kiili	In Attendance
Mr. Earl Moler	In Attendance
Mr. Aimoku Pali and Mrs. Lehua Pali	In Attendance
Ms. C. Mikahala Kermabon	In Attendance
Mr. George Namauu and Mrs. Gertrude Uwekoolani Namauu	In Attendance
Ms. Chad Newman	Via phone
Ms. Donna Sterling	Via phone

Table 3-3. Maui Community College Hawaiian Studies Program Student Consultation.

Name
Kamaʻāina, Student (name not given)
Ms. Cheyenne Sylva
Mr. Walter Kozik
Ms. Kathleen Zwick

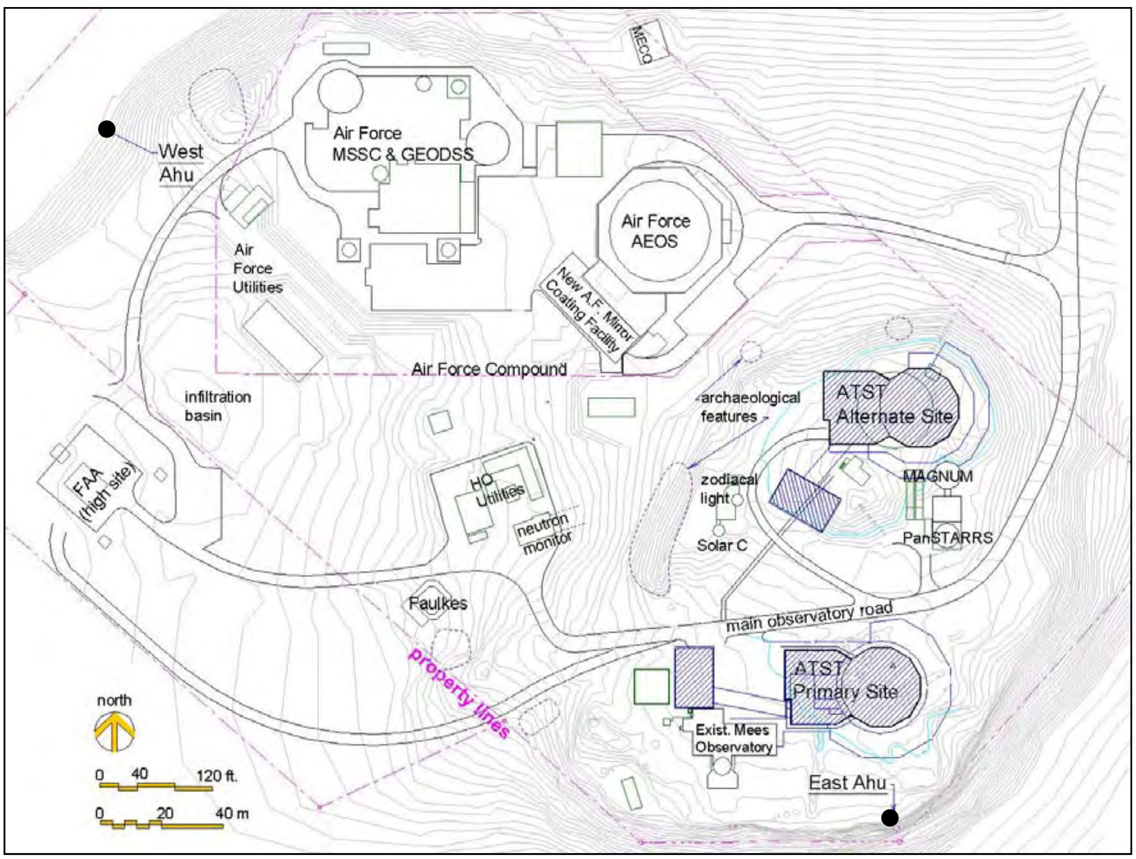


Figure 3-3. East and West Ahu Locations at HO.

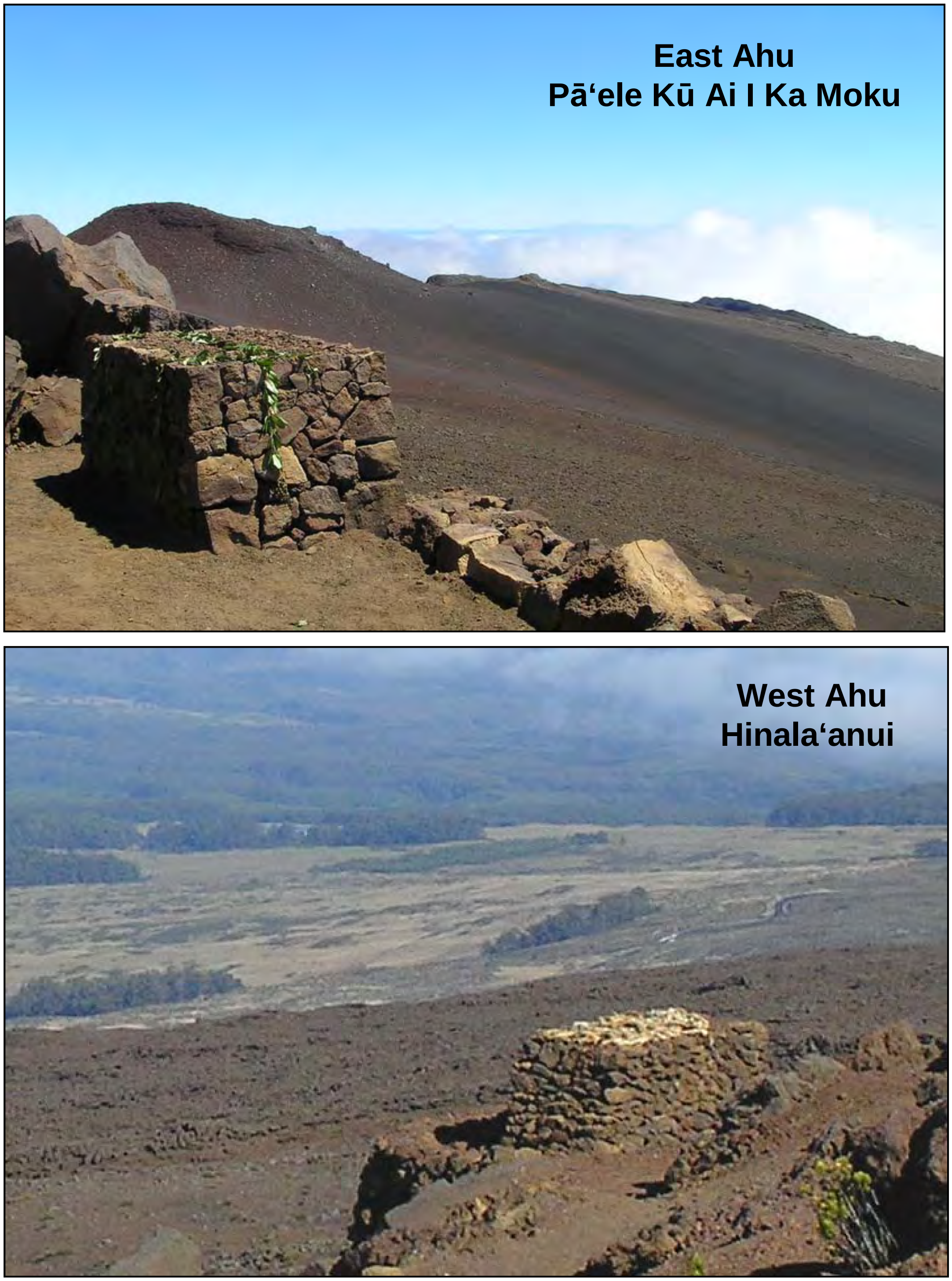


Figure 3-4. East- and West-facing Ahu.

Summary of Haleakalā in Native Hawaiian Tradition

The SCIA provides a comprehensive discussion about the role of Haleakalā in Native Hawaiian tradition. Excerpts from that discussion are provided below:

> In order to gain an understanding of the importance and significance of Haleakalā, it is necessary to look at the symbology of the mountain, as well as the mountain's role in the history of Maui Island as a living entity. It has been said that the island of Maui was once known as Ihikapalaumaewa (Kamakau in Sterling 1989:2 and McGuire and Hammatt 2000). The name suggests a meaning of sacred reverence and respect (from *hōʻihi*). In former times, Maui was also known as Kūlua, a probable reference to the East and West Maui districts, which were separate polities by A.D. 1400-1500. (Sterling 1998:2; Kolb *et al*. 1997:16)

There are many legends and stories about Haleakalā that were identified in the SCIA. The following are some accounts from Kupuna, as described in the SCIA:

> Kapiʻioho Naone (McGuire and Hammatt, 2000) recalls a story told by Kupuna Pale, a Hawaiian woman that he cared for as a young boy. According to Naone, she always referred to Haleakalā as the entire mountain and to Halemahina as the West Maui mountains:
>
>> (S)he would refer to Haleakalā as the house of the male and, this one over here as Halemahina, the house of the female or the house of the moon … The whole West Maui mountains, she considered the *piko ka honua*, the navel of the earth, the woman. She would tell me that Maui was lucky because Maui had a male and female — Maui was complete. It wasn't all male and it wasn't all female. It was complete. And, so we would talk about Haleakalā as the male part of the island … (Kapiʻoho Naone in McGuire and Hammatt 2000:Appendix B).
>
> Sam Kaʻai (McGuire and Hammatt, 2000:13) also indicated that Haleakalā was "male" and related that the best adze material comes from a cliff at Nuʻu where Māui's *ule* (penis) struck the side of the mountain.
>
> According to Abraham Fornander, the name "Haleakalā" is said to be a "misnomer" and is incorrect: Aheleakala is the correct name (Fornander 1919, V, III: 536). He goes on to explain that Ahelekalā is:
>
>> The ancient name of Maui's famous crater, which means, "rays of the sun," and it was these which the demigod Maui snared and broke off to retard the sun in its daily course so that his mother might be able to dry her kapas. (Fornander 1918-1919:V:534-36)
>
> Fornander (1918-1919:V: 538) further states that an informant, Lemuel K.N. Papa Jr., gives the correct name is Alehelā "on account of Māui's snaring the rays of the sun, where the word *ʻalehe* is a variant form of *ʻahele*. Both words literally mean "to snare". "Haleakalā" refers to not only the literal meaning, but the fact that the sun's path passes through Haleakalā each morning, thus the common interpretation of the name, "house of the rising sun". Today, the practice of driving up to the summit of Puʻu ʻUlaʻula to see the sunrise, by both tourist and *kamaʻāina*, serves to reinforce this perception of the name "Haleakalā".
>
> Inez Ashdown (1971:68) disagrees with Fornander and writes that "Aleha-ka-lā" (Sun-snarer) is a more recent name attributed to the Māui traditions and Māui's feat of slowing the sun. She goes on to say that the name is really "Haleʻa-ka-lā" which refers to the "entire east mountain of Maui", while "Hale-a-ka-lā" is the peak over by Kaupō Valley. She writes:

> The proper name means Consecrated to, or by the sun and is poetically associated with Nā Mele o Nā Māhele of that mountain of legends and creation. (Ashdown 1971:68.)
>
> …or a sacred place of rejoicing because Wa-na-ao, the Dawn, brings the new day from that mountain mass. (Ashdown 1971:30)

Included in the first U.S.G.S survey of Haleakalā Caldera report was also an analysis of the place name "Haleakalā":

> Some of the white residents, learned in the native language, suggest that this name should be Hele-o-ka-lá, which means the trap in which the sun was caught. *Hale* means a house, but *hele* means a trap. The prepositions *a* and *o* both signify *of*, but the former implies an active relation of the *la*, or sun, while the latter implies a passive relation; that is to say, a-ka-la means that the sun did something – perhaps built the house or dwelt in it. But o-ka-la means that something was done to the sun. Now there is a well-known myth that Maui, the great hero and Ulysses of the Hawaiians, laid a snare for the sun and caught him, compelling him to make the daylight twelve hours long instead of eight. (Dutton 1883:199).

The mountain of "Hale-a-ka-la" (terminology of Westervelt 1910) is the setting for the greatest deed of the legendary demi-god of Hawaiian literature, Māui. The myth depicting Māui's power over the travels of the sun is known throughout most of Polynesia, and although many of the details of Māui snaring the rays of the sun may be different (the composition of the snare, etc.), the importance of Māui capturing the sun as it rose in the east, from the underworld, is a universal detail. The many deeds of the demi-god Māui have become united into a continuous series, known universally to cultural anthropologists as the "Maui Cycle" (Luomala 1949).

Legends of the goddess Pele are also well known throughout Polynesia. In Rarotonga, Pere, the fire goddess, is the daughter of Mahuika, and it is from her that Māui (the demi-god of Hawaiʻi) obtains fire for his family. Pere is driven away from Raratonga by Mahuika, and she flees to Va-ihi (Hawaiʻi). In French Polynesia, Pere exists as the goddess of volcanoes, and in Aotearoa (New Zealand), she is known as Pele-honua-mea. In Hawaiʻi, Haleakalā was once her home, but she is now believed to reside on the island of Hawaiʻi, at the active volcanic vents of Kīlauea.

See SCIA, pp. 7-10. The SCIA also notes that early visitors to the Pacific Islands recorded traditional stories regarding the Hawaiian demi-god Māui, the fire goddess Pele, and references to Mauna Haleakalā (SCIA, pp. 10-14). These stories are summarized below in Table 3-4.

Table 3-4. Summary of Traditions Related to Haleakalā.

Legend	Source	SCIA Page No.	Synopsis
How Māui snared the Sun	Armitage, George T. and Henry P. Judd (Ghost Dog and other Hawaiian Legends)	61	Reference to the sun rising over the Koʻolau Gap: ("He made a trip over the mountain ridges and across the plains until he came to Mount Haleakalā. He first saw the sun through the Koolau Gap and then, like a giant disc, it wheeled over the top of the black crater walls and thence up into the heavens.") Māui's grandmother was said to have lived in Haleakalā Crater, and baked bananas in an oven near a *wiliwili* tree where the sun would stop for a meal.
Māui snares the Sun	Colum, Padraic	22,26	Māui observes the sun rising over Haleakalā through a break in the chasm sides. The correct name for the crater is given as "A-hele-a-ka-lā (rays of the sun)". As the sun comes through the chasm, it eats the bananas cooked by Māui's grandmother, who lives at Haleakalā. Māui forces an agreement with the sun, making longer days in the summer and shorter days in the winter.
How Māui snared the sun so that his mother's *kapa* could dry.	Colum, Padraic (Legends of Hawaiʻi)	47-52	A hele-a-ka-lā (rays of the Sun) is given as the old name for Haleakalā. Maui's grandmother lives on the side of Haleakalā. The legend explains the longer days of summer and the shorter days of winter.
Legend of Māui snaring the Sun	Fornander, Abraham (Fornander Collection of Hawaiian Antiquities and Folk-Lore	Vol. V: 536,538	Māui climbs Haleakalā to slow the sun and gives "Aheleakala" as the correct name of the mountain. Māui broke some of the sun's rays with a coconut husk snare. Fornander's informant, Lemuel K.N. Papa Jr. gives the correct name as "Alehela" for the mountain. The name given to the sun's rays which Māui found sleeping in a cave was "Moemoe".
Māui conquers the Sun	Hapai, Charlotte ("Legends of the Wailuku")	4-6	Māui travels to Haleakalā from Rainbow Falls, outside of Hilo, to battle the sun. This account gives the explanation for shorter winter days and longer summer days.
Māui slows the Sun	Lyons, Barbara ("Māui, The Mischievious Hero")	15-19	From the tip of Mauna Kahalawai (the meeting place between heaven and earth) Haleakalā could be seen. Māui's grandmother lives at the edge of the crater, near a *wiliwili* tree with red seeds.
How Māui snares the Sun	Metzger, Berta ("Tales Told in Hawaii")	81	Māui climbs Haleakalā to snare the Sun.
Slowing the Sun	Pukui, Mary Kawena ("Tales of the Menehune")	19-21	Collected from Harriet Coan, island of Hawaiʻi. The sun is described as rising through an opening in Haleakalā. The seasonal variation of summer/winter is explained.
How Maui slows the Sun	Thrum, Thomas ("Hawaiian Folk Tales")	31-33	Maui observes the sun rising directly over Haleakalā and battles it to allow his mother, Hina, to dry her *kapa*. The word for sun snarer is given as "Alehekalā".

Table 3-4. Summary of Traditions Related to Haleakalā (cont.).

Legend	Source	SCIA Page No.	Synopsis
Māui destroys Kuna Loa	Armitage, George T. and Henry P. Judd ("Ghost Dog and other Hawaiian Legends")	72-73	Māui rests near the *wiliwili* tree on Haleakalā and sees a warning cloud ("ao ʻōpua") over his mother's cave.
Māui and Kuna Loa: the long eel	Colum, Padraic ("At the Gateways of the Day")	34	From Haleakalā, Māui sees the warning cloud ("ao ʻōpua") over his mother's cave in Wailuku.
Māui and the eel, Kuna Loa	Lyons, Barabara ("Māui, the Mischevious Hero")	25-29	Māui makes the long trip to Haleakalā to visit his grandmother. From Haleakalā, he sees the danger signs of the "ao ʻōpua".
Kana, the youth who could stretch himself upwards	Colum, Padraic ("At the gateways of the Day")	145	A "groove" was made in Haleakalā by Kana, as he stepped over the sea and mountain to reach his grandmother's door on the island of Hawaiʻi. The groove remains to this day.
Legend of Kana and Niheu	Fornander, Abraham	Vol. IV: 448	Kana bends himself over the top of Haleakalā, creating a groove in the mountain which "can be seen to this day".
Story of the Great Flood	Fornander, Abraham	Vol. V: 526	A flood accompanied the arrival of Pele in Hawaiki [Hawaiʻi] after she left Tahiti. Pele and her brothers and sisters went to live at Haleakalā, where she excavated the crater with her digging stick.
Pele and the Deluge ("Kai a Kahinaliʻi")	Thrum, Thomas ("Hawaiian Folk Tales")	36-38	Pele travels to Hawaiʻi in search of a new home. A flood accompanies her. The sea rises and only the tops of the highest mountains can be seen. Pele digs the crater of Haleakalā.
How Māui lifted the sky	Armitage, George and Henry P. Judd ("Ghost Dog and other Hawaiian Legends")	49	Storms and storm clouds plague Haleakalā, forcing Māui to push them further skyward.
Māui lifts the sky	Lyons, Barbara ("Maui the Mischeivious Hero")	7-9	Maui lifts the sky above Haleakalā.
Māui lifting the sky	Westervelt, W.D.	31	"Nevertheless dark clouds many times hang low along the eastern slope of Maui's great mountain-Haleakalā -and descend in heavy rains upon the hill Kauwiki; but they dare not stay, lest Maui the strong come and hurl them so far away that they cannot come back again".

Table 3-4. Summary of Traditions Related to Haleakalā (cont.).

Legend	Source	SCIA Page No.	Synopsis
Māui fishes for an island	Armitage, George and Henry P. Judd (“Ghost Dogs and Other Hawaiian Legends”)	51	Mentions Haleakalā in the distance as Maui sets out to dislodge the islands from the hold of a supernatural being at the bottom of the ocean.
Maui fishing for the islands	Westervelt, W.D.	12	“The bottom of the sea began to move. Great waves arose, trying to carry the canoe away. The fish pulled the canoe two days, drawing the line to its fullest extent. When the slack began to come in the line, because of the tired fish, Maui called for the brothers to pull hard against the coming fish. Soon land rose out of the water. Maui told them not to look back or the fish would be lost. One brother did look back-the line slacked, snapped, and broke, and the land lay behind them in islands”.
Māui discovers the secret of fire	Armitage, George and Henry P. Judd (“Ghost Dogs and other Hawaiian Legends”)	66, 68	Māui sees smoke rising from the slopes of Haleakalā and discovers the secret of fire from the mudhens. The mudhens [‘alae] have a red mark on their foreheads as punishment after they tried to trick Māui and not give up the secret of fire.
The secret of fire-making	Collected by Pukui, Mary Kawena (“Tales of the Menehune”)	26-32	From a translation by A.O. Forbes in Thrum’s “Hawaiian Annual”. Tells how man accidently discovered that the fire from lava could cook food (‘ulu, mai‘a), but did not know how to create it himself. Explained how the head of the mudhen was turned red.
Keoua, a story of Kalawao	Gowan, Herbert H. (“Hawaiian Idylls of Love and Death”)	106	Keoua goes to Kalawao, Kalaupapa (Moloka‘i) in search of his wife, Luka, a resident of the leper colony. The rising sun revealed “the majestic ridges of Haleakalā”.
The Tomb of Pu‘upehe (A Lāna‘i legend)	Thrum, Thomas (“Hawaiian Folk Tales”)	181-185	The beauty of Pu‘upehe was described: “Her glossy brown spotless body shone like the clear sun rising out of Haleakalā”.
Halemano and Princess Kama	Colum, Padraic (“At the Gateways of the Day”)	102	While at the grove at Ke-a-kui, Halemano makes a maile lei (a wreath) and describes Haleakalā: “like a painted cloud in the evening”.
Legend of Halemano	Elbert, Samuel H., editor, Selections from Fornander (1959)	266-68, 274	Halemano describes the sight of Haleakalā from Lele (Lahaina) on Maui as “like a painted cloud in the evening, as the other clouds drifted above it”.
Legend of Halemano	Fornander, Abraham	Vol. V: 238, 240	Halemano describes the sight of Haleakalā from Lele (Lahaina) on Maui as “though floating above the clouds”. The vision was enough to entice Halemano to travel to Kaupō and live there awhile.

Table 3-4. Summary of Traditions Related to Haleakalā (cont.).

Legend	Source	SCIA Page No.	Synopsis
The Jealous Wife	Metzger, Berta ("Tales Told in Hawaii")	81	The story of Aukele mentions Pele's travels and her work at Haleakalā. Her fires were too small to heat the large crater, so she moved to Kīlauea.
The Legend of Puʻulaina	Fornander, Abraham	Vol. V: 534-36	Details the two ancient names of the mountain (Aheleakala and Alehela). "Formerly there was no hill there, but after Pele arrived, this hill was brought forth".
Hua, the unjust king, and the famine he caused	Skinner, Charles M. ("Myths and Legends of our New Possessions")	243	Luahoʻomoe of Hāna sent his two sons to live in Haleakalā to escape the wrath of Hua. Hua is cursed after the unjust death of Luahoʻomoe, and dies. The two sons meet a visiting chief from Oʻahu at Kaupō, and leave Haleakalā to form a new government in Hāna.
Travels of Pele and Hiʻiaka	Emerson, Nathaniel	XIV-XV	Pele made her home in Haleakalā but left because it was too large to keep warm. Pele fights with queen Namakaokahaʻi.
Travels of Pele and Hiʻiaka: "Legend of Aukelenuiaiku"	Fornander, Abraham	Vol IV: 104-106	Pele digs a pit at Haleakalā and starts her fires burning there. The battle with queen Namakaokahaʻi ends in Pele's death, but Pele returns as a spirit.
The Story of Pele and Hiʻiaka	Green, Laura ("Hawaiian Stories and Wise Sayings")	18-19	Reference to Pele's travels through the islands looking for a home and her short stay at Haleakalā.
Dwelling places of Pele	Lawrence, Mary Stebbins ("Stories of the Volcano Goddess")	63	Tells of Pele's travels in Hawaiʻi, and of her arrival at East Maui, whereupon she began building up the mighty crater of Haleakalā.
Pele goddess of the volcanoes	Nakuina ("Hawaii: Its People, Their Legends")	25	Tells of Pele's arrival at Haleakalā and her short stay there.
Pele and her fight with her sister, Namakaokahaʻi	Westervelt, W.D. ("Hawaiian legends of Volcanoes")	11	Pele dug the crater at Haleakalā with her pāoa, her special divining rod by which she tested the suitability of areas for excavation. Pele dies in the fight with Namakaokahaʻi and her torn body is thrown across the coastline of Kaupō at Kahikinui.
Legend of Kihapiʻilani	Fornander, Abraham	Vol. V: 180	Warfare in East Maui spreads to Haleakalā, where Piʻimaiwaʻa followed Hoʻolae until he caught him on the eastern side of the mountain of Haleakalā.
The Story of the ʻŌhelo	Fornander, Abraham	Vol. V: 576	Kaʻōhelo, one of Pele's sisters, dies, and a portion of her body was thrown over to Haleakalā. She is remembered in the volcanic areas of the islands of Hawaiʻi by the proliferation of *ʻōhelo* berry shrubs.
Description of the powers of the demi-god Māui, and his relationship to Haleakalā	Westervelt, W.D. ("Hawaiian Legends of Volcanos")	12	"One legend says that he crossed the channel, miles wide, with a single step. Another says that he launched his canoe and with a breath the god of the winds placed him on the opposite coast, while another story says that Māui assumed the form of a white chicken, which flew over the waters to Haleakalā."

Table 3-4. Summary of Traditions Related to Haleakalā (cont.).

Legend	Source	SCIA Page No.	Synopsis
Burials, relating to the dead in ancient times.	Fornander, Abraham	Vol. V: 572	"Here are the secret graves of wherein the chiefs of Nuʻu are buried, all on the side of Haleakalā."
Battle of the Alapa Regiment of Kalaniopuʻu	Fornander, Abraham	Vol IV: 286	The Alapa Regiment of Hawaiʻi's chief Kalaniopuʻu were annihilated at the Battle of Waikapū Commons, but not before they laid waste to Honuaʻula, an area of Maui described as "the rugged slope of Haleakalā".
Pele and the snow-goddess	Westervelt, W.D.	56	"Lilinoe was sometimes known as the goddess of the mountain Haleakalā. In her hands lay the power to hold in check the eruptions which might break forth through the old cinder cones in the floor of the great crater. She was the goddess of dead fires."

A complete list of legends and chants which depict stories of Haleakalā can be found in Vol. II, Appendix F(1)-Cultural and Historical Evaluation.

Traditional Cultural Practices

The SCIA also provides information about Haleakalā as an important place where traditional cultural practices take place. There are several types of traditional cultural practices that have and continue to take place with the ROI. These are described below:

Gathering of Plants

Several plants have had and continue to have particular cultural importance with the ROI. The SCIA reported that traditional gathering for plants resources continues to take place today with the upper elevations surrounding the summit; however, no gathering of plant resources occurs with the proposed ATST Project sites (SCIA p. 102).

In the past,*ʻōhelo* berries (*Vaccinum sp.*) were traditionally offered to Pele by those who frequented the upper elevations of the mountainous regions (SCIA, p. 102). Today, upland hikers and those in transit often pick *ʻōhelo* berries as a food resource when found ripe. Another example of plant gathering is the collection of *pūkiawe* (*Syphelia tameiameiae*) and *lehua* blossoms used for lei making (SCIA, p. 102). The SCIA also reported that *pūkiawe*, *lehua*, māmane and other plants and flowers are used for this same purpose (SCIA, p. 102). The trunks and branches of the *ʻaʻaliʻi* (*Dodonaea viscosa*) and *māmane* (*Sophora chrysophylla*) were traditionally harvested and used for *hale*, or house, posts. Present day efforts have revived the construction of traditional structures, however, it is unknown at this time whether these plants are actively harvested (SCIA, p. 102). *Māmane* timber has also been traditionally used for weaponry, particularly spears; however, it is unknown whether modern craftsmen of traditional harvest this timber today (SCIA, p. 102). *Pōpolo* (*Solanum americanum*) leaves, which are also found along the upper elevations and summit of Haleakalā were traditionally used (and appear to continue to be used) in *laʻau lapaʻau*, or Hawaiian medicinal practices. Specifically, they have been used for alleviating sore tendons, muscles, and joints. (SCIA, p. 102)

Hunting Practices

Traditional hunting of birds for food and feathers was documented at least 100 years ago (SCIA, p. 103). The ʻuʻau (Hawaiian petrel, *Pterodoma phaeopygia sandwichensis*) was particularly sought after; they were considered to be very tasty, especially the nestlings, which were reserved for the exclusive enjoyment of the chief (SCIA, p. 103 and NPS 2008 Ethnographic Study, p. 36). In addition to the ʻuʻau and nēnē (*Nesochen sandvicensis*) and the extinct flightless birds *Platochen pau* and *Branta hylobadisies* were hunted. Today, hunting practices continue. Specifically, "deer, goats, pigs, pheasant, chukar partridges, francolin and other game birds has become a culturally- supported subsistence practice." (SCIA, p. 104). Feathers from some of the game birds "are highly prized for their use in hatbands (SCIA, p. 104).

Basalt Collection

One of the reasons people came to the mountain was to collect, such as basalt for use in tool-making. Physical evidence from several archeological sites on the mountain seems to indicate that there were areas used for collection, reduction, and transport of basalt to lower elevations. (NPS 2008 Ethnographic Study, p. 36). Evidence exists of areas that were used to quarry the basalt are areas that were used for "lithic workshops." which "are surface scatters of basalt debitage, with very few finished tools: this suggests that the scatters are related to reduction activities rather than sites where tools were used." (NPS 2008 Ethnographic Study, p. 36). Many of the lithic workshops are associated with cave shelters, structures, or natural rock formations (such as cliff faces) that would have afforded protection from inclement weather (NPS 2008 Ethnographic Study, p. 36).

Pōhaku Pālaha – The Piko of East Maui

> Traditionally, Maui Island was separated into 12 *moku*, or districts during the time of the *Aliʻi* Kakaalaneo and under the direction of the *Kahuna* Kalaihaʻohiʻa (Beckwith 1940:383). The western portion Maui Island, dominated by Mauna Eke, the range commonly referred to as the West Maui Mountains, was subdivided into three *moku*: Lāhaina, Kaʻanapali, and Wailuku. The eastern portion of Maui Island, dominated by Mauna Haleakalā, was subdivided into the remaining nine *moku*: Hāmākua Poko, Hāmākua Loa, Koʻolau, Hāna, Kīpahulu, Kaupō, Kahikinui, Honuaʻula, and Kula. There is a naturally circular stone plateau, referred to as Pālaha (Sterling 1998:3), along the summit of Haleakalā where one *ahupuaʻa* from each *moku*, with the exception of Hāmākua Poko, originate. Pōhaku Pālaha (SCIA Fig ref), as it is commonly known today, is located on the northeast edge of Haleakalā Crater, at Lauʻulu Paliku and is considered as the *piko* (navel or umbilical cord [Pukui and Elbert 1986]) of east Maui (Mr. Timothy Bailey, personal communication. (References omitted).

The term *Pōhaku Pāloha*, is used to describe a place in the northeast corner of the crater. The origin of the term is complex, perhaps interpreted as smooth and flat, or flat rock, but essentially referring to a convergence point where eight of the nine districts of Maui meet, which is a unique spatial organization of the islands (NPS 2008 Ethnographic Study, p. 24). There are more prominent points on the mountain, e.g., Haleakalā Peak, which is the high point on the south rim of the crater, but the cultural significance of this location originates with the concept of a *piko*, or mouth, which has been described as that of an octopus (SCIA, p. 106) from which eight tentacles spread out over a rock, making it difficult to pry loose, in essence, they are stuck flat to the rock. The symbolic significance of the *piko* to Native Hawaiians as the center, or source life, would apply to this locus of interlocking districts, or *moku* (SCIA, p. 107).

Birth and Burial Practices

Native Hawaiians frequently buried their dead in the crater. In addition, the umbilical cords of newborns, or *piko*, were left in the crater as well. Burial sites have been identified in the crater and one possible burial feature has been described at HO (E. Fredericksen, 2003). Haleakalā is vital to the birth and death life cycle for Native Hawaiians who were and continue to be *maʻa* (familiar or accustomed) to this place (SCIA, p. 103).

Haleakalā as a Sacred Mountain

There is much historical research, testimonies, and other views that Haleakalā is a sacred place. As such, those who view Haleakalā as sacred consider development of the summit area to be desecration. Different individuals explain this viewpoint in various terms, or as expressed by one Maui *kupuna* (elder), "[w]hen a culture depends on these natural wonders of their environment for survival and reverence communications to a higher power than themselves, all care must be given to this practice." (SCIA, p. 105). Some Native Hawaiians involved in the Section 106 consultation process for the proposed ATST Project shared similar sentiments, and their testimonies, letters, and research have been included in Section 5.0 of the SDEIS.

The summit area is referred to as *Wao Akua* and is considered to be the realm of the gods, and, as such, is a place to be revered. It is an area that is described to have been *kapu*, or restricted to all but the highest ranking of Native Hawaiians, such as their *kahuna*, or priests. Even today, visitors "…must go in a sense of humbleness and in a sense of asking and in a sense of not disturbing unduly…" (SCIA, p. 106).

There is a protective instinct among Hawaiian people to properly care for Haleakalā, not just for themselves but for future generations. That care is expressed as a strong feeling for responsibility to prevent development on Haleakalā, rather than propose or agree to mitigation for the adverse cultural effects that may result from construction at the summit (SCIA, p. 106).

Ceremonial Practices

Most of the cultural rituals and ceremonies that may be practiced on Haleakalā are not known to the general public because they are kept secret for personal reasons or to maintain the integrity or particular rituals from generation to generation (SCIA, p. 107). This is not uncommon in the Hawaiian culture, and during consultations with Native Hawaiians, only a few specifics of these practices have been shared (SCIA, p. 107). The best known ritual to non-Native Hawaiians is the calling of the Sun, or *e ala e*, which is a chant used to greet ancestors, kupuna, and [also] greet the Sun as it rises (SCIA, p. 107). Some consulted parties have shared other rituals that include such practices as annual pilgrimages to honor certain trees, conducting solstice ceremonies, visiting special sites at certain times of the year for offerings, and going to the summit for chanting. Certain times of the day, month, or year are considered important because at these times the Sun is at zenith. The zenith has particular significance in that there would be the greatest amount of *hā*, or spiritual breath that comes from above. For example, ceremonies at Leleiwi, about two miles from HO, have been described that involve the time when one's shadow is completely absent. These are described as being a time of *hālāwai*, or meeting, where everything in the world meets (Leleiwi is famous for "Specter of the Brocken", an unusual effect in which one can see his/her own shadow in the clouds surrounded by a rainbow, if the clouds are low and the Sun is behind the viewer. The *hālāwai* can also provide an opportunity to simply sit, with a sense of being with one's ancestors, doing what they did for generations (SCIA, p. 109).

Another example of the importance of Haleakalā for ritual practices is the ability to honor the Sun during the solstices and equinoxes in ways that are not possible at sea level. With visibility to the horizon over long distances, it is possible to see, for example, the Sun track across the sky and touch particular points around the summit, e.g., Pu'ukukui. These practices essentially use Haleakalā as a calendar (SCIA, pp. 107-108).

Astronomy

As described in oli (chants) and the *mo'olelo* (stories) about the summit of Haleakalā, the area around Kolekole was used for a training ground in the arts of reading the stars and being one with the celestial entities above and was considered sacred because of its height and closeness to the heavens.

Astronomy has a very large role in the cultural importance of Haleakalā:

> Astronomical matters, both practical and ceremonial, may have been the basis for the most important activities at Haleakalā. All of the possible traditional names for the mountain are associated with tales of the demi-god Maui and his efforts to catch and slow the Sun. These tales involve two aspects, one is the perception of Haleakalā reaching to the sky, and the other is Haleakalā as a place where the observation of solar movement (that is, the marking of seasons) took place.

The recognition of Haleakalā as a place to study the Sun, astronomy, astrology, and the constellations continues into modern times (NPS 2008 Ethnographic Study, p. 31).

Travel

Haleakalā has long been recognized as a traditional traveling route through East Maui. Travel from one side of Maui Island to the other side often resulted in experiencing Haleakalā. The Kaupō and Koolau Gaps provided an excellent route to connect these two districts, and it traversed through the crater (NPS 2008 Ethnographic Study, p. 33). A trail once led from Nuu (in Kaupō) directly up the steep southern flank of the mountain to the south rim of the summit of Haleakalā (NPS 2008 Ethnographic Study, p. 33).

3.2.2 Historic Resources

Historic resources were identified at both the HO site and within the HALE Park road corridor. Those resources are discussed more fully below.

HO Site

To augment the comprehensive survey from 2002, a field investigation of the proposed project site was conducted during fall 2005 (Vol. II, Appendix A-Archaeological Field Inspection). One historic site was identified at the Reber Circle site. This site remnant lies at the peak of Pu'u Kolekole. It is designated by the SIHP as Site 5443 (UH IfA, 2005) and is eligible for listing on the NRHP under Criterion "A" because of its association with mid-20th century scientific studies at Haleakalā, and under Criterion "D" for its information content.

This site remnant consists of a concrete and rock foundation that was part of the former radio telescope facility that was constructed in 1952 by Grote Reber, an early pioneer of radio astronomy. The bulk of this structure was dismantled about 18 months after the facility was completed. This site is composed of a concrete and rock foundation that is approximately 25 meters (82 feet) in diameter, the outer rim of which is up to 1 meter (3.28 feet) in width and approximately 80 centimeters (2.62 feet) in height.

HALE Park Road Corridor

The HALE roadway has been determined eligible for listing in the National Register of Historic Places as an historic cultural landscape with contributing historic features. The applicable eligibility criteria include Criterion "A" (for its development of the National Park System, the development of early NPS landscape architectural design styles, and the craftsmanship of the Civilian Conservation Corps (CCC) and Criterion "C" (for its association with rustic Park design, that characterized early NPS development during the 1930s). In addition, the Park road corridor is within the boundaries of the Crater Historic District, which is listed on both the SIHP (SIHP 50-50-11-12-1739) and on the NRHP. The period of historical significance for the Park road corridor extends from 1933, when development began to provide access to additional views of the Haleakalā Crater in addition to those provided by White Hill, to 1966, when the improvements and expansions of development modes (such as Pu'u 'Ula'ula) along the road designed to enhance the visitor's access to the Haleakalā Crater were built (NPS, CLI, pp 14-17). The end of the significance period is important to recognize because the last development areas, including the Pu'u 'Ula'ula, Leleiwi, and Kalahaku Overlooks, were built as part of the "NPS Mission 66 Program". This

Program, which was intended to modernize or update Park facilities and, at the same time, decrease the cost of development, ended in 1966; the date was chosen to commemorate the NPS' 50th year anniversary (NPS, CLI, pp. 14-16).

The 10.6-mile portion of the highway within the Park boundaries was designed by the Bureau of Public Roads (BPR) between 1925 and 1933 with input from the Hawai'i National Park superintendent and National Park Service (NPS) landscape architects. Road construction on this segment of the road began in 1933 and was completed in 1935 with improvements made at Pa Kaʻoao (White Hill) and the Kalahaku Overlook. Modifications and improvements to the transportation corridor continued until 1941 before the U.S. entered World War II and picked up again following the war as part of the Mission 66 Program. Alignment and construction techniques of the road, buildings, and structures were carefully employed to decrease its visual and physical impact on the landscape and to showcase the spectacular views of the island and ocean below as tourists would drive to the top of Haleakalā Crater and culminate at the summit with views into the crater. (NPS, 2008b, p. 2.)

The entire Haleakalā Highway is a 37-mile road that stretches from central Maui's main town of Kahului to the summit of Haleakalā. (NPS, 2008b, p. 2). The portion of the highway up to the HALE entrance is a State road and was built prior to the Park road corridor. This part of the highway traverses through private property comprised of land used for both residential and ranch purposes.

The contributing landscape characteristics of the Park road corridor are discussed in detail below.

> ***Natural Systems and Features***
> The principal feature of HALE is the Haleakalā Crater. The crater is located at the summit of a massive 10,000-foot dormant shield volcano. The crater is a 3,000-foot deep depression that is approximately 7.5 miles by 2.5 miles wide. Surrounded by jagged mountain peaks, the crater is home to numerous endangered flora and fauna, most notably the ʻahinahina (Haleakalā silversword) and nēnē (Hawaiian goose).
>
> * * *
>
> To reduce the expense of the road, engineers and designers had to carefully consider the rough terrain to avoid building costly bridges and box culverts. The largest obstacles were two large ravines that almost paralleled each other about a half-mile apart. Road engineers avoided the need to build expensive bridges by aligning the road between the two ravines, using switchbacks as necessary until the line reached an elevation at which the ravines were small enough to cross without using a bridge. In order to keep the road between the gullies, additional switchbacks were added to the original road plans and as a result, only one bridge was necessary.
>
> * * *
>
> …the landscape through which the [Park road corridor] traverses to reach the crater is predominantly characterized by fields of black lava deposited by thousands of years of lava flows (with the last two flows occurring sometime between AD 1480 and 1600). The dark color of the landscape influenced design and construction methods of buildings and structures associated with the road, following standard design philosophies during the Rustic-era. Native lava stone was used for construction of culverts and buildings (both 1930s and Mission 66) to help blend them in with the natural environment.
>
> * * *
>
> [Due to extreme weather conditions, including wind, cold, mist and fog.] the Park has maintained a center stripe (referenced as a fog line during the historic period) on the road as early as 1935.
>
> * * *
>
> As a landscape characteristic, natural systems and features have influenced the historic alignment and experience of the road ranging from the natural topography to the native vegetation and contributes to the historic character of the [Park road corridor] historic district.

NPS, CLI, pp. 60-63.

Spatial Organization

Spatial organization of the [Park road corridor] cultural landscape is based on the road's alignment and the development nodes along its path up the volcano. Historically, the 10.6-mile segment of the highway within the Park's boundary was designed to create the most pleasant and scenic driving experience, while working within the constraints of a budget and rough, steep terrain of the volcano's northern slope. Following rustic design guidelines, the road's designers were careful to keep the grade of the road as low as possible and to blend it in with the landscape by allowing it to follow the contours of the land and using native lava stone as building material. Following the contours of the hillside also helped cut costs, by requiring less fill material. The switchbacks were carefully located to keep the road between two large gullies, thus eliminating the need for expensive bridges. Since the period of significance, the road's alignment has remained the same, with the addition of road spurs and observation points along the way. (NPS, CLI, pp. 63).

Land Use

The Park road corridor was a massive construction project funded by the Federal government. It was developed in cooperation with the Maui government and local business leaders with the goal of increasing tourism on the island. It resulted in converting "the arduous horseback trip up the crater into a route accessible by automobile." (NPS, CLI, p. 67). The road easily accommodated more visitors ascending the mountain to experience the sunrise view. The use of the road was later enhanced with the expansion of access routes for the United States military, Federal Aviation Administration and scientific organizations that use the mountain. (NPS, CLI, p. 67)

Buildings and Structures

Structures built in association with the Park road over the course of the historic period reflect the spectrum of development periods from the naturalistic and rustic design philosophy of the 1930s to the more modern philosophies of the 1950s and 60s. The buildings, bridges, box culverts, and culverts along the road corridor were designed by architects and landscape architects over the course of the period of significance to minimize the visual effect of the structures and accentuate the picturesque qualities of the natural surroundings. Use of native materials, along with strict design principles and construction standards, ensured the structures blended with the scenery, matching the color and character of natural rock outcrops and surrounding terrain. The consistency in design and materials among the different structures along the road creates a visual unity and helps define the character of the road landscape.

(NPS, 2008b, pp. 67-69). The CLI also includes a chart (Table 3-5) that lists contributing buildings and structures. (NPS, 2008b, pp. 96-99).

Circulation

The Park road corridor has served as the primary circulation route within the northwestern section of HALE. Features of the Park road corridor that are relevant to circulation include "the roadbed itself, as well as development nodes with their associated spur roads, parking areas, sidewalks, and trails." (NPS CLI, p. 83). "These development nodes are found at Halemauʻu Trailhead, Leleiwi Overlook, Kalahaku Overlook, White Hill and Red Hill." (NPS CLI, p. 83)

Topography

The term "topography", as used here refers to that topography that has been manipulated by human activity. Within the Park road corridor, the majority of manipulation of topography is associated with the road construction itself, which is still evident throughout the corridor:

> The volcano's west slope is cut by deep gullies, lava dykes, and spurs, requiring engineering techniques to create a pleasant, scenic road for Park visitors. As with any road construction, the [Park road corridor]

> required grading. Although great care was taken to minimize disturbance to the surrounding landscape, the use of rick cuts and cut fill sections was required to negotiate the rough, sloping terrain.

(NPS CLI, p. 95).

Table 3-5. Contributing Features of the Haleakalā Highway Historic District.

Contributing Structure Name	Date Built
Haleakalā Highway	1933-1935
Haleakalā Highway Bridge	1934
Haleakalā Highway Box Culvert (MP 1.993)	1933-1935
Haleakalā Highway Box Culvert (MP 2.621)	1933-1935
Haleakalā Highway Box Culvert (MP 2.937)	1933-1935
Haleakalā Highway Box Culvert (MP 2.950)	1933-1935
Haleakalā Highway Box Culvert (MP 3.966)	1933-1935
Haleakalā Highway Box Culvert (MP 4.209)	1933-1935
Haleakalā Highway Box Culvert (MP 4.985)	1933-1935
Haleakalā Highway Box Culvert (MP 5.212)	1933-1935
Haleakalā Highway Box Culvert (MP 5.819)	1933-1935
Haleakalā Highway Box Culvert (MP 5.840)	1933-1935
Haleakalā Highway Box Culvert (MP 5.910)	1933-1935
Haleakalā Highway Box Culverts (29)	1933-1935
White Hill (Pa Ka‘oao) Observatory/Haleakalā Visitor Center	1936
White Hill Trail	1934
Red Hill (Pu‘u ‘Ula‘ula) Observatory	1963
Red Hill Stairs	1963
Red Hill Road	1963
Red Hill Parking Lot	1963
Red hill Walkway (Asphalt)	1963
Kalahaku Overlook	199
Kalahaku Stairs	1954
Kalahaku Silversword Enclosure Walls	1966
Kalahaku Overlook Walkways	1954-1966
Silversword Trail at Kalahaku Overlook	1957
Leleiwi Overlook	1966

Ref.: NPS, 2008b

Views and Vistas

The Park road corridor was "designed to capture views of the island and ocean below with minimal distraction from the road itself." (NPS CLI, p. 98). Although clouds frequently envelope the slopes near the middle elevations of Haleakalā, the historical views that have attracted visitors to HALE include viewing the sunrise and sunset from Kalahaku and White Hill. These views inspired the original design and alignment of the Park road corridor. "The color of the surface material was chosen to blend in with the native lava stone landscape, guardrails were purposefully omitted to prevent blocking views, and the switchbacks were aligned tightly to try to minimize visibility of the road downhill." (NPS CLI, p. 98). In addition, the natural low-growing nature of the native vegetation on the crater ensured that the views would not be blocked by growth." These views and vistas comprise a landscape characteristic that contributes to the historic significance of the Park road historic district. (NPS CLI, p. 98)

Archeological Sites Associated with the Cultural Landscape

Archeological sites that are within 50 feet of the Park road corridor are addressed in the following subsection. Those archeological sites that contribute to the significance of the Park road historic district are discussed in this paragraph. One site that has some potential o reveal information regarding this construction of the Park road is the Kalahaku Overlook, which was the location of both the 1894 and 1914 crater rest houses. It was also the location recommended during the planning phase of the road project to be the terminus of the road (NPS CLI, p. 99). The crater rest house was built by the Chamber of Commerce and was designated a Maui landmark, it has since been demolished. It was linked to the development of tourism and served as a CCC camp while a crew constructed the White Hill trail and cleared the area for construction of the White Hill Observation Station (NPS CLI, p. 100). "Other archeological sites associated with the construction of the road are three caves (SIHP sites #50-20-11-3600, 3644, and 3688) located near the road that contain historic materials such as empty dynamite boxes, sawed wood, and ceramic serving plates and vessels (Carson and Mintmier, 2007)" (NPS CLI, p. 100). It is believed that these caves may have been used as temporary campsites by road construction workers (NPS CLI, p. 100).

3.2.3 Archeological Resources

Numerous archeological sites have been recorded on the slopes and in the crater of Haleakalā, including, in order of frequency, temporary shelters, cairns, platforms with presumed religious purposes, adze quarries and workshops, caves, and trails (UH IfA, 2005). These are all remnants of the very elaborate spiritual and cultural life that the Kanaka Maoli focused around Haleakalā.

Archeological Resources Within HO

There were two archeological surveys conducted in portions of HO during the 1990s. The first of these archeological studies was carried out in 1990 and consisted of a reconnaissance survey by Pacific Northwest Laboratory on behalf of the U.S. Air Force for the Advanced Electro-optical System (AEOS) Environmental Assessment (Chatters, 1991).

Cultural Surveys Hawai'i, Inc. conducted the second study, an archeological inventory survey, in 1998. During the course of this study, a walkover, four archeological sites were identified, primarily along the western side of Kolekole. These features included 23 temporary shelters and a short low wall. These wind shelters were typically constructed against the existing rock outcrop of the hill. The sites were designated SIHP No. 50-50-11-2805 through 50-50-11-2808. One sling stone was found on the floor of Feature J at Site 50-50-11-2807. In addition, one 'opihi, or limpet (Cellana spp.) shell, was noted on the surface of the Feature B floor of Site 50-50-11-2808. There was no subsurface investigation carried out, and only Site 50-50-11-2805 was mapped (additional inventory work was done at these sites in 2005).

Cultural Surveys Hawai'i, Inc., conducted another study in 2000, in conjunction with the planned construction of the FTF. This survey located two previously unidentified sites (50-50-11-4835 and 50-50-11-4836) to the west of the MSO facility. Both of these sites were constructed against an exposed rock outcrop. Site 50-50-11-4835 consists of two features — both historic rock enclosures filled with burned remnants of modern refuse — obviously historic trash burning pits. It was suggested that the U.S. Army might have initially used these during the war and later by UH workers (FTF EA, 2001).Site 50-50-11-4836 consists of three terraces, a rock enclosure, two leveled areas and a rock wall, all constructed against an exposed rock outcrop. Five of the features are interpreted as temporary shelters, while the two leveled areas were of indeterminate usage. Although one test unit did not reveal any pre-contact cultural materials, their construction is consistent with pre-contact structures used for temporary shelters in other areas of Haleakalā Crater (Bushnell and Hammatt, 2002, pp. 16-19). The IfA opted to preserve both sites.

A comprehensive archeological inventory survey of HO was completed during fall 2002 (UH IfA, 2005) and the inventory survey report was approved by the SHPD in a July 10, 2006 review letter (Vol. II, Appendix B(2)-"Science City" Preservation Plan). Whereas surveys had previously been conducted for specific construction projects within HO and a number of archeological features had been identified, the 2002 survey of the entire 18.166 acres for the LRDP (UH IfA, 2005) was exhaustive and included location and description of six previously unidentified sites within HO property. These sites were assigned State designations and further documentation was obtained for four previously identified sites that were listed with the SHPD. In total, 29 new features were identified and five excavation units were utilized to sample selected features that were located in some of the previously undocumented sites.

Most of the newly identified features are temporary habitation areas or wind shelters. Two features at one site are petroglyph images and, as indicated above, one new site is interpreted as a possible burial. Two small platforms thought to have ceremonial functions were also identified, as was a possible trail segment. All of the newly identified sites and previously designated ones retain their significance rating under at least Criterion "D" for their information content under Federal and State historic preservation guidelines. All of the sites mentioned in this report qualify for significance because of their information content under Criterion "D" of State and Federal historic preservation guidelines. In addition, the possible burial (Feature D) and the 2 petroglyph images (Features F and G) of Site 50-50-11-5440, as well as Site 50-50-11-5441 and the Site 50-50-11-4836 trail segment (Feature F) also qualify for their cultural significance under Criterion "E". Finally, it is important to note that the various sites located in HO are a remnant of a Kanaka Maoli cultural landscape. Because Haleakalā is noted for its ceremonial and traditional importance to the Kanaka Maoli, the entire HO complex of sites may well qualify for importance under significance Criteria "A" and "E".

The general lack of material culture remains suggests that the area comprising HO was utilized for short-term shelter purposes, rather than extended periods of temporary habitation use. While there was no charcoal located during testing in the project area, the newly identified sites are nevertheless tentatively interpreted as indigenous cultural resources, some of which may have been modified and/or used in modern times.

Xamanek Researches, LLC carried out an inventory survey of the entire 18.166-acre parcel in 2002-2003 (Fredericksen and Fredericksen, 2003). A total of six previously unrecorded sites (50-50-11-5438 through 50-50-11-5443) were located during the course of this inventory survey. These sites consist of wind shelters, two petroglyph images, a possible burial feature, and an historic foundation known as Reber Circle. Supplemental information was obtained from Sites 50-50-11-2805 to 50-50-11-2808 per discussions with Dr. Melissa Kirkendall of the SHPD Maui office. In addition, a trail segment was recorded at Site 50-50-11-4836 and designated as Feature F. Several isolated pieces of coral were noted in the southeastern portion of the 18.166-acre study area, but not assigned a formal site number because the coral pieces were not weathered. A possible site consisting of several pieces of coral in a boulder was plotted on the project map, but was determined to lie off the project area. The results of the inventory survey were submitted to SHPD for preservation review, although there was no triggering action requiring submittal of the survey, as described in HRS Section §6E-8. The significance assessments were accepted (DLNR, 2003). The results of these surveys are summarized in Table 3-6.

Table 3-6. Summary of HO Archeological Sites.

Site numbers are prefaced by 50-50-11: 50=State of Hawai'i, 50=Maui, 11=Kilohana quadrangle.

SIHP Site #	Description (Number of Features)	Age	NRHP Significance Criterion
2805	Wind shelter (1)	Pre-contact - post-contact	D
2806	Wind shelter (1)	Pre-contact	D
2807	Wind shelter (13), Wind shelter, C-shape (2), Wind shelter/terrace (1)	Pre-contact - post-contact	D
2808	Wind Shelter (3)	Pre-contact - post-contact	D
4835	Trash pit (2)	Possible WWII era, modern trash observed	D
4836	Wind shelter (5), Trail (1)	Pre-contact-post-contact	D
5438	Wind shelter (1), Terrace/Wind shelter (1), Terrace-like Wind shelter (3), Rock pile (1)	Pre-contact - post-contact	D
5439	Rock Shelter (2), Wind shelter (4), Wind shelter, C-shape (6), Rock pile (1)	Pre-contact - post-contact	D
5440	Wind shelter, enclosure (1), Wind shelter, C-shape(2), Wind shelter natural terrace (1), Platform (1), Petroglyph (2)	Pre-contact - post-contact	D
5441	Terrace (2)	Pre-contact - post-contact	D
5442	Rock wall partial enclosure (1)	Pre-contact - post-contact	D

Archeological Resources Along the Park Road

The ROI also includes archeological sites located along the Park road corridor (Table 3-7). There are 11 archeological sites within 50 feet of the Park road corridor identified in the 2007 Archeological Survey conducted by International Archaeological Research Institute, Inc. (Carson and Mintmier, 2007). Most of these sites are eligible for listing in the NRHP under Criterion "D", and one is eligible under both Criteria "C" and "D". These sites include short-term camp sites associated with pre-historic and/or historic activities, cairns that appear to be trail markers and segments of wall associated with cattle ranching. (Carson and Mintmier, 2007).

Table 3-7. Summary of HALE Archeological Sites Along the Park Road Corridor.

Site numbers are prefaced by 50-50-11: 50=State of Hawai‘i, 50=Maui, 11=Kilohana quadrangle.

SIHP Site #	Description (Number of Features)	Age	NRHP Significance Criterion
3660	Cairn	Unknown	D
3673	Wall	Unknown	D
3688	Rock shelter, wall	Historic	D
3600	Cave	Historic	D
3637	Enclosures (110), mound, possible defensive post	Pre-historic, also historic	C, D
3641	Platform	Probable historic	D
3642	Cairn (2), rock shelter	Historic	D
3643	Cairn	Probable historic	D
3646	Enclosures (4)	Unknown	D
3651	Multiple wall segments	Historic	D
3659	Platform	Pre-historic	D

(Carson and Mintmier, 2007)

3.2.4. National Historic Preservation Act, Section 106 Regulatory Compliance

The NSF's consultation process, pursuant to the National Historic Preservation Act of 1966 (NHPA), is discussed in this section because it has been a mechanism to assist in determining the affected environment. Prior to issuance of the DEIS, NSF's Section 106 compliance process (as described below) was initiated. Both formal and informal consultations were conducted as discussed in further detail in Section 5.0-Notification, Public Involvement, and Consulted Parties. Subsequent to the publication of the DEIS, additional consultations have taken place with Native Hawaiian organizations and individuals, community groups, other State and Federal agencies, and other interested parties to discuss the cultural resources involved, potential effects on those resources, and ways in which those effects could be addressed. All of these additional consultations are detailed in Section 5.0.

The NHPA requires Federal agencies to consider whether their actions will have impacts on historic properties eligible for listing in the NRHP. The heart of the NHPA is the Section 106 process, which "seeks to accommodate historic preservation concerns with the needs of Federal undertaking through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties… the goal of consultation is to identify historic properties potentially affected by the undertaking, assess its effects and seek ways to avoid, minimize or mitigate any adverse effects on historic properties." (36 CFR § 800.1(a). In the State of Hawai‘i, the NSF must also consult with the State Historic Preservation Division (SHPD) and all interested Native Hawaiian organizations and individuals where historic properties of significance are involved.

Because of Section 106, Federal agencies must assume responsibility for the consequences of their actions on historic properties and be publicly accountable for their decisions. The regulations governing this process are published in 36 CFR § 800, "Protecting Historic Properties", and can be found on the ACHP web site at www.achp.gov/regs-rev04.pdf. To successfully complete a Section 106 review, Federal agencies must determine if Section 106 of NHPA applies to a given project and, if so, implement the following:

1. Identify historic properties within the area of potential effects,
2. Evaluate historic properties for significance,
3. Assess whether the Federal undertaken will have adverse effects on the historic properties; and,
4. Through consultation with SHPD, all interested Native Hawaiian organizations and individuals, and other interested parties (and the ACHP in some cases), determine whether the adverse effects can be addressed through avoidance, minimization and/or mitigation.

In addition to the NHPA requirements, it is the policy of the State of Hawai‘i under Chapter 343, HRS, to alert decision makers, through the environmental assessment process, about significant environmental effects which may result from the implementation of certain actions. An environmental assessment of cultural impacts gathers information about cultural practices and cultural features that may be affected by actions subject to Chapter 343, and promotes responsible decision-making. Articles IX and XII of the State Constitution, other State laws, and the courts of the State require government agencies to promote and preserve cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups. Chapter 343 also requires environmental assessment of cultural resources in determining the significance of a proposed project.

Since the issuance of the DEIS, NSF and HALE have been working together to address HALE’s environmental compliance needs associated with the Special Use Permit required by HALE to operate commercial vehicles associated with the proposed ATST Project within the Park. NSF and HALE have agreed to coordinate their environmental compliance requirements under both NEPA and Section 106. It was through this partnership that the cultural, historic, and archeological resources of HALE (as discussed in Sections 3.2.1 through 3.2.3, above) were identified.

3.3 BIOLOGICAL RESOURCES

Biological resources were evaluated within the (Region of Influence) ROI, which, for these resources, falls within both the HO and the Park road corridor. A discussion of these resources follows.

It should be noted that during the period from 2003 to 2008, surveys at HO were conducted to assess its botanical and invertebrate habitats and to map the visitation flight patterns of avian fauna. These surveys were done as part of the LRDP for HO, AEOS Mirror Coating Section 7 consultations, and more recently, as part of the EIS assessment of the affected environment for the proposed ATST Project.

The results of these surveys generally indicate that the diversity and density of biological populations at HO are dynamic from season to season and over longer temporal periods, depending on a number of factors such as rainfall, temperature variations and less well-understood factors. Human activities certainly play a role in these dynamic variations, i.e., ground disturbances associated with minor construction at the MSSS resulted in numerous new ‘ahinahina sprouts in that part of HO the following year, and the renovation of parts of the stormwater drainage system at HO resulted in increased plant growth along restored water channels

The alternative sites for the proposed ATST Project are located on State of Hawai‘i land within the Conservation District on Pu‘u Kolekole, approximately three-tenths mile from the highest point, Pu‘u Ula‘ula in HALE. Mountain summits are typically aeolian deserts populated by a few mosses, lichens, and grasses. The predominant vegetation type at HO is alpine desert/shrubland. Alpine ecosystems exist at elevations of from 9,842 to 11,155 feet above sea level (ASL) and can be extremely dry. Rainfall ranges from less than 15 inches to as much as 60 inches annually. Great daily variations in temperature occur with frost most common at night. Cinder and ash soils underlie this community on Maui (UH IfA, 2005). While there was at least one historical account of an abundance of ‘ahinahina (Haleakalā silversword, *Argyroxipbium sandwicense*) (Bird, 1890), a recent study reported that dry alpine shrublands are sparsely vegetated with dwarf native shrubs. At HO, shrubs consist of interspersed ‘ahinahina and na‘ena‘e *(Dubautia menziesii)*. Vegetation cover is restricted by harsh environmental conditions to 10 percent of the surface area or less. Some areas have little as one percent coverage. The vegetation is also low, generally less than three feet high (UH IfA, 2005).

Within HO, undisturbed land is interspersed amid land that has been disturbed by construction. Undisturbed sites are inhabited by predominately native shrubs, including na‘ena‘e *(Dubautia menziesii),* pukiawe *(Styphelia tameiameiae),* and ‘ohelo *(Vaccinium reticulatum),* herbs, such as tetramolopium *(Tetramolopium humile),* and, grasses, including bentgrass *(Agrostis sandwicensis),* hairgrass *(Deschampsia nubigena),* and mountain pili *(Trisetum glomeratum).* Three species of native ferns, ‘iwa‘iwa *(Asplenium adiantum-nigrum),* ‘oali‘i *(Asplenium trichomanes* ssp. *densum),* and kalanoho *(Pellaea ternifolia),* are found tucked into rock crevices and overhangs and on the steep slopes of the southeast part of the property. Areas of HO where construction has occurred generally support fewer native species and more weeds. During the November 2002, LRDP survey of the entire HO site (UH IfA, 2005), 32 plant species were observed, 11 of which were native and 21 were non-native. In the 2005, proposed ATST Project survey for the Mees and the Reber Circle sites, 25 plant species were observed, 11 of which were native and 14 were non-native.

The following species, listed as either threatened or endangered under the Endangered Species Act (ESA), have been observed within the ROI:

1. ‘ahinahina or Haleakalā silversword *(Argyroxiphium sandwicense* ssp. *macrocephalum)*;
2. ‘ua‘u or Hawaiian Petrel *(Pterodoma phaeopygia sandwichnesis)*;
3. nēnē or Hawaiian goose *(Branta sandvicensis)*; and,
4. ‘ope‘ape‘a or Hawaiian hoary bat or *(Lasiurus cinereus semotus)*.

The Park road corridor contains biological ecosystems that are both unique and fragile. Prior to the late 1980’s, these ecosystems were not well protected from feral goats and pigs. However, considerable efforts have been expended in recent years to keep feral animals off the upper slopes of HALE (a feral animal control fence encloses Haleakalā Crater and much of Manawainui), and there are extensive staff and volunteer efforts to check the spread of alien invasive species (AIS). Because since that time, the threat to certain ecosystems within HALE has been more compelling than others, the focus of interest for this SDEIS are those ecosystems within the Park road corridor of the ROI. These include plants, avian species, and arthropods.

The Park road corridor consists of more than one biological zone for plants. The lower half of the Park road corridor, up to about 8,500 feet is within the subalpine shrubland zone. Subalpine shrublands of Haleakalā occur primarily on the western and northwestern flanks of the volcano extending from just below the Park boundary at 6,724 feet up to where it grades into the alpine zone at approximately 8,530 feet. The upper Park road corridor is in the alpine zone, which occurs above 8,530 feet on the older, outside western slope of the volcano (Medeiros, et al, 1998). Considerable diversity exists within both biological zones, and ‘ahinahina (Haleakalā silversword, or *Argyroxiphium sandwicense* subsp. *Macrocephalum),* an endangered species of concern during construction of the proposed ATST Project, inhabits both zones.

Native and non-native vertebrate and invertebrate species occur along the Park Road corridor. These are discussed in detail below. Those that are threatened and endangered are discussed in Section 3.3.3.1. Other native and introduced fauna are discussed in Section 3.3.3.2. Invertebrate species are discussed in Section 3.3.3.3.

3.3.1 Botanical Resources

The landscape at HO is considered to be an *Argyroxiphium*/*Dubautia* alpine dry shrubland vegetation type. Dry alpine shrublands are typically open communities, occurring between about the 9,800 to 11,100-foot elevations in Hawaiʻi, predominantly on barren cinders, with very sparse vegetation cover (UH IfA, 2005). The substrate is a mixture of ash, cinders, pumice, and lava (UH IfA, 2005). Vegetation is sparse, varying from a near barren landscape (<1 percent cover) to about 10 percent cover. Vegetation is low to the ground, no more than 3 feet (1 meter) tall anywhere on the site. During the November 2002, LRDP survey conducted by Starr Environmental (UH IfA, 2005), a total of 32 plant species were observed, consisting of 11 (34 percent) were native species and 21 (66 percent) non-native species. The December 2005 survey (Vol. II, Appendix E-Botanical Survey) identified 25 plant species, consisting of 11 were native species and 14 non-native species.

The land in HO can be divided into two general areas: undisturbed and disturbed (i.e. those where construction or other human influence has occurred). Undisturbed areas are comprised of predominantly native plants including shrubs, herbs, and grasses. Three species of native ferns are found in rock crevices and overhangs around the Pan-STARRS (PS-1) observatory and on the steep slopes on the southeast portion of the property near the MSO facility.

Areas of HO property where construction has occurred generally support fewer native species and contain more weeds. One notable exception is the endemic ʻahinahina, or Haleakalā silversword (*Argyroxiphium sandwicense*. *macrocephalum*), which is found exclusively on areas where construction has occurred. The only tree species found at HO were two unidentified pines (*Pinus* sp.) located between a weather station tower and the MSO facility were approximately 20 cm (7.87 inches) tall and looked more like a small multi-branched shrub than a tree. This was the first record of pines on the summit of Haleakalā. It was not known if the trees were planted, arrived as contaminants in soil, or through natural wind dispersal. These trees were thought to be many years old despite their minimal height (compared to other pine species). At the recommendation of the Friends of Haleakalā National Park, these trees were removed.

There are ten native species and nine non-native plants species found on the Mees site. Portions of the site that were moderately disturbed, especially areas near buildings and roads contained the mostly weeds (non-native species) and fewest native species. Non-native plants found on the Mees site include thyme-leaved sandwort (*Arenaria serpyllifolia*), storksbill (*Erodium cicutarium*), hairy cat's ear (*Hypochoeris radicata*), black medick (*Medicago lupulina*), evening primrose (*Oenothera stricta* subsp. *stricta*), pine (*Pinus* sp.), English plantain (*Plantago lanceolata*), Kentucky bluegrass (*Poa pratensis*), and common or spring vetch (*Vicia sativa* subsp. *nigra*). (Vol. II, Appendix E-Botanical Survey).

Portions of the site that were the least disturbed contain the most native plant species and the least weeds. Native plants found on the Mees site include Hawaiian bentgrass (*Agrostis sandwicensis*), ʻiwa ʻiwa (*Asplenium adiantum-nigrum*), ʻoaliʻi (*Asplenium trichomanes* subsp. *densum*), hairgrass (*Deschampsia nubigena*), kupaoa (*Dubautia menziesii*), kalamoho (*Pellaea ternifolia*), pukiawe (*Styphelia tameiameiae*), tetramolopium (*Tetramolopium humile*), mountain pili (*Trisetum glomeratum*), and ohelo (*Vaccinium reticulatum*). (Vol. II, Appendix E-Botanical Survey).

The most undisturbed areas of HO hold remnant pockets of native plants indicative of relatively pristine conditions. Two native shrubs, ohelo and pukiawe, appear to be sensitive to disturbance/urbanization on Puʻu Kolekole, and were found on the proposed construction site adjacent to the MSO facility.

The Reber Circle site is mostly disturbed, with the original profile of the rise evident only on the margins of the site, often where the land is steep. There were nine native and seven non-native plants found on the Reber Circle site. The most heavily disturbed portions of the site, such as the roads, parking lots, and existing buildings, contain virtually no plants, native or non-native.

Portions of the site which are moderately disturbed, especially those areas near buildings and roads, contained the most weeds and fewest native species. Non-native plants found on the Reber Circle site include Japanese sugi pine (*Cryptomeria japonica*), storksbill (*Erodium cicutarium*), Yorkshire fog (*Holcus lanatus*), hairy cat's ear (*Hypochoeris radicata*), lythrum (*Lythrum maritimum*), evening primrose (*Oenothera stricta* subsp. *stricta*), and Kentucky bluegrass (*Poa pratensis*). (Vol. II, Appendix E-Botanical Survey)

Portions of the site that were the least disturbed contained the most native plants and the least weeds. Native plants found on the Reber Circle site include Hawaiian bentgrass (*Agrostis sandwicensis*), ʻahinahina or Haleakalā silversword (*Argyroxiphium sandwicense* subsp. *macrocephalum*),ʻiwa ʻiwa (*Asplenium adiantum-nigrum*), ʻoaliʻi (*Asplenium trichomanes* subsp. *densum*), hairgrass (*Deschampsia nubigena*), kupaoa (*Dubautia menziesii*), kalamoho (*Pellaea ternifolia*), tetramolopium (*Tetramolopium humile*), and mountain pili (*Trisetum glomeratum*). (Vol. II, Appendix E-Botanical Survey)

The same patterns of nativity in relation to disturbance that occur on the Mees site also seem to occur on the Reber Circle site. Native plants dominate undisturbed areas, while non-natives dominate disturbed sites. Additionally, it appears some native species are never found in the most disturbed sites. The Reber Circle site does not contain the native shrubs pukiawe and ohelo, suggesting a higher level of disturbance than some of the other areas at HO, such as the Mees site, which contains both pukiawe and ohelo.

Botanical resources along the Park road corridor can be grouped into the alpine and subalpine shrubland habitat zones, depending upon elevation. The upper, alpine zone largely contains the botanical diversity described above for HO. The lower elevations, below about 8,500 feet, are within the subalpine shrubland habitats, which contain common species such as the coriaceous, small-leaved shrub pukiawe (*Styphelia tameiameiae*). The tallest tree-shrub of subalpine shrublands is mamane (*Sophora chrysophylla*) whose golden yellow flowers in the spring provide food for native honeycreepers that seasonally travel from nearby rain forests. 'Ohelo (*Vaccinium reticulatum*) and kiipaoa (*Dubautia menziesii*) are common components of the subalpine zone; historically, both have been suppressed by feral goats and are recovering well in their absence. Other common and characteristic native subalpine species include the shrubs pilo (*Coprosma montana*), kukaenene (*Coprosma ernodeoides*), and hinahina (*Geranium cuneatum tridens*), and (ʻa'aliʻI *Dodonaea viscosa*), and the herbs *Carex wahuensis*, *Deschampsia* nubigena and 'uki (*Gahnia gahniiformis*). Non-native grasses, especially velvetgrass (*Holcus lanatus*) are common and persistent between native shrubs (Medeiros, et al, 1998).

3.3.2 Endangered, Threatened, Listed, or Proposed Plant Species

The ʻahinahina, or Haleakalā silversword, is Federally-listed as a “threatened” species, meaning they may become endangered throughout all or a significant portion of their range if no protective measures are taken. In 2002, nine live ʻahinahina and three dead ʻahinahina flower stalks were located within the HO property. None of the live plants were located on or around the proposed ATST Project areas. One of the dead plants, also found during the 2005, proposed ATST Project survey, was located east of Reber Circle. The area around the plant was searched for seeds, but none were found. There are a number of ‘ahinahina in HALE, 382 hectares (944 acres), of designated ‘ahinahina critical habitat. Approximately seven miles of the Park road corridor traverse through Designated Critical Habitat for the ‘ahinahina. There is also 1 hectare (2 acres) designated critical habitat for the nohoanu plant (many-flower geranium, *Geranium multiflorum*) in HALE.

3.3.3 Faunal Resources

Fauna at HO and along the Park Road corridor consist of avifaunal species, mammals, and invertebrates. Three Federal- and Sate-listed animal species, described below, occur in the summit area and slopes of Haleakalā. Table 3-8 lists the habitat preference and the likelihood of occurrence of avifaunal species and mammals in the ROI.

Table 3-8. Threatened and Endangered Species Occurring at HO and Along the Park Road Corridor.

<table>
<tr><th>Scientific Name</th><th>Common Name</th><th>Federal Status</th><th>State Status</th><th>Habitat</th><th>Date Last Observed</th><th>Likelihood of Occurrence</th></tr>
<tr><td colspan="7">Flora</td></tr>
<tr><td rowspan="2">Argyroxiphium sandwicense ssp. macrocephalum</td><td>Haleakalā silversword, ‘ahinahina</td><td>Protected under ESA</td><td>Protected by State</td><td>May occur in alpine dry shrubland.</td><td>Known currently</td><td>C</td></tr>
<tr><td colspan="6">NOTE: No live or dead plants occupy the proposed ATST project sites, although they exist in the ROI.</td></tr>
<tr><td colspan="7">Fauna</td></tr>
<tr><td rowspan="2">Pterodoma phaeopygia</td><td>Hawaiian Petrel, ‘ua‘u</td><td>Protected under ESA</td><td>Protected by State</td><td>May occur in alpine dry shrubland.</td><td>Known currently</td><td>C</td></tr>
<tr><td colspan="6">NOTE: Most likely observed during the nesting season, February to November.</td></tr>
<tr><td rowspan="2">Branta sandvicensis</td><td>Hawaiian goose, nēnē</td><td>Protected under ESA</td><td>Protected by State</td><td>May occur in beach strands, shrublands, grasslands, woodlands.</td><td>Known currently</td><td>C</td></tr>
<tr><td colspan="6">NOTE: May be incidentally sighted at HO, but unlikely a resident.</td></tr>
<tr><td rowspan="2">Lasiurus cinereus semotus</td><td>Hawaiian hoary bat, ‘ope‘ape‘a</td><td>Protected under ESA</td><td>Protected by State</td><td>May be seen foraging in open areas, including alpine shrublands, near the edges of native and non-native forests, or over open water. May roost in foliage of native and non-native trees.</td><td>Known currently</td><td>P</td></tr>
<tr><td colspan="6">NOTE: May be incidentally sighted at HO, but unlikely a resident.</td></tr>
</table>

*Likelihood of occurrence at HO: C = Confirmed P = Potentially may occur U = Unlikely to occur

3.3.3.1 Endangered, Threatened, Listed or Proposed Avifaunal And Vesper Bat Species

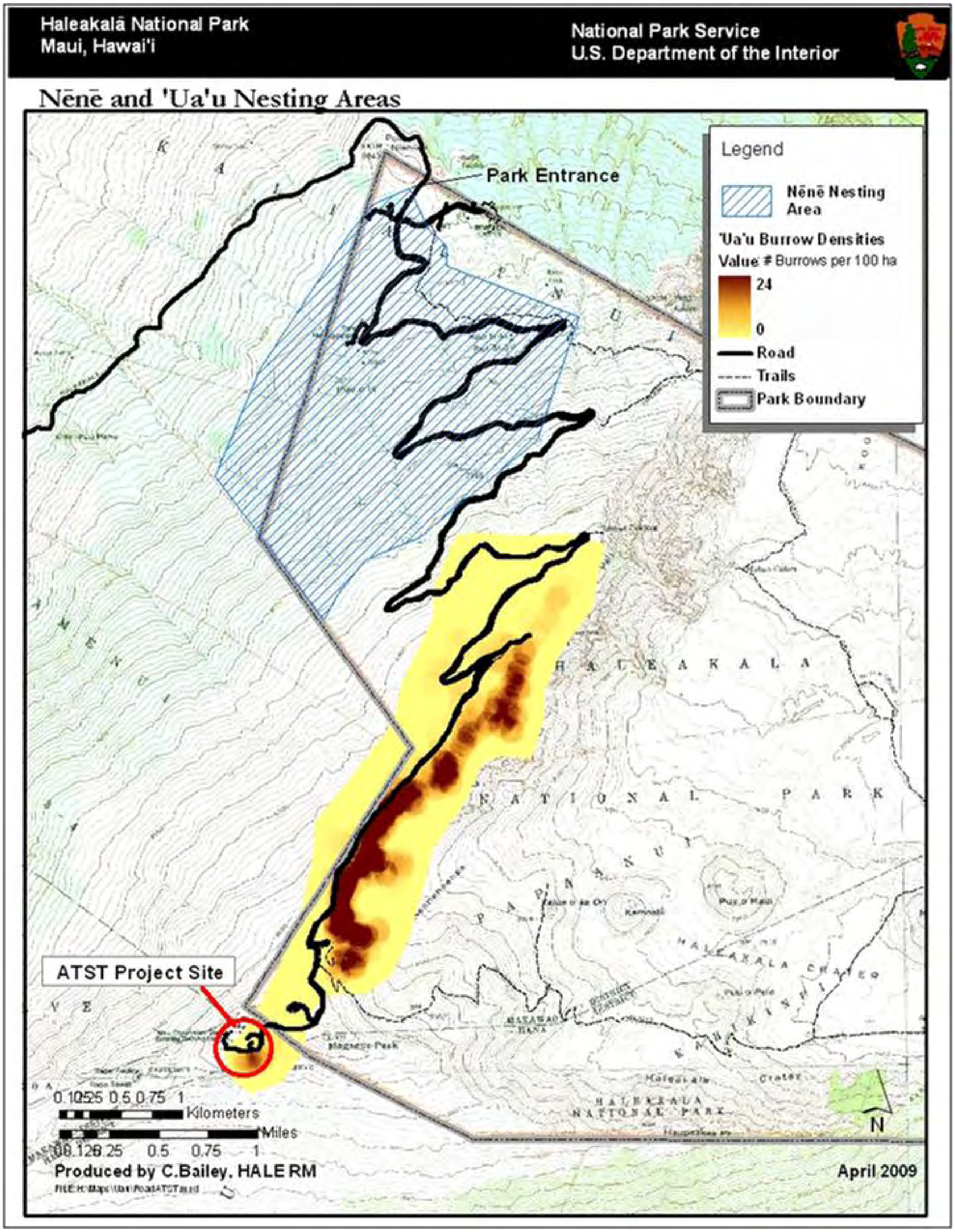
<u>‘Ua‘u (Hawaiian Petrel)</u>

The ‘ua‘u, or Hawaiian Petrel *(Pterodroma sandwichensis)*, a Federal- and State-listed endangered bird species, is present in the summit area (Natividad Bailey, unpublished report for IfA). The largest known nesting colony of 'ua'u is located in and around HALE (Simons and Natividad Hodges 1998). About 30 known burrows are along the southeastern perimeter of HO and several burrows are northwest of HO, as shown in Figure 3-5, with a large number of burrows within two miles of HO (HALE, 2003). There are about 220 burrows along the Park road corridor and outside the crater rim (HALE unpublished data). As shown in Figure 3-5, many of these burrows are within the 50-foot Park road corridor that constitutes part of the ROI for the proposed ATST Project. The ‘ua‘u at HALE is the only population of seabirds in Hawaii's national parks that is intensively monitored and managed. Monitoring for ‘ua‘u distribution and breeding success at HALE occurs annually as part of regular resource management activities, and has since 1980. ‘Ua‘u in HALE nest in burrows, most of which are located along the steep cliffs of the western rim of Haleakalā Crater. A recent report states that “There are currently more than 1,000 known ‘ua‘u burrows at HALE, of which about 60 percent are occupied by ‘ua‘u each year.” ‘Ua‘u are present at Haleakalā from February through October and are absent from November through January. HALE staff search for new burrows and check existing burrows periodically while the ‘ua‘u are present (Natividad Bailey, 2009). These monitoring efforts include burrows located along the Park road corridor. Figure 3-6 illustrates the location of ‘ua‘u in and around HO. The closest burrow is approximately 50 feet to the east of the Mees site (Fig. 3-6, burrow #SC40).

The ‘ua‘u can be found nesting at Haleakalā from February to November. The birds make their nests in burrows and return to the same burrow every year. The species distribution during their non-breeding season is poorly known, but they are suspected to disperse north and west of Hawai‘i, with very little movement to the south or east. The ‘ua‘u typically leave their nests just before sunrise to feed on ocean fish near the surface of the water and just before sunset transit from the ocean back to Haleakalā. These birds have limited vision and their high speed and erratic nocturnal flight patterns may increase the possibility of collisions with fences, utility lines, and utility poles (Simons and Natividad Hodges 1998).

‘Ua‘u are believed to navigate by stars, so man-made lights may confuse in-flight ‘ua‘u. Evidence suggests these birds will fall to the ground in exhaustion after flying around lights, where they are susceptible to being hit by cars or attacked by predators (Simons and Natividad Hodges 1998); however, this has not been observed at HO. However, ‘ua‘u have been seen on the Park road at night and data indicates that ‘ua‘u carcasses found show indications of being hit by vehicles on the Park road (HALE unpublished data). In addition to these hazards, confirmed causes of ‘ua‘u mortality include nest collapse by wild goats, predation by native owls and introduced predators, road-kills, collision with such objects as buildings, utility poles, fences, lights, and vehicles, and disturbance from road resurfacing activity (Natividad Hodges and Nagata, 2001).

During fall 2004, ABR, Inc. conducted a study for the Maui Space Surveillance Complex (MSSC) (ABR, 2005). Using ornithological radar and visual sampling techniques, this study's objective was to determine movement patterns of ‘ua‘u near the summit of Haleakalā, including spatial movement patterns, temporal movement patterns, and flight altitudes. Many of the patterns observed in this study matched what is known about the biology of ‘ua‘u. Breeding adults, non-breeding sub-adults, and adults are active in the summer when the displaying non-breeders are active and fly erratically and circle the colonies at low altitudes. In contrast, only adults visit the colonies during the fall, when they simply fly in and land at burrows to feed young. It is suspected that fewer birds were seen on the radar in the vicinity of the MSSC than near the crater because the crater is much more active for breeding and displaying birds than is that part of the colony along the southwestern ridge (i.e., the ridge on which the observatories and the Federal Aviation Administration (FAA) site are located).



The Park road corridor for the Proposed ATST Project is defined specifically as a 50-foot corridor along the Park road, measured from the mid-point of the road extending out 25 feet on each side.

Figure 3-5. Petrel Burrows Near Summit of Haleakalā.

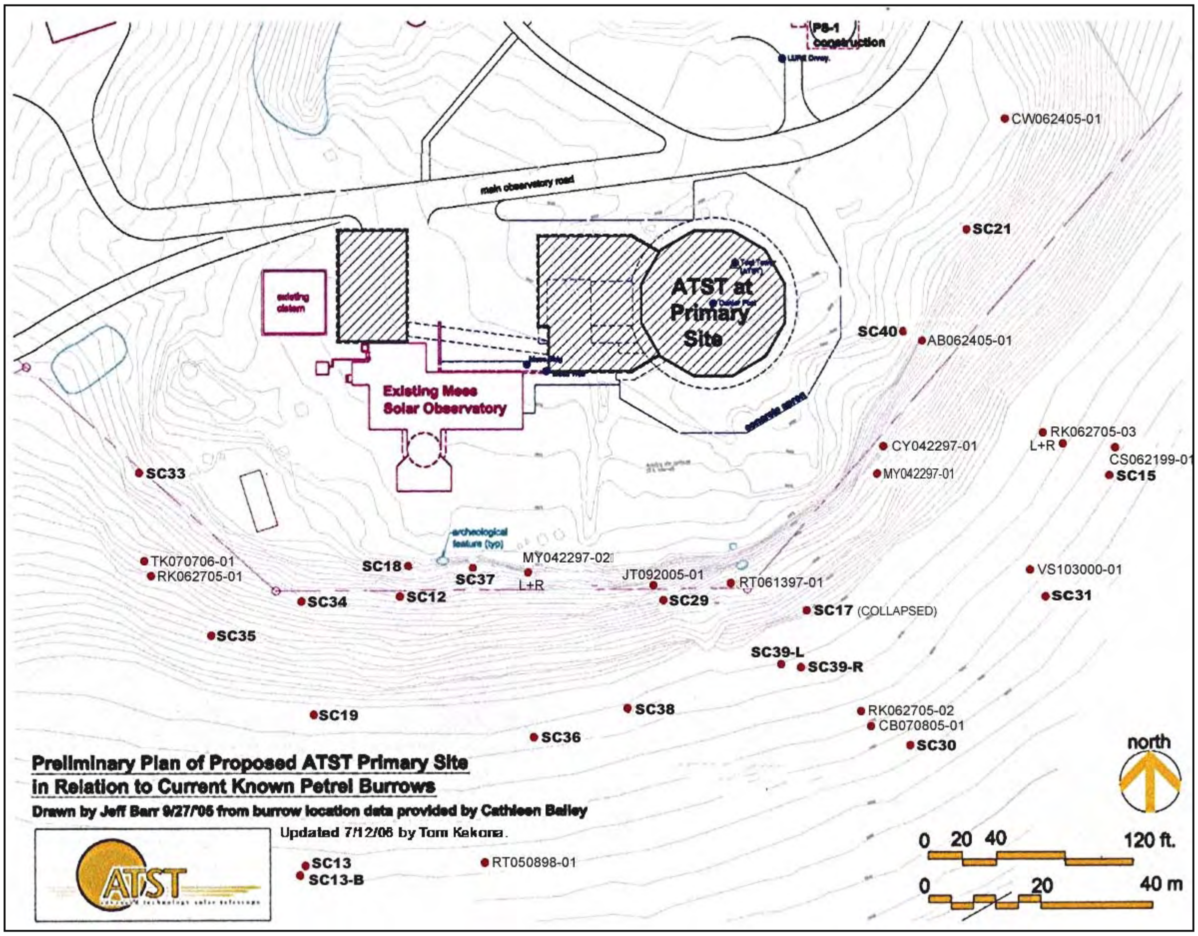
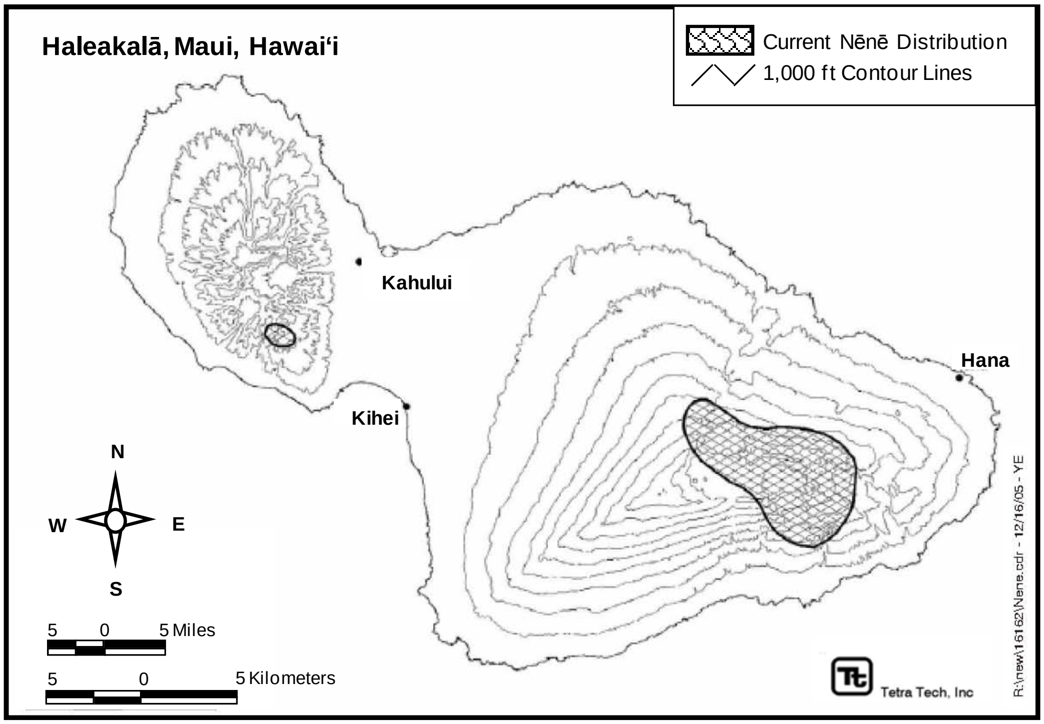


Figure 3-6. Petrel Burrows In and Around HO Property.

<u>Nēnē (Hawaiian Goose)</u>

The nēnē, or Hawaiian goose *(Branta sandvicensis* also known as *Nesochen sandvicensis)*, is a Federal- and State-listed endangered species on Haleakalā and is the only extant species of goose not occurring naturally in continental areas. The nēnē formerly bred on most of the Hawaiian Islands, but breeding is currently restricted to the islands of Hawai‘i, Kaua‘i and Maui. Nēnē seem to be adaptable and are found at elevations ranging from sea level to almost 8,200 feet (Fig. 3-7) in a variety of habitats, including non-native grasslands, sparsely vegetated, high elevation lava flows, cinder deserts, native alpine grasslands and shrublands, open native and non-native alpine shrubland-woodland community interfaces, mid-elevation (approximately 2,300 to 3,900 feet) native and non-native shrubland, and early successional cinder fall. Critical habitat has not been designated for the nēnē. The nēnē population on Maui is thought to consist of approximately 330 individuals. While the nēnē has been known to fly over HO, the summit area is outside the known feeding range of the bird. The nēnē is known to frequently occur along the Park road corridor, from the Park entrance to the Leleiwi Overlook and occasionally above, as well as areas outside, the Park on the lower slopes of Haleakalā.

The nesting periods for this non-migrating, terrestrial goose occur from October to March. Preferred nest sites include sparsely to densely vegetated beach strands, shrublands, grasslands and woodlands on well-drained soil, volcanic ash, cinder, and lava rock substrates. Nēnē are ground nesters and their nests are usually well hidden in the dense shade of a shrub or other native vegetation, but on Kauaʻi nēnē have built nests under alien species. Nēnē are browsing grazers, eating over 50 species of native and introduced plants.



Draft Revised Recovery Plan for the Nene or Hawaiian Goose, USFWS, 2004

Figure 3-7. Current Distribution of Nēnē on Maui.

Once abundant, the nēnē population has declined. The primary causes of this decline were habitat loss, hunting during the nēnē breeding season (fall and winter), and the effects of alien mammals introduced during both Polynesian and western colonization.

Current threats to the nēnē population include predation, nutritional deficiency due to habitat degradation, lack of lowland habitat, human-caused disturbance, road-kills, behavioral problems, and inbreeding depression. Dogs *(Canis familiaris)*, cats *(Felis cattus)*, mongoose *(Herpestes auropunctatus)*, rats *(Rattus* spp.*)*, and pigs *(Sus scrofa)* prey on nēnē, while feral cattle *(Bos taurus)*, goats *(Capra hircus)*, pigs, and sheep *(Ovis aries)* have been known to alter and degrade nēnē habitat through their foraging activities.

Potential threats to the nēnē are identified below and follow the U.S. Fish and Wildlife Service (USFWS) classification of factors that may negatively affect a species, leading to its decline, as identified in Section 4(a) of the ESA. These include:

1. The present or threatened destruction, modification, or curtailment of its habitat or range;
2. Over-utilization for commercial, recreational, scientific, or educational purposes;
3. Disease or predation;
4. The inadequacy of existing regulatory mechanisms; and,
5. Other natural or manmade factors affecting its continued existence.

The last threat includes being hit by vehicles travelling along the Park road. An average of one nēnē per year has been killed in that manner (HALE, unpublished data).

The Draft Revised Recovery Plan for Nēnē of Hawaiian Goose (USFWS, 2004) indicates there is a high degree of threat to this species. USFWS also believe that this species has a high recovery potential because it is a taxonomically, or genetically “pure” species and as such does not interbreed with domestic geese and is generally not in conflict with regular human activities.

‘Ope‘ape‘a (Hawaiian Hoary Bat)

The ‘ope‘ape‘a, or Hawaiian hoary bat *(Lasiurus cinereus semotus),* is a Federal-listed endangered species that resides on the lower slopes of Haleakalā. The ‘ope‘ape‘a is found on Hawai‘i Island, Maui, O‘ahu, Kaua‘i and Moloka‘i. On the island of Hawai‘i, most observations have been from between sea level and 7,500 feet ASL, although individuals have been recorded at elevations as high as 13,000 feet. On Maui, the bat resides in the lowlands of the Haleakalā slopes. Bats have been detected near the Park Headquarters Visitor Center and Hosmer Grove (Frasher, et al) but there has been no effort made by HALE personnel to determine whether bats occur along the Park road corridor. Even though several sightings have been reported near HO, it is unlikely that the bat is a resident of the area, due to the relatively cold summit temperatures and the lack of flying insects in the area, which is the preferred food source (AFRL, 2005). The ‘ope’ape’a has been observed both visually and acoustically along the Park road corridor at all elevations.

The nocturnal ‘ope‘ape‘a is the only native terrestrial mammal known to occur in the Hawaiian archipelago, although other bat species have been found in sub-fossil remains. According to the USFWS, relatively little research has been conducted on this endemic Hawaiian bat and data regarding its habitat and population status are very limited. It is believed that bats typically depart the roost shortly before sunset and return before midnight, although this is based on a small number of observations (USFWS, 1998). Bats are most often observed foraging in open areas, near the edges of native and non-native forests, or over both marine and fresh open water, and over lava flows. Roosting bats have been recorded from a variety of species including hala *(Pandanus tectorius),* kukui *(Aleurites moluccana),* pukiawe *(Styphelia tameiameaiae),* java plum *(Syzygium cumini),* ohia lehua *(Metrosideros polymorpha),* and *Eucalyptus* sp. Bats have been observed feeding from 3 to 492 feet above ground and water. Most of the available data suggests that this elusive bat roosts solitarily in the foliage among trees in forested areas.

Habitat requirements may vary seasonally and with reproductive condition, but this is not clear. Breeding probably occurs mostly between September and December, with young being born in May or June. Hawaiian hoary bats do not migrate off island, although seasonal elevation movements and island-wide migrations may occur. The availability of roosting sites is believed to be a major limitation in many bat species, but other threats to this subspecies include direct and indirect effects of pesticides, predation, alteration of prey availability (introduced insects), and roost disturbance (USFWS, 1998). The recovery plan for the Hawaiian hoary bat (USFWS, 1998) suggests the subspecies is experiencing a moderate degree of threat and has a high potential for recovery. Critical habitat has not been designated for this species.

3.3.3.2 Other Native and Introduced Fauna

Avian species are abundant along the Park road corridor. Other avian inhabitants reported in HALE which are likely to be found along the Park road corridor include but are not limited to, quails, francolins, pheasants, chukars, plovers, sandpipers, doves, pigeons, short-eared owls, northern mockingbird, common myna, house finch, common Amakihi (*Hernignathus virens*)**,** Iiwi, (*Vestiaria coccinea*), (Conant and Stemmermann Kjargaard, 1984). Introduced fauna that could be observed within the summit area and along the Park road corridor include the chukar *(Alectoris chukar),* the feral goat *(Capra hircus),* the Polynesian rat *(Rattus exulans)*, and the roof rat *(Rattus rattus)* (AFRL, 2005). The Indian mongoose *(Herpestes auropunctatus)* is occasionally observed on the summit. These are not listed as Federal- or State- threatened or endangered species. Cats (Felis catus) and mice (Mus musculus) are also found along the Park road corridor, with cats occasionally seen crossing the Park road (HALE unpublished data).

3.3.3.3 Invertebrate Resources

The highest elevations of Haleakalā were once considered lifeless, but biologists have discovered a diverse fauna of resident insects and spiders. These arthropods inhabit unique natural habitats on the bare lava flows and cinder cones. Because they feed primarily on windblown organic materials, they form an aeolian ecosystem.

In Hawaiʻi, Aeolian ecosystems are used to describe those that mostly, but not exclusively, exist on non-weathered lava substrates, found at high elevations (Medeiros, et al, 1994). On Haleakalā, there is an aeolian ecosystem extending up the summit from about the 7,550 feet elevation. It is characterized by relatively low precipitation, porous lava substrates that retain relatively little moisture, little plant cover, and high solar radiation. The dark, heat-absorbing cinder provides only slight protection from the extreme temperatures, and thermal regulation and moisture conservation are critical adaptations of arthropods occurring in this unusual habitat.

Due to the harsh environment, fewer insects are present at upper elevations on Haleakalā than are found in the warm, moist lowlands. However, an exceptional assemblage of insects and spiders make their home on the mountain's upper slopes. A survey and inventory of arthropod fauna was conducted for the 18.166 acres of HO in 2003 for the LRDP. In this study, several species were added to the previous inventory site records. An additional survey including arthropod collection and analysis was conducted in 2005 at the Mees and Reber Circle sites for the proposed ATST Project (Vol. II, C(1)-Arthropod Inventory). The arthropod species that were collected in this study were typical of what had been found during previous studies. Although the study was conducted during the fall months, no species were found that are locally unique to the site, nor were there any species found whose habitat is threatened by normal observatory operations.

A supplemental arthropod inventory in response to comments submitted on the ATST DEIS was conducted in March 2007 for sampling for arthropods at the sites considered in the proposed ATST Project. This report can be found in Vol. II, Appendix C(2)-Supplemental Arthropod Sampling. The goal was to detect additional species that may have been missed during previous samplings. This additional survey, including night sampling, covers a seasonal component not included in the two previous studies. This survey was conducted during the winter months. The results of the arthropod survey indicate there are no special concerns or legal constraints related to invertebrate resources in the project area. No invertebrate species listed as endangered, threatened, or that are currently proposed for listing under either Federal or State of Hawai'i endangered species statutes were found at the project site.

The diversity of the arthropod fauna at HO is somewhat less than what has been reported in adjacent, undisturbed habitat. This is expected, in that buildings, roads, parking areas, and walkways occupy 40 percent of the site. However, the undisturbed habitat on the site that was sampled has an arthropod fauna generally similar to what could be expected from other sites on the volcano with similar undisturbed habitat (Vol. II, Appendix C(1)-Updated Arthropod Inventory and Assessment). Most of the arthropods collected during the 2003 study were largely associated with vegetation at the site. Observatory construction and operations may have increased the suitability of some habitats for plants and increased vegetation and could have caused an increase in the populations of some native arthropod species.

The two proposed ATST Project sites represent an even smaller portion of the habitat overall on Haleakalā. The Mees site is partly undisturbed. Native vegetation is more abundant, and the undisturbed nature of the substrate provides excellent microhabitats for arthropods. The diversity and abundance of arthropods at the Mees Site there is greater than that of the Reber Circle site, but is low compared to the HO site in general and to the surrounding undisturbed habitats found elsewhere on Haleakalā.

The Reber Circle site was previously developed and has very sparse vegetation to support arthropods. The ground there is largely compacted and lacks the structure necessary for most ground-dwelling arthropods. Only the surrounding, undisturbed areas contain habitats in which arthropods can survive. Fewer species of arthropods were identified in the 2005, proposed ATST Project survey than were reported in the 2003, LRDP survey. This was probably due to restricting the sampling to a smaller area — the two sites for the proposed ATST Project. Overall, these two sites contain fewer microhabitats than can be found elsewhere within HO.

Comments on the DEIS indicated that the collective invertebrate inventories obtained at HO did not address certain "Species of Concern" (SOC), although these were not specified (HALE, 2008). Therefore, USFWS was contacted to obtain a list of SOC for the ROI so that future surveys could include those. It should be noted that SOC is an informal term. It is not defined in the Federal Endangered Species Act. The term commonly refers to species that are declining or appear to be in need of conservation. Many agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. According to the USFWS, these species are not directly addressed by the USFWS Section 7 consultations (D. Greenlee, USFWS, personal communication, April 2009). Using an updated (2008) version of the Hawaiʻi Biodiversity and Mapping Program data set, which includes map locations for SOC, the USFWS imported the data to the Hawaiʻi Biodiversity and Mapping Program and no invertebrate SOC were identified in the ROI for the proposed ATST Project (D. Greenlee, USFWS, personal communication, April 2009).

The diversity and abundance of invertebrate species in the Park road corridor and at HO includes introduced arthropods that pose a potential risk to both endemic and native species within the ROI. Two notable examples are the Argentine ant (*Iridomyrmex humilis*) and the Yellow-jacket (*Vespula pensylvanica*) both of which are predators within the high-elevation shrubland that constitutes the northwest slope portion of the Park road, all the way to the summit area, including HO. However, no studies have been done at HALE to determine the diversity and abundance of invertebrates along the Park road corridor and other threats are largely unknown.

Since ants are not a common endemic species in Hawaiʻi (Wilson & Taylor, 1967), introduced species are often successful in the favorable environment. The Argentine ant is one of about 60 species that has flourished since invasions of biological organisms were aided by humans to enter in the Hawaiian Islands. With HALE's large visitor population and vehicular traffic from lower elevations, it is not surprising that several of these predatory ant species have found their way into the Park. The threat to endemic species within HALE has been studied by various researchers and data is available for parts of the HALE that are within the ROI for the proposed ATST Project. For example, the presence of the Argentine ant has been studied along the 0.75 mile of road from entry of the Park to Headquarters, and between mile markers 17 and 18 (Cole, et al., 1992). That study revealed that the relative abundance of the population subsequent to its introduction around 1972 was found to have expanded considerably. At the time of the survey in 1992, the species still only occupied about 1.5 percent of the Park, but the potential to invade much larger portions of the Park than it now occupies was clearly evident. The invasive potential of the Argentine ant requires active management by HALE to prevent further spread of the species, including such methods as inspection, when warranted, of vehicles, freight, and soils that may contain individuals capable of colonizing areas within the ROI.

The Yellow-jacket is also a predator within the upper shrubland of the Park and at HO that has an effect on the varied arthropods on which it preys. It poses a substantial threat to biodiversity within the Park, and since its introduction to Maui in 1978, it has experienced a population explosion in subsequent years (Gambino, et. al., 1990). The identity of its diet and location in HALE (Gambino, 1992) suggests that it is a threat to biodiversity in wide areas of the Park and HO, at lower and upper elevations. In particular, this predator is found within the ROI for the proposed ATST Project, where active management for prevention of widened invasion is required. With a capability to colonize in massive numbers (*ibid*, 1990), any reproducing individuals of this species introduced to the upper slopes of HALE could prove damaging to the biodiversity of the Park taxonomy. Therefore, active management of this species is needed at HO in addition to HALE.

3.4 TOPOGRAPHY, GEOLOGY, AND SOILS

The ROI for the following discussion on topography, geology, and soils includes both the HO and Park road corridor. Unless otherwise noted, the discussion in this section applies equally to all areas within the ROI.

3.4.1 TOPOGRAPHY

The Island of Maui, nicknamed “The Valley Isle” and the second largest of the Hawaiian Islands, is a volcanic doublet: an island formed from two volcanic mountains that abut one another to form the isthmus between them (Fig. 3-8). Mauna Kahalawai, also known as the West Maui Mountain, is the much older volcano and has been eroded considerably. Haleakalā, the larger volcano on the eastern side of Maui, rises above at 10,023 feet ASL. The last eruption occurred at some time between 1650 and 1790, and the lava flow can been seen between Āhihi Bay and La Perouse Bay on the southwest shore of East Maui. Both volcanoes are shield volcanoes and the low viscosity of the Hawaiian lava makes the likelihood of the large explosive eruptions negligible.

The area within the ROI is rugged and barren, consisting of lava and pyroclastic materials. Within a 4-mile radius of HO, the elevation drops to approximately 3,600 feet ASL, with an average slope greater than 30 percent.

The proposed ATST Project is located in the crater area of the Kolekole cinder cone, which developed in the central region of the triple junction rift zone where the Southwest Rift Zone, the East Rift Zone and the North Rift Zone meet (Bhattacharji). Lava deposits in the area are from both the Kula and Hana series.

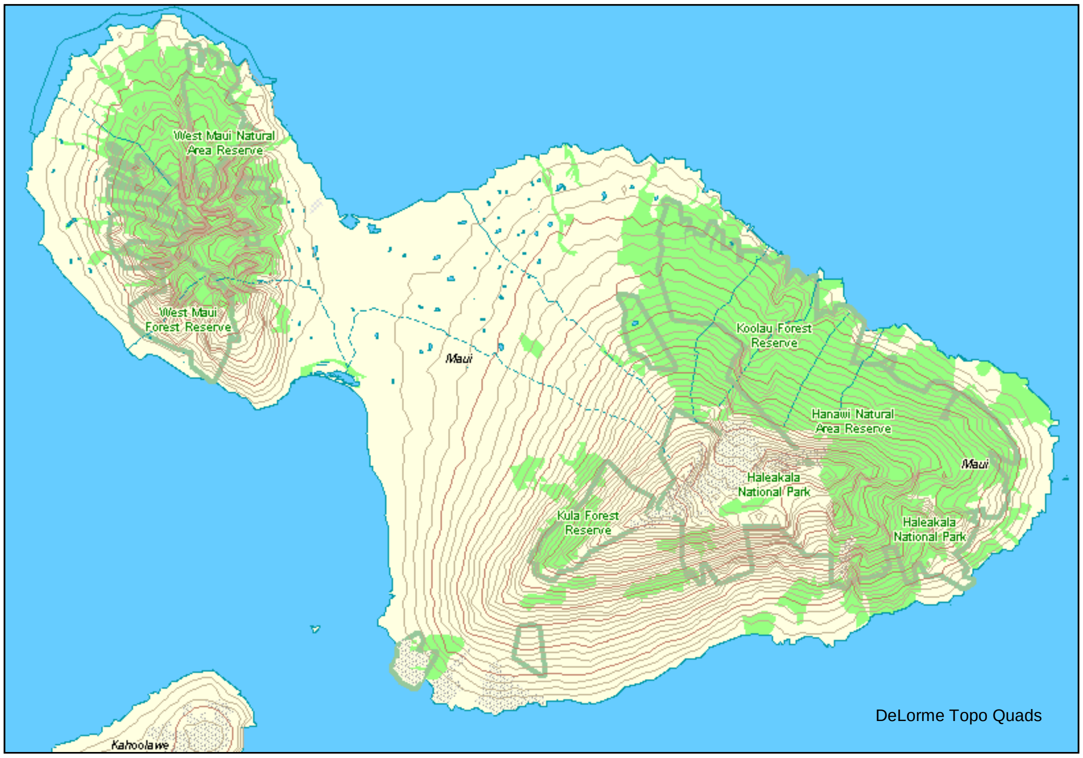


Figure 3-8. Topography for Island of Maui, Hawai'i.

3.4.2 Geology

Over the course of Haleakalā's formation, three distinct phases of eruption have taken place. The first, called the Honomanu Volcanic Series, is responsible for the formation of Haleakalā's primitive shield and most likely its three prominent rift zones. Honomanu lavas are exposed over less than 1 percent of Haleakalā, but are believed to form the foundation of the entire mountain to an unknown depth below sea level. The second series, or Kula Volcanic Series, overlaid the previous Honomanu Series with its lava flows. Eruptions of this series were considerably more explosive than its predecessor, leading to the formation of most of the cinder cones along the three rift zones.

A period of inactivity followed the Kula Series, during which time erosion began to predominate the formation of Haleakalā Crater by forming great valleys leading to the coast. After this long period of erosion, the final volcanic eruptions, called the Hana Volcanic Series, partially filled the deep valleys. Several cinder cones and ash deposits lined the East and Southwest Rift Zones ranging from a few feet high to large cones more than a mile across at the base and 600 feet high. Lava flows within the Haleakalā Southwest Rift Zone range from 200 to 20,000 years old. Six flows have erupted in this area within the last 1,000 years. During the latest eruption, sometime between 1650 and 1790, lava emerged from two vents and flowed into La Perouse Bay, where a small peninsula was constructed. Recent studies have indicated that Haleakalā volcano may still be active, in light of the numerous eruptions during the last 8,000 years (Bergmanis, et al, 2000).

The Mees construction site of the proposed ATST Project consists of polygonal to sub-columnar lava horizons which are broken into large blocks along horizontal and vertical joints. The near horizontal ankaramite lava is ponded and agglutinated with spatter and some cinder (UH IfA, 2005). These lava horizons are several feet thick and intermixed with cinder beds.

During the 2005 survey (Vol. II, Appendix G-Geological Report), neither the Mees site nor the Reber Circle site showed gross evidence of faulting, instability or mass wasting, and in a human-referenced time scale, they do not appear to be geologically unsuitable sites.

3.4.3 Soils

The summit area and the areas adjacent to the Park road corridor are covered with volcanic ejecta consisting of lava, cinder, and ash of the Kula and Hana Volcanic Series. There is no soil development in the immediate vicinity of HO. Soil development occurs with increased distance (greater than 1.5 miles) from the summit. Most of the area is situated on Cinder Land (rCl), which is thought to be of the Kula period of volcanism (U. S. Soil Conservation Service, 1972). A foundation investigation conducted in 1991, in the northern area of HO revealed that cinder in this area is underlain by five feet of volcanic clinker and 16 feet of volcanic cinder.

In March 2005, soil borings at the Mees site identified a soil profile generally consisting of cinder sands and gravels on top of a basalt layer. Soil profiles were obtained from cores at six locations, five within the proposed ATST Project footprint (Vol. II, Appendix K-Soils Investigation Report). Boring six was performed on the west side of the proposed ATST S&O Building site. Moderately hard to hard basalt substrate substantial enough for bearing weight was identified at depths of 5 to 21 feet below grade. Two cores taken at the Reber Circle site identified hard basalt substrate beneath a thin (5- to 15-foot) layer of less consolidated basalt (Dames and Moore, 1991).

3.5 VISUAL RESOURCES AND VIEW PLANE

The ROI for this section includes HO, the Park road corridor, other areas within HALE, and a few areas on Maui as discussed below. Approximately 1.7 million (HALE, 2006) visitors annually are attracted to Haleakalā's various lookouts and vantage points for its spectacular vistas. Looking down the slopes to the northwest, a majestic view of Maui's isthmus and West Maui Mountains is afforded, while to the east are the richly colored scenes of the crater and, on minimal cloud-cover days, the slopes of Mauna Kea and Mauna Loa.

On a cloudless night, Haleakalā also serves as an outstanding platform from which to view the heavens, facilitated by its position above the cloud inversion layer, the clean atmosphere, and the lack of degrading light sources. As indicated on the HALE signage on Puʻu Ulaʻula, "Observatories were built near the highest point on Maui because the air offers the fourth best viewing conditions on the planet. Here above the clouds, the atmosphere is clear and dry, with minimal air and light pollution." Because Haleakalā is blanketed with dark-hued cinders and ash and lacks vegetation, its appearance contrasts sharply with the lush tropical forests found at lower elevations.

Visibility of the HO facilities within HALE varies depending upon one's vantage point within HALE. Several HO facilities are highly visible from Puʻu Ulaʻula (Fig. 3-9). Some HO facilities are partially visible from the Park entrance station to about the first mile of the Park road, the Park Headquarters Visitor Center, portions of the Park road corridor (particularly the last 1/3 of the Park road closest to the summit), and near the summit from the Haleakalā Visitor Center (Pa Kaʻoao, or White Hill).

Overall, visibility of the HO facilities is highly variable depending on a combination of factors. These include locations from where one views them on the island, atmospheric conditions (e.g., dust content, humidity), time of day, cloud cover, and human activity (e.g., cane burning). For example, on a clear, low-humidity day, some of the facilities would be distinguishable as very small man-made objects from as far away as Maʻalaea Bay, which is a distance of approximately 17 linear miles. However, in humid and/or dusty conditions, they may not be visible at all from Maʻalaea Bay or even from locations in

Upcountry Maui at half that distance. Section 4.5-Visual Resources and View Plane describes and presents photographs of various locations on Maui where HO facilities may be visible, again, depending on a combination of factors described above.

Visibility of the summit area from the ROI would be more likely in the early morning before the daytime cloud inversion layer builds up, and in the late afternoon after the inversion layer dissipates. When mid- and upper-level cloud cover is absent, a few of the existing structures at HO are, depending on one's vantage point, visible from miles away. Some of the facilities can also be seen from public viewpoints and highways (see Fig. 4-4) that climb the slopes of the mountain (UH IfA, 2005). The current facilities at HO that are closest to the northern boundary of the property are visible in various locations on Maui. The tallest of these, the metallic 117-foot tall U. S. Air Force AEOS completed in 1994, is easily seen with the unaided eye from most areas within the Central Valley as well as from some windward and leeward communities, especially in morning and late afternoon hours. However, the two white 60-foot tall domes of the MSSS, completed in 1965, are also visible in many of those same areas when the summit area is free of clouds. The colors of the domes of the HO facilities, which are either white or aluminized, make them more or less visible depending on Sun angle, cloud cover, and position of the viewer.

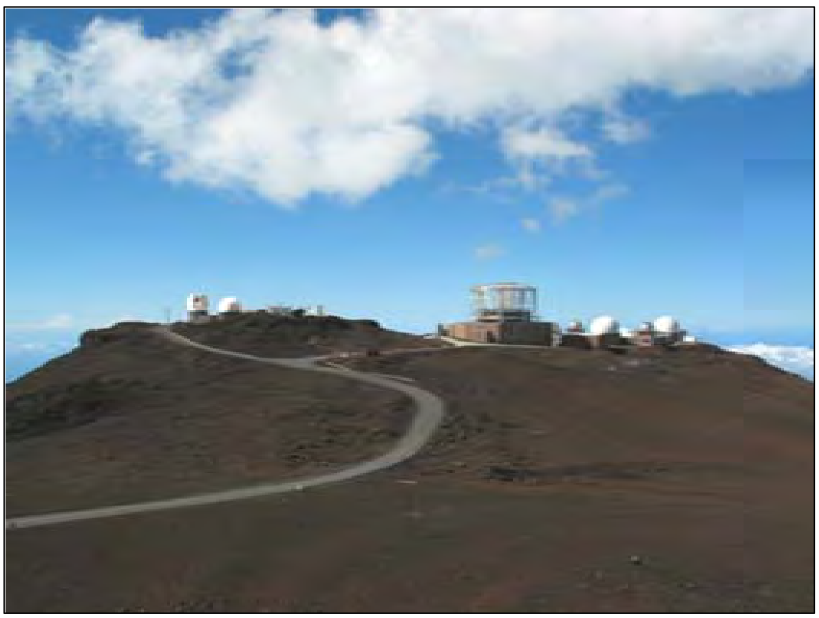


Figure 3-9. Current View of HO from Puʻu Ulaʻula.

3.6 VISITOR USE AND EXPERIENCE

Haleakalā National Park encompasses approximately 33,230 acres and attracts more than one million visitors annually to experience the natural and cultural wonders the park was designated to protect. The Park Headquarters Visitor Center, the Haleakalā Visitor Center and the Kipahulu Visitor Center have cultural and natural history exhibits. Books, maps, and postcards are also for sale. Rangers are on duty during business hours to answer questions and assist visitors. Guided interpretive hikes and activities are available at both the Haleakala Visitor Center and the Kipahulu Visitor Center. There is no food or gas available within the Park. Restrooms are located at the Park Headquarters Visitor Center, the Haleakalā Visitor Center, the Kalahaku Overlook, and at Hosmer Grove, and are handicapped accessible. Limited emergency services are available at both the Park Headquarters Visitor Center, the Haleakalā Visitor Center.

There are three primary visitor areas within the Park. The first, the “Summit Area,” is considered to be the Haleakalā summit. There are two visitor facilities in this area. The Haleakalā Visitor Center, which is near the cinder cone known as Pa Kaʻoao (White Hill), is located on the rim of the crater. Another overlook building accessible by vehicle or foot is located at the highest point of Halealakā on Puʻu Ulaʻula and is also one of the main attractions for visitors to the summit.

The second, the “Wilderness Area,” is located over the majority of the eastern side of the Park. A portion of the Wilderness Area inside the crater is accessed through the Summit Area and offers hiking from two major trailheads: Halemau’u begins at the 7,000-foot elevation along the crater road and Keonehe’ehe’e Trails, also called Sliding Sands, begins in the Summit Area near the Haleakalā Visitor Center. Both trails lead down into the crater floor. The crater area is open to camping. There are two primitive wilderness campsites (Holua and Palikū) and historic cabins situated along the trails. These campsites and cabins are available through Park reservations for overnight stays.

Leleiwi and Kalahaku Overlooks are located along the Park road between the Park Headquarters Visitor Center and the Puʻu Ulaʻula and Haleakalā Visitor Center summit viewing areas. The rare ʻahinahina (Haleakalā silversword) that can be seen at Kalahaku draws many nature enthusiasts (NPS, 2009). Each Overlook is equipped with orientation panels and descriptive displays. Besides boasting a magnificent view of the crater, the Haleakalā Visitor Center also details the geology, archeology, and ecology of the area as well as the wilderness protection programs in exhibits posted throughout the area. Many visitors are attracted to the summit and crater area because of the walking, hiking, camping, and picnic opportunities. Hikes can range from short self-guiding walks to rigorous backpacking for several days. In addition, commercial service providers offer their own trips through the crater on a one day or overnight basis.

Within the crater, at Paliku cabin and campsite, from the top of Kaupo Gap, is another hiking trail. This trail traverses through native shrubland and mesic koa forest to the Park boundary. The trail descends 6,100 feet in 8.7 miles and crosses onto private land before reaching Kaupo Ranch in the village of Kaupo. On the main road, the Kaupo Store is about eight miles away from the Kipahulu area of HALE.

The frequently visited third area is located on the eastern side of HALE near the coast, and is known as Kipahulu. Hiking, swimming, and camping are available in this area of the Park. Hikes are self-guided through the Pipiwai Trail to the Oheo Gulch lower pools where many visitors go to swim. There is no safe ocean entry from anywhere within HALE.

The proposed ATST Project is located within the HO property and is not open to the general public. The closest visitor facility is the Puʻu Ulaʻula Overlook. The Haleakalā Visitor Center and the Keonehe’ehe’e (Sliding Sands) Trail Head are approximately a quarter mile to the east of the entrance to both the Puʻu Ulaʻula Overlook and the road leading to HO. Haleakalā Observatories are clearly visible from the Pu’u ʻUla’ula Overlook located directly to the northeast of the proposed ATST Project location.

In a 2007 survey of visitors exiting from HALE, 75 percent of respondents reported they would be very likely to return to Haleakalā to tour the ATST. HALE has indicated that this survey is significantly flawed and likely biased and there are significant technical errors in the instrument and related reporting. Also, HALE indicated that the conclusions are based on an insufficiently designed and administered survey. Despite the flaws, the proposed ATST Project found that approximately 22.3 percent of respondents to the survey saw and read the observatory sign, and approximately 21.2 percent took pictures of the observatories. This study also found little negative reaction to an addition of the proposed solar observatory, as approximately 60 percent of respondents did not care if the new observatory was built. Approximately 33 percent of respondents were in favor of the building of the new observatory, (Vol. II, Appendix N-Haleakalā Visitor Survey).

A visitor's survey was conducted between March 26 and April 1, 2000 by the NPS Visitor Services Project as part of the Cooperative Park Studies Unit at the University of Idaho. This study was conducted to assess the visitor's use of the Park and to support visitor's use of the backcountry area of HALE. This study found that backcountry campers and cabin users contribute their sense of being in wilderness to the following factors: 1) experiencing solitude; 2) hearing natural sounds/quiet; 3) a perceived lack of human presence and/or development; and, 4) observing the Park's flora and fauna (Lawson et al, 2008).

Outside of HALE, an unimproved, access road known as Skyline Drive originates 0.5 mile away from HO at the Saddle Area. It traverses the Southwest Rift Zone, ultimately leading to Spring State Recreation Area (also known as Polipoli State Park), which is located at 6,200 feet ASL within the fog belt of the Kula Forest Reserve (DLNR, Hawaiʻi State Parks). Its entire length is located on State land within the Forest Reserve. A locked gate near the Saddle Area restricts vehicle access to the road from the Haleakalā summit to only those holding DLNR permits. Hikers, hunters, and bicyclists use the unpaved road. There are sections of this trail that have a steep grade and soft cinder roadbed that will not support standard construction truck traffic, only smaller vehicles with four-wheel drive.

3.7 WATER RESOURCES

The ROI for water resources includes HO, the affected areas within HALE and the Park road corridor. The entire ROI is within the Waiakoa and the Manawainui Gulch watersheds. As shown on Figure 3-10, the groundwater boundaries are the Kamaole and Makawao Aquifer Systems of the Central Aquifer Sector and the Lualailua and Nakula Aquifer Systems of the Kahikinui Aquifer Sector (AFRL, 2005). A sector is a large region with hydro-geological similarities that primarily reflects broad hydrogeological features, and secondarily, geography. A system is an area within a sector showing hydro-geological continuity.

There is no source or supply of water at the summit area of HO. At various times during the year — particularly the winter months — rainwater is collected from building roofs, etc., and stored in water catchment systems. To supplement this source, water is trucked to each user in certified tanks where it is stored on-site. Users maintain their own collection systems and storage tanks for potable and/or non-potable water, as well as their individual pumping and distribution systems.

Within HALE, there are only surface water resources. Maui has both perennial and intermittent streams, with the former concentrated on the wetter north slopes of the island (DLNR, Maui Watershed). Streams in the affected portion of HALE are largely intermittent runs that are typically dry in good weather. These runs cross under the Park road corridor under the bridge and through the 11 box culverts and other drainage that permit water to flow downhill without crossing over the road surface. During heavy winter rains, stormwater flows in the intermittent channels and visitors sometimes experience the sight of very rapid flow in stream beds that were dry only a short time before. Aerial maps show that numerous channels within HALE coalesce into wider and deeper channels down slope, some of which reach the ocean.

At HALE, water is not drawn from the subsurface aquifer to provide for visitor drinking water. Water from surface sources is utilized via catchment and storage systems. Within or near the Park road corridor, catchment rainwater is stored in tanks that provide for toilets at Hosmer Grove, the Park Headquarters Visitor Center, the Haleakalā Visitor's Center and the Kalahaku Overlook. Drinking water is also available from catchment sources at the Park Headquarters Visitor Center and the Haleakalā Visitor's Center. Within the crater, water tanks supply the campsites. All of these sources are wholly dependent upon rainfall and may not be available during long periods of drought. Because the entire ROI is within the Waiakoa and the Manawainui Gulch watersheds and because all public water resources in HALE are of surface water origin, the following discussion of surface water applies to the affected environment for HO, relevant areas of HALE, and the Park road corridor.

3.7.1 Surface Water

The primary hydrologic unit for describing stream flow is the drainage basin, whereas the principal division for groundwater is the aquifer system. Because groundwater flow is governed by subsurface geological continuity rather than by topographic controls (Yuen and Associates, 1990), the boundaries of drainage basins and aquifer systems do not necessarily coincide. Drainage basin boundaries for the proposed ATST Project are the Waiakoa and Manawainui Gulch watersheds, two of the 112 Maui Watershed Units totaling 466,437 acres.

Most streams on Haleakalā are intermittent because of the steep, permeable lava terrain. The nearest intermittent streams are approximately 1.9 miles down slope of the proposed ATST Project site within HALE. Perennial streams at low elevations originate from groundwater springs.

There are no water bodies within the affected areas of HALE, along the Park road corridor, or at the HO site. An area of lower elevation within HO acts as a ponding and infiltration area for stormwater at Puʻu Kolekole cinder cone (AFRL, 2005). The Polipoli Springs water system is within the proposed ATST Project aquifer system. The Polipoli Spring State Recreation Area water system is in the Kahikinui Forest Reserve which is 9.7 miles upland from Kula on Waipoli Road. The water system is owned and operated by the State of Hawaiʻi and managed by the DLNR State Parks. The water system serves a park cabin and campsite area. The non-potable source for the water system is an unnamed spring whose water flows to the campsite area through a 1.5-inch pipe. The estimated water demand is 2,000 gallons daily (Fukunaga and Associates, 2003).

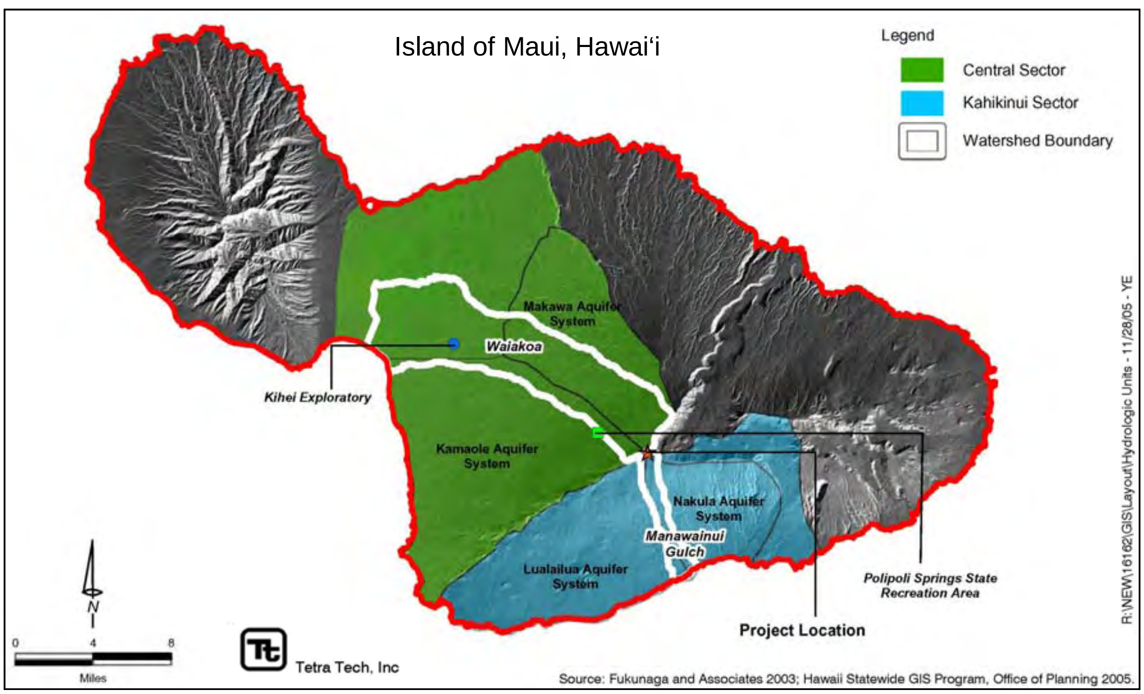


Figure 3-10. Hydrologic Features.

Drainage Features

On the native slopes of Haleakalā, virtually all precipitation infiltrates the soil profile. Once in the soil, gravity continues to force the water down into the soil. When the water hits a less permeable layer, such as basalt, it flows in the path of least resistance. This means subsurface water flows, driven by gravity, down gradient along the surface of the basalt layer. The flow continues along the interface between the highly pervious cinder material and the basalt layer until it either resurfaces as a spring or stream or flows into a fissure in basalt, contributing to groundwater storage (UH IfA, 2005a).

In March 2005, soil borings were advanced at HO to support design planning for construction of the proposed ATST Project (Vol. II, Appendix K-Soils Investigation Report). The results of the exploratory borings revealed that the soil profile generally consists of sands and gravels on top of a basalt layer. This means water can easily infiltrate the upper soils and then becoming significantly slowed when it reaches the basalt layer, which ranges from 5 to 21 feet (UH IfA, 2005a).

All precipitation falling near the summit is infiltrated and flows subsurface toward the natural drainage courses, such as Manawainui Gulch. Loss of rainfall would be caused by evaporation in the soil column (UH IfA, 2005a). Due to site topography, as well as a small collection of stormwater conveyance systems consisting of concrete channels and culverts, runoff generated within the HO site is controlled and conveyed via natural drainage paths to an infiltration basin at the western extremity of HO property. This infiltration basin is a depression that represents an old vent on the cinder cone, and its substrate is considerably more porous than the lava or spatter portions of Kolekole. The runoff collection system was originally designed to maintain stormwater runoff on paved surfaces and consists of gutters and channels intended to prevent stormwater from discharging onto native soils adjacent to paved surfaces. Ten main stormwater flow paths have been identified at the HO site. Figure 3-11 illustrates the existing runoff patterns associated with HO.

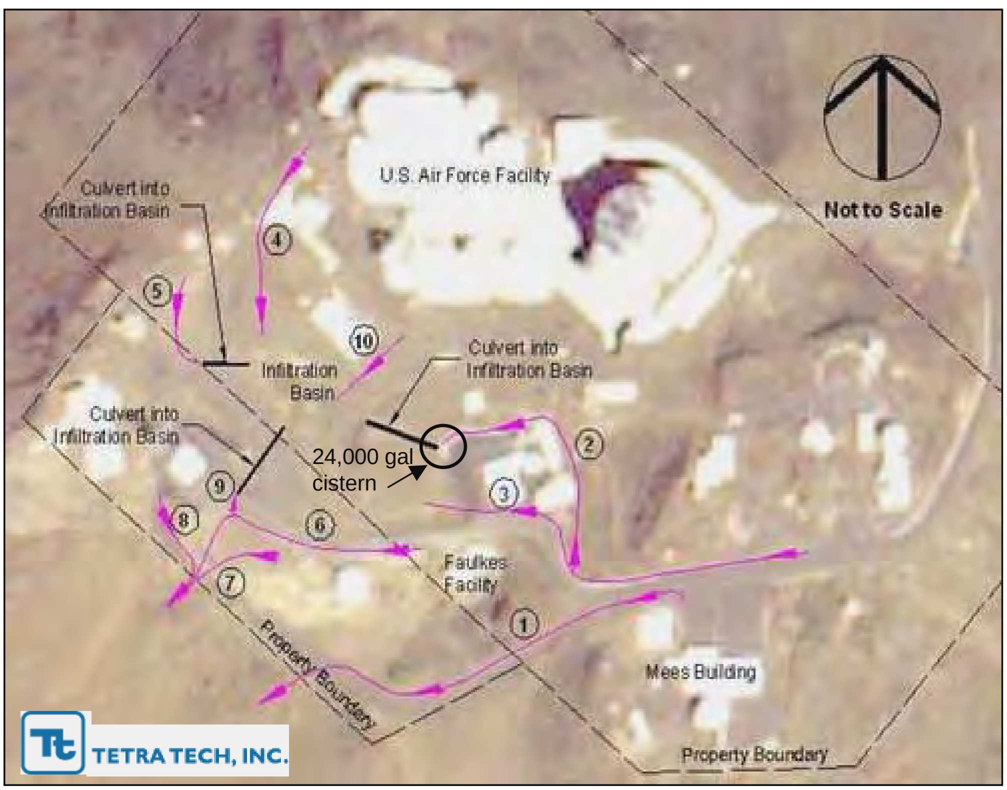


Figure 3-11. Existing Stormwater Runoff Patterns at HO.

The following is a brief description of each flow path in the HO drainage system:

Flow Path 1: Runoff from the parking lot associated with the MSO facility leaves the paved surface and flows down an abandoned road. The runoff then flows across a flat area before discharging along the southern slopes of the volcanic cone.

Flow Path 2: Runoff from the upper portion of the site drains onto the road and flows into a pipe conduit. As originally designed, the runoff was to enter a concrete channel constructed behind the gathering of buildings and then be conveyed through a culvert into the infiltration basin. However, the concrete channel was subject to debris entry.

Flow Path 3: Due to temporary blockage of Flow Path 2, concentrated runoff flow was redirected along the paved areas associated with the cluster of buildings. An asphalt berm was constructed to direct the runoff away from the buildings and toward the infiltration basin. Once the runoff discharges onto the native material, the flow dissipates into multiple undefined channels leading toward the infiltration basin.

Flow Path 4: Stormwater runoff from a small portion of the Air Force complex, along with runoff from the access road and concrete storage areas, flows along the edge of the road leading toward the infiltration basin.

Flow Path 5: The native soil in this Department of Energy (DOE)-controlled area appears to have been affected from past activities such as parking and storage. Runoff from this area is conveyed to the infiltration basin through a culvert under the access road.

Flow Path 6: This concrete channel is designed to convey runoff from the road and from the Faulkes facility. The channel leads to two culverts under the access roads. The lower portion of the channel is a deposition location for sediment prior to where it enters the first culvert.

Flow Path 7: Runoff flows toward the south.

Flow Path 8: A portion of the runoff from the FAA facility flows toward the south and discharges over the slopes of the volcanic cone.

Flow Path 9: Runoff within the concrete channel was designed to flow into the infiltration basin through a series of two culverts that were placed under access roads

Flow Path 10: A portion of the Air Force facility generates stormwater runoff that flows into the infiltration basin. The paved surfaces associated with the facility have curbs, which keep the runoff on paved surfaces until it enters the pipe network which discharges into the infiltration basin.

Runoff harvesting is also part of the drainage features at HO. Runoff from the MSO facility building is captured and stored in the adjacent 64,100 gallon cistern and is used for domestic water; and a 24,000 gallon cistern is associated with the former Neutron Monitoring Station below the MSO facility. Some of the runoff from the IfA facilities is captured by these cisterns before it reaches the infiltration basin.

3.7.2 Groundwater

As previously mentioned, the groundwater resources below HO are characterized as part of the Kamaole and Makawao systems of the Central sector and the Lualailua and Nakula systems of the Kahikinui sector. The characteristics of the groundwater of the Kamaole, Makawao, Lualailua, and Nakula systems are the same as those of the nearby systems and sectors. A high level, unconfined, perched aquifer exists above a high level unconfined aquifer in dike compartments. Groundwater in both the upper and lower aquifers was identified as freshwater (containing less than 250 milligrams per liter of chloride) that has the potential for future use as drinking water, but it was not being used when the aquifer was classified. The upper aquifer is classified as being replaceable and highly vulnerable to contamination, while the lower dike aquifers are classified as being irreplaceable and moderately vulnerable to contamination. There are no drinking water wells within 11 miles of the summit (AFRL, 2005).

The current MSO facility utilizes a cesspool for handling wastewater and septic waste. Although this issue is discussed in Section 2.4.4-Telescope Operation Activities, the handling of wastewater has the potential to affect subsurface water quality and is therefore mentioned briefly here. As a part of the proposed ATST Project, a new wastewater treatment plant would be installed near the MSO facility after removing the cesspool and remediation of the site. The new plant would be underground in the same vicinity as the previous cesspool. Installation of the treatment facility and the method of effluent distribution would be in accordance with the permits and procedures of Maui County and the State Department of Health. The proposed wastewater treatment plant and wastewater issues are discussed in Section 2.4.4-Telescope Operation Activities.

3.8 HAZARDOUS MATERIALS AND SOLID WASTE

The ROI for hazardous materials (HAZMAT) and solid waste includes HO, the Park road corridor, and the portion of the State highway leading up to the HALE Park road corridor. This section focuses primarily on the HO portion. This section focuses on the solid and hazardous waste management and disposal practices at HO because this location is the main user of such materials and solid waste on the summit. Regulation of transportation of hazardous waste and material on the Park road corridor is governed by NHP Regulations as well as State transportation regulations. The State highway leading up to the Park road is under jurisdiction of the State Highway Department of Transportation. Regulations requiring a permit for transportation of heavy and wide truck transportation of project equipment will be required from the State Highways Maui District Office of the Hawaiʻi State Department of Transportation. Load capacities are also governed by the State agency. This section also covers the regulations applicable to each of these topics.

Solid waste, as defined under Section 1004(27) the Resource Conservation and Recovery Act (RCRA), refers to any solid, semisolid, liquid, or contained gaseous materials discarded from industrial, commercial, mining, or agricultural operations, and from community activities.

Hazardous waste, as defined by the EPA, Title 40 of the CFR, Chapter 1, Subchapter I-Solid Wastes, Part 261-299, refers to substances that have “imminent and substantial danger to public health and welfare or the environment.”

Contaminated sites are areas of soil or water where hazardous substances occur at concentrations above background levels and where assessment shows it poses, or is likely to pose, an immediate or long-term hazard to human health or the environment.

3.8.1 Solid Waste

Because of the remote location of HO, each facility must be diligent when handling or managing waste. Each facility within the HO complex has its own trash receptacle and each facility’s building maintenance personnel are responsible for trash collection. Non-hazardous trash is disposed of off-site in a licensed landfill, with computer paper and aluminum being recycled (UH IfA, 2001). IfA picks up approximately four to five bags of solid waste once a week from the MSO facility and other facilities at HO under their jurisdiction (i.e., the Atmospheric Airglow facility, the Zodiacal Observatory, and the FTF). Municipal solid waste from MSSC, such as food trash, is collected twice a week for off-site disposal at the Central Maui Landfill. Other wastes associated with MSSC operations and maintenance, such as used oil, are collected in containers within the AEOS facility and transported off-site for disposal as non-hazardous waste. MSSC generated 3,335 pounds of non-RCRA waste in fiscal year 2004 (Shimko, 2004).

Maui County owns and operates two municipal solid waste landfills on Maui: the Central Maui Sanitary Landfill and the Hana Sanitary Landfill. The Central Maui Landfill recently opened a new section, referred to as Phase 4, which accepts approximately 450 tons per day and is expected to reach capacity in 2012. The Hana Sanitary Landfill accepts approximately three tons per day and is expected to reach capacity in 2055 (Baker, 2005). Commercial construction and demolition debris is banned from the County landfills on Maui. The private Maui Demolition and Construction Landfill in Maʻalaea receive this type of debris from commercial haulers for disposal. (County of Maui, 2008a and 2005).

3.8.2 Hazardous Materials

The ATST Hazardous Material and Hazardous Waste Management Plan (HazMat Plan) was finalized in April 2006 and provides extensive guidance on hazardous material and hazardous waste management for the proposed ATST Project. The HazMat Plan addresses the following topics:

1. Responsible personnel,
2. Hazardous material management,
3. Inventory control procedures,
4. Criteria for determining hazardous waste,
5. Accumulation of wastes for conditionally exempt small quantity generators (SQG),
6. Storage of hazardous waste,
7. Preparedness and prevention,
8. Emergency spill procedures; and,
9. Specific information on the disposal of various materials/wastes; and hazardous waste minimization.

Guidance on HAZMAT at HO that cover the entire HO property is provided via management plans from IfA (UH Manoa, 2002, and UH IfA, 2005b) and the AFRL (Boeing, 2005b), which are required by several Federal/DoD regulations. Table 3-9 lists these plans, an overview of their guidance, and the regulations under which they are required. Implementing these plans ensures that EPA requirements for hazardous waste management and spill contingency are fulfilled at HO.

Hazardous waste and petroleum product wastes from operations at the MSSC (no other HAZMAT are used at other sites) are segregated at their generation points (e.g., utility building or laboratory) and are handled separately. Hazardous waste at MSSC is managed in the 270-day hazardous waste storage unit, and the average storage time in fiscal year 2004 ranged from 42 to 153 days. A waste disposal contractor transports and disposes of hazardous waste two to three times per year. Hazardous wastes are sampled and analyzed by the waste disposal contractor prior to off-site disposal. MSSC is a small quantity generator (SQG), which means that it can generate between 220 and 2,205 pounds of hazardous waste per month (AFRL, 2005). The amount of RCRA-regulated wastes generated at MSSC for FY 2004 was 684 pounds and included such materials as waste aerosols, gel-cell batteries, combustible liquid materials, chemicals, paint, and mercury, among others.

Other facilities at HO have varying amounts and types of HAZMAT on-site and would be considered SQGs or contain no HAZMAT at their facility. The MSO facility, the FTF, the Pan-STARRS, the Zodiacal Light Observatory, and the Airglow Facility do not have HAZMAT on-site and are not considered SQGs.

Hawaiʻi does not have a hazardous waste disposal facility; therefore, hazardous waste is shipped to the continental United States for proper disposal.

Spill prevention at MSSC is guided by the February 2003, Spill Prevention Control and Countermeasure Plan for MSSC, prepared by Rocketdyne Technical Services, a Boeing Company (Rocketdyne, 2003). This plan outlines procedures for carrying out response actions for releases of HAZMAT into the air, soil, or water that pose a threat to human health or the environment.

Table 3-9. Hazardous Materials Management Plans at HO.

Category	Plan Title	Description	Required by
Hazardous Waste	Hazardous Waste Management Plan	Plan should contain information on emergency contacts, hazardous waste inventory and location, and waste management procedures and must include a waste analysis plan.	UH Hazardous Materials Management Program, Oct. 2002 and AFI 32-7042.
	Contingency Plan	The plan should set forth the procedures for conducting response actions in case of hazardous waste releases into the air, soil, or water that pose a threat to the environment.	Title 40 CFR Part 265, Subpart and UH IfA Hazardous Material and Hazardous Waste Management Program, Rev. Dec. 1, 2005.
Hazardous Materials	Hazardous Material Emergency Planning and Response Plan	Provides guidance on handling known and unknown HAZMAT. The plan must integrate the various emergency action, response, and contingency plans for releases into the environment.	AFI 32-4002.
	Halon Management Plan	Also referred to as the Halon 1301 Management Plan. The plan must provide an inventory of Halon 1301 systems and an implementation schedule for removal or replacement.	AFI 32-7086.
	Refrigerant Management Plan	Also known as Class I ODS (ozone-depleting substance) Refrigerant Management Plan. This plan should include information on leaking equipment, a retrofit schedule, and set forth procedures for recovery of ODSs.	AFI 32-7086.

(Boeing LTS 2004, 2005a, 2005b, IfA 2005b, and UH Manoa, 2002)

The UH Hazardous Material Management Program, dated October 2002, governs the handling of HAZMAT for the HO site. The management plan complies with applicable Federal, State, and local regulations that govern the use of HAZMAT and the disposal of hazardous wastes. The handling of hazardous waste emergencies at MSSC is directed by the Hazardous Material Emergency Response Plan for the MSSC, which was most recently revised in June 2004 by The Boeing Company, which has the prime responsibility for spill response (Boeing, 2005b). The HAZMAT plan identifies emergency contacts, an emergency action plan, organizational roles and responsibilities, site-specific contingency plans, information on hazards analysis, response functions, public information and community relations, as well as information on containment and cleanup.

Spills or Releases

There has been only one recorded material spill incident within HO. On September 11, 1999, a subcontractor working at MSSC released 330 gallons of a 20 percent mixture of propylene glycol and water into the cinders and rock. (NOTE: The Food and Drug Administration (FDA) has determined propylene glycol to be “generally recognized as safe” for use in food, cosmetics, and medicines.) All required notifications were made to the appropriate agencies and personnel. A containment trench and a plastic covering were installed immediately. The EPA was not contacted because the material did not violate RCRA and was not Federally-regulated.

The site was cleaned up on Saturday, September 18, 1999. A trench was dug around the contaminated area, plastic was used to cover it, samples were collected and prepared for shipment to a certified lab in Honolulu, and photographs were taken. Soils were excavated to a depth of six inches in the contaminated areas and at three feet along an area where a concrete slab acted as a dam. The excavated soil was placed in containers and covered with plastic sheeting. A "no further action" letter was received from the State of Hawaiʻi, Hazard Evaluation and Emergency Response on September 27, 1999 (Ueshiro, 1999), and the site does not pose any risk to human health. There have been no spills or releases at any of the other facilities on HO (Shimko, 2005).

Transportation

Hazardous materials related to the operation of current HO facilities, and as required for the proposed ATST Project (described in Section 2.4.4-Telescope Operation Activities), require transportation on the public roads leading to the site. This includes the Park road corridor, which is subject to traffic congestion during peak tourist seasons and times of day. Since the risk posed by potential spills of HAZMAT would be heightened in the presence of traffic congestion, the transportation of these materials would be scheduled in advance with HALE to avoid peak traffic hours. The other safeguards and regulations that would apply to the transportation of HAZMAT are outlined in Section 2.4.4-Telescope Operation Activities.

3.9 INFRASTRUCTURE AND UTILITIES

The ROI for infrastructure and utilities includes HO, the adjacent FAA facilities, and the HALE Park road corridor.

3.9.1 Wastewater and Solid Waste Disposal

Septic tanks are the primary means of sewage disposal within the summit area. There is no central waste/sewage collection or storage system at the Haleakalā summit. Each user provides for the collection and proper storage of wastewater and sewage generated by that site.

Trash collection is the responsibility of building maintenance personnel for each facility located within the HO complex. Non-hazardous trash is disposed of off-site in a licensed landfill, with computer paper and aluminum being recycled. Hazardous wastes and petroleum product wastes are segregated at the generation point and handled separately.

3.9.2 Stormwater and Drainage System

On the slopes of Haleakalā, as mentioned in Section 3.7-Water Resources, virtually all precipitation will infiltrate into the soil profile. Once in the soil, gravity continues to force the water down into the soil. When the water hits a less permeable layer, such as basalt, it will flow in the path of least resistance. At the HO site, this confining layer of basalt ranges from depths of 5 to 20+ feet. The significance of a confining layer of basalt near the summit area is that all precipitation falling near the summit is infiltrated and flows subsurface toward the natural drainage courses such as Manawainui Gulch. As a result, runoff from the impervious surfaces associated with HO facilities and adjacent roads may not increase the total volume of stormwater flow entering natural drainages, but may only affect the way it is transported there (UH IfA, 2005a).

3.9.3 Electrical and Communications Systems

MECO generates electricity for the HO site. There is a 3750/4688 kilovolt-ampere (kVA) transformer at the Kula substation that presently serves HO. The site is connected via 23 kV conductors on power lines to a 450 kVA transformer bank and voltage regulators at a substation within HO and distributed from there.

MECO is planning an upgrade to the HO substation that is expected to provide sufficient power for the proposed ATST Project. ATST Project engineers have submitted an official request for service and have been in cooperative contact with MECO to provide anticipated power demands and to investigate ways to minimize power consumption during peak electrical demand hours.

Hawaiian Telcom provides telephone and other communications services for the HO complex. HO is currently served for data and telephone connectivity by a range of copper, fiber-optic, and microwave lines. The U. S. Air Force facilities are served by a dedicated fiber cable with OC3C capacity. The IfA facilities are served by a microwave link with DS3 capacity. Hawaiian Telecom provides commercially available copper and fiber-optic lines to HO with more than 100 percent reserve capacity.

The Federal Aviation Administration (FAA) operates and maintains 50 Watt transmitter and receiving equipment for remote air/ground interisland and trans-Pacific communications to and from aircraft. The antennas for these transmitters/receivers are located on two towers within the FAA property adjacent to HO. The frequencies for transmission and receiving are in the Very High Frequency (VHF) and Ultra-High Frequency (UHF) radio bands, to and from transiting aircraft at altitudes from 8,000 to 50,000 feet.

3.9.4 Roadways and Traffic

The Haleakalā Crater Road (State Route 378) is the only route to the summit of Haleakalā that would be viable for construction and operation of the proposed ATST Project. Various route options in the upper Kula community intersect to a two-lane County- and State-maintained road. This road continues to the entrance to HALE and to the boundary adjacent to HO. This road is the only access to HO and is maintained by HALE.

At the point where State Route 378 becomes the HALE Park road, the existing Park entrance station currently presents restricted access to wide loads. The proposed means to allow passage of wide loads required for construction of the proposed ATST Project is described in Section 2.4.3 (Construction Activities, HALE Entrance Station Clearance).

The condition of the road through HALE has been investigated by the Federal Highway Administration (FHWA). The report from that investigation is included in Vol. II, Appendix P-FHWA, HALE Road Report. The pavement condition, at the time of the field testing campaign conducted by the FHWA in early 2009, is characterized in three different sections, identified by milepost (MP) location. "From mile post (MP) 10.3 to 11.2 and from MP 14.8 to 21.2, the roadway appears to be performing adequately without any noted severe structural problems or distresses and should continue to perform well with a continued maintenance program. The remaining service life for MP 10.3 to 11.2 is estimated at 15 years or more, and for MP 14.8 to 21.2 the service life is estimated at 8-10 years. This remaining service life however could be reduced with increased traffic volumes and larger than expected traffic loadings. The pavement section from MP 11.2 to MP 14.8 has also received numerous overlays but has not performed as well due to the unstable underlying conditions and water issues. This section exhibits severe fatigue cracking and associated water bleeding/pumping and loss of underlying materials. Based on the investigation performed and the data gathered, the pavement from 10.3 to 11.2 and MP 14.8 to 21.2 should continue to perform well with a regular maintenance program. However, the pavement from MP

11.2 to 14.8 is at or near the end of its service life and will continue to deteriorate at a faster rate over time." The summary of the FHWA states that: "It is recommended that the Park begin planning for a rehabilitation project in this section [MP 11.2 to 14.8]. While the rehabilitation my not have to occur in the next 3 to 5 years, it is expected that reactive and routine maintenance (small patches and pothole repairs) will increase until rehabilitation is completed."

With regard to the condition of the culverts along the Park road, the FHWA HALE Road Report concludes: "All metal and concrete box culverts inspected have the minimum specified cover to withstand an H-20 loading. The culvert with the least amount of cover, which should be monitored during construction, is the culvert at site #26 (Vol. II, Appendix P-FHWA Report, Table 8). It is also recommended that the masonry stone work at all structures including box culverts and retaining walls be photographed prior to start of ATST project work. Unless a construction vehicle comes into direct contact with a structure it is not anticipated that the minimal construction traffic would impact the stone masonry."

The FHWA HALE Road Report notes the generally sound condition of the bridge located on the Park road, based on inspection reports; however, they recommend specific measures and precautions to protect its structural integrity as noted in Section. Although constructed in 1934 the bridge has a favorable load rating as was noted in the 2005 inspection report. Nevertheless, it would be prudent to require written notification within 30 days of each anticipated occurrence of vehicle loadings above legal limits crossing the structure. Diagrams showing vehicle configuration (axle spacing and width), weight per axle, and overall vehicle widths and lengths should be presented to the NPS for verification by the Federal Lands Highway Bridge Office for conformance with current load rated capacity. With the anticipated heavy and wide loads that will be necessary for the construction, the probability of accidental damage to the bridge will also proportionally increase. It is recommended that prior to the construction notice to proceed that the bridge be photographed, inspected and documented as to existing condition. Periodic monitoring during the construction project may be employed if actual construction traffic deviates from [that estimated by ATST engineers]...to verify that the bridge is not being impacted due to construction activities resulting from the project."

There are two other access roads that serve the Haleakalā summit area. The FAA maintains an exclusive access road to facilities in the Saddle Area and the FAA Low Site. There is also an unimproved access road known as Skyline Drive originates at the Saddle Area and traverses the Southwest Rift zone, ultimately leading to Spring State Recreation Area (also known as Polipoli State Park) (DLNR, Hawaiʻi State Parks). Its entire length is on State land within the fog belt of the Kula Forest Reserve. Approximately half of it is in the Limited Subzone of the State Conservation District and the remaining half in the Resource Subzone. A locked gate near the Saddle Area restricts vehicle access to the road from the Haleakalā summit to those holding DLNR permits. Hikers, hunters, and bicyclists use the unpaved road. The slopes along the existing road range from flat to 28 percent. The surface area consists of small lava cinder rock from which the small particulate resulting from weathering over time has been washed to a level approximately three feet below the surface (UH IfA, 2001). Due to the steep grades, tight turns, and soft roadbed conditions of this access road, it is not appropriate for the range of vehicles necessary for construction, maintenance, and operation of HO facilities.

The current daily operational workforce level at HO averages from 60 to 80 individuals, including technicians and science team members and facilities staff (UH IfA, 2005). As shown on Table 3-10, a 2003 traffic study included in the LRDP showed an average daily total traffic volume of 48 vehicles entering and leaving HO.

The State of Hawaiʻi Department of Transportation (DOT) conducted the most recent 24-hour traffic survey on September 19 and 20, 2007 (DOT, 2007). This survey was conducted at the intersection of

Haleakalā Crater Road, Haleakalā Highway, and Kekaulike Avenue and counted individual vehicles traveling on Haleakalā Crater Road. On September 19, 2007, the traffic volume in a 24-hour period totaled 1,562 vehicles (796 entering the region and 766 exiting). On February 20, 2009, the 24-hour traffic volume totaled 1,439 (734 entering and 705 exiting) (DOT, 2007). These counts are relatively consistent with a previous traffic study in 2003, which recorded a total two-way 24-hour traffic volume of 1,616 at the same location.

Volume/Capacity (V/C) design standards and the level of service (LOS) ratings for Haleakalā Crater Road were not available at the time this traffic impact analysis was completed. V/C measures traffic demand on a facility (expressed as volume) compared to the traffic carrying capacity. In other words, this is the ratio of the level of vehicular travel for a roadway to the amount of designed capacity on the roadway. A V/C ratio of 1 means the roadway is functioning at capacity and congested conditions are expected to occur (APA, 2002). LOS refers to a standard measurement used by transportation officials that reflects the relative ease of traffic flow on a scale of A to F, with free-flowing traffic being rated LOS A and congested conditions rated as LOS F (FHWA). HALE is conducting traffic studies to develop a Draft Traffic Management Plan to address parking and visitor traffic volume congestion at the summit.

Visitors to HALE generate most of the vehicle traffic on Haleakalā Crater Road, with the highest traffic volumes occurring in the early morning hours when visitors experience the sunrise. The high elevations combined with relatively steep grades and numerous switchback curves on the road, limit vehicle speeds, particularly trucks and tour buses.

The FHWA study of the condition of the road through HALE also characterized the current traffic volume on that road, based on statistics provided by the NPS. Tables 9 and 10 in the FHWA report (Vol. II, Appendix P-FHWA HALE Road Report) depict an average traffic volume from 2004 to 2008 of approximately 190,000 total vehicle trips annually, comprising approximately 443 daily passenger car trips and 30 daily bus trips. To quantify the level of wear that the road is exposed to, the FHWA HALE Road Report converts these traffic volume statistics to 11,021 equivalent single-axle loads annually.

Table 3-10. Haleakalā High Altitude Observatory Site Traffic Study Summary.

Date	Day	Vehicles In	Vehicles Out	AM Peak In	PM Peak In	AM Peak Out	PM Peak Out	Total Vehicles
24-Oct	Fri	55	55	12	7	5	10	110
25-Oct	Sat	32	24	4	7	3	5	56
26-Oct	Sun	23	25	3	3	4	5	48
27-Oct	Mon	52	50	12	5	4	19	102
28-Oct	Tues	60	66	13	4	4	25	126
29-Oct	Weds	82	63	13	11	4	24	145
30-Oct	Thurs	67	74	14	5	3	25	141
31-Oct	Fri	47	44	6	4	4	9	91
1-Nov	Sat	24	25	6	5	5	4	49
2-Nov	Sun	23	22	3	4	2	4	45
3-Nov	Mon	57	61	14	4	4	22	118
4-Nov	Tues	68	61	14	7	3	23	129
5-Nov	Weds	62	67	13	8	2	21	129
6-Nov	Thurs	84	78	12	5	4	26	162
7-Nov	Fri	47	49	7	4	3	11	96
8-Nov	Sat	17	19	3	4	3	4	36
9-Nov	Sun	17	16	3	4	2	3	33
10-Nov	Mon	55	56	10	4	4	19	111
Total Traffic		**872**	**855**					**1727**
Daily Average		**48.4**	**47.5**	**9.0**	**5.3**	**3.5**	**14.4**	**95.9**

(UH IfA, 2005)

3.10 NOISE

The ROI for noise includes the HO, the Park road corridor, Sliding Sands trail and the Haleakalā Crater.

Hawaiʻi has adopted statewide noise standards that apply to fixed stationary noise sources and equipment related to agricultural, construction, and industrial activities. The alternatives under the proposed ATST Project involve various construction-related activities, as well as the introduction of stationary sources. The project area is zoned as a Class A district under these statewide community noise regulations (State of Hawaiʻi, HAR 11-46-4). Class A zoning districts include “all areas equivalent to lands zoned residential, conservation, preservation, public spaces, open space or similar type,” and are the most restrictive of maximum allowable ambient noise levels. The “A-weighted” decibel scale (dBA) is used in statewide standards because it best approximates the way the human ear responds to noise levels. Maximum permissible daytime sound levels in Class A zones under HAR 11-46-4 are 55 dBA for non-impulsive noise and 65 dBA for impulsive noise. These noise limits are defined as levels that can be exceeded no more than 10 percent of the time in any 20-minute period, or L_{10}.

Management policy outlined by the National Park Service (NPS, 2001) states, “The Service will take action to prevent or minimize all noise that, through frequency, magnitude, or duration, adversely affects the natural soundscape or other park resources or values, that exceeds levels that have been identified as being acceptable to, or appropriate for, visitor uses at the sites being monitored.” Noise levels above the natural soundscape can affect the way that visitors experience a National Park. In HALE, various land features such as the summit, the crater, and various other mountain terrain can affect the way that sound attenuation occurs throughout the Park.

As stated in the Traffic section of this document, significant vehicular and bus traffic traverse the Park road each year. In 2007, there were 540,864 vehicular visits and approximately 9,102 buses that traversed the Park road; in 2008, there were 493,846 vehicular visits and approximately 6,416 buses. (NPS Stats). With this approximate number of vehicles on the park road each year and estimating the number of vehicles per day and per hour (approximately 56 cars and 0.73 buses per hour) the approximate daytime baseline noise level from visitor traffic is 47 dBA, similar to a typical rural setting.

Background noise conditions at the summit of Haleakalā vary somewhat, depending on location, wind conditions, and the nature of nearby noise sources. Previous sound level measurements conducted at HO indicated truck traffic and atmospheric conditions to be the primary mobile noise sources, while air conditioning units and exhaust fans were determined to be the loudest stationary noise sources. Moderate wind speeds at the summit had instantaneous noise levels measured in the range of 45 to 50 dBA, backup generators had noise levels averaging 73 to 84 dBA at a distance of 50 feet, while construction-related vehicles (general) were recorded at 82 to 93 dBA, also at a distance of 50 feet (AFRL, 2005). Baseline conditions, or natural sound levels, in the Crater area are typically 10 dBA (NPS, 2009).

There are no noise-sensitive human receptors at HO, such as residences, schools, hospitals, or other similar land uses where people generally expect and need a quiet environment. In addition, HO is not open to the public, with the exception of Native Hawaiians participating in cultural and traditional practices. Although multiple observatories and research facilities are stationed at HO, the majority of personnel at these operations work indoors in structurally insulated facilities with negligible outdoor occupational tasks. The public areas closest to the proposed ATST Project area are the Puʻu ʻUlaʻula Overlook in HALE, which is approximately a quarter mile away, and the Pa Kaʻoao (White Hill) Visitor Center, which is approximately half a mile away. Potential noise-sensitive biological receptors, such as ʻuaʻu, are discussed in Section 3.3.3-Faunal Resources.

3.11 CLIMATOLOGY AND AIR QUALITY

The ROI for determining the affected environment for climatology and air quality includes both HO and the HALE Park road corridor.

3.11.1 Climatology

Maui County is comprised of four islands: Maui, Molokai, Lanaʻi and Kahoʻolawe. Maui stands out among the other islands in the County as having the tallest summits and thus the most extreme climate variations. The elevation at the summit of Haleakalā is 10,023 feet ASL and at times experiences snow and hail. In contrast to the beach areas, the summit of Haleakalā can become quite cold at times, with low temperatures that can be below freezing levels. Rainfall on Maui usually is heaviest in the mountain areas, while the beaches and coasts are the driest. Rainfall on Haleakalā peaks in a band at elevations between 3,000 to 5,000 feet ASL where the moisture-laden trade winds are cooled as they rise against the mountain front and are held below 5,000 feet ASL by a temperature inversion that acts as a climatalogical boundary in the Hawaiian Islands. At higher elevations, the air can be much drier, resulting in average rainfall of from less than 15 inches to as much as 60 inches a year.

The precipitation levels of Maui County are on the whole somewhat low, occasionally resulting in mild droughts in some areas during the summer (Yuen and Associates, 1990). The annual average total precipitation on Haleakalā summit between 1949 and 2005 was 52.92 inches (WRCC, 2005). Rainfall in the microclimate area on the western slope of Haleakalā is usually from frontal systems or storms and is about 29.5 inches a year or less. This microclimate is characterized by the temperature inversion. Rainfall above the inversion is predominantly from storms or frontal systems (Scholl, et al, 2002).

Temperature data collected at the MSSC located within HO between 1985 and 1991 shows that the lowest seven-year monthly average temperatures is about 42 degrees Fahrenheit. This usually occurs in December, January, and February, and the highest seven-year monthly average temperatures of about 50 degrees Fahrenheit occur in August. During the winter months, sub-freezing temperatures and frost are common at higher elevations with occasional sub-zero temperatures recorded. Between December and February the summit area occasionally experiences snow, hail and sleet.

Maui experiences predominantly northeasterly trade winds spurred by high-pressure anticyclones and ridges that occur several hundred miles to the north and northeast of the island. These trade winds are most persistent during the months of March to November. Conversely, southwesterly (Kona) winds occasionally occur in the winter months, usually accompanied by clear weather ahead of frontal storms. However, wind speeds at the summit can be extreme; the greatest wind speed recorded at the summit is over 125 miles per hour (mph). Gusts exceeding 60 mph are common throughout the year as are sustained winds of 50 mph. Winter storm systems originating from the north Pacific have been known to bring the strongest winds through the island chain.

3.11.2 AIR QUALITY

All areas in Hawaiʻi are considered to comply with Federal and State ambient air quality standards; no areas of Hawaiʻi are classified as non-attainment or maintenance areas. Therefore, all of Maui, including Haleakalā, is currently an attainment area for EPA "criteria" pollutants, which include sulfur dioxide, nitrogen oxides, carbon monoxide, ozone, lead, and certain particulate matter. Furthermore, HALE is categorized as a "Class 1" area under the Clean Air Act's Prevention of Significant Deterioration Program, a category the EPA reserves for the most pristine areas of the country in order to maintain the excellent level of air quality already attained. HALE itself has a long-term visibility-monitoring agenda currently in effect under this program to ensure the region's continued Class 1 attainment (HALE, 2005a).

The relatively limited commercial or industrial development in Haleakalā results in few local anthropogenic (manmade) emission sources with the potential to affect air quality at HO. However, since the natural substrate at the project site is a mixture of fine volcanic sand and cinders, a small amount of naturally occurring fugitive dust from the finer material is released when the substrate is disturbed. The primary sources of anthropogenic pollutant emissions at HO are the intermittent activities associated with existing research facility operations. These include low-impact mobile emission sources, such as light vehicle traffic to and from the summit, as well as stationary source emissions resulting from periodic testing of diesel-fueled emergency generators. General maintenance activities at HO likewise result in temporary and low-impact emissions. For example, mirrors at observatories are periodically recoated and this produces short-duration air emissions well below those requiring a State permit.

Another contributing factor to the excellent air quality at the summit of Haleakalā is the favorable meteorological conditions, including a temperature inversion layer that rings the mountain at an elevation of approximately 5,000 and 7,000 feet ASL (HALE, 2005b). This inversion layer stabilizes the atmosphere above the basin and limits airborne pollutants from rising to the summit, including that of the largest source of air pollution in the area, Kilauea Volcano on the island of Hawaiʻi (HALE, 2005a). Additionally, prevailing trade winds from the northeast are persistently gusty at HO, which accelerates the dilution of any locally generated air emissions. Ambient winds of 20 to 50 miles per hour are commonly reported at the summit, creating turbulence and accelerating the atmospheric dispersion.

3.12 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The ROI for socioeconomics and environmental justice includes both HO and the Park road corridor. This section is a description of the contribution of the proposed ATST Project to the economy and the sociological environment of the ROI, as well as any effects on minority or low-income communities or the health and safety of children within this region. The proposed ATST Project would be implemented on Maui, one of the four islands that make up Maui County. Three of the four islands, Maui, Lanaʻi, and Molokaʻi, are inhabited, while the fourth, Kahoʻolawe, is uninhabited. The socioeconomic indicators used for this study include the following:

1. Population and housing,
2. Employment, economy, and income; and,
3. Education

Additionally, a discussion of environmental justice issues is presented in accordance with EO 12898, and a discussion relating to the protection of children from environmental health risks is also presented in accordance with EO 13045.

The baseline year for socioeconomic data is 2006, the most recent year for which U.S. Census Bureau data are available for most of the socioeconomic indicators. When available, more recent data are used to best characterize the current socioeconomic conditions.

3.12.1 SOCIOECONOMICS

3.12.1.1 Resident Population and Housing

The population of the County of Maui almost doubled between 1980 (71,600) and 2006 (139,995) (County of Maui, Office of Economic Development, 2005 and HBDEDT, 2007). While the increase in population in the State of Hawaiʻi was approximately 29.2 percent, between 1980 and 2006, the population increase for the County of Maui was approximately 97.5 percent. Table 3-11 provides a comparison of population trends.

Table 3-11. Hawaiʻi State, County of Maui, and Island of Maui Resident Population.

	1980	2006	Percent Change
State of Hawaiʻi	994,691	1,285,498	29.2%
County of Maui	71,600	141,440	97.5%

(County of Maui, Office of Economic Development, Maui County Data Book, 2006)

The County of Maui has experienced significant growth over the 26 years between 1980 and 2006, and the trend is projected to continue. The resident population for the island of Maui is expected to grow from 129,471 in 2005 to 186,254 in 2030. This is a 1.68 percent annual growth rate, for a total of approximately 42 percent increase in population over the 25 year period (Table 3-12) (County of Maui, 2008b).

Table 3-12. Population Projection for the Island of Maui, 2000 – 2030.

Year	2000	2005	2010	2015	2020	2025	2030
Total	117,644	129,471	140,290	151,011	162,370	174,184	186,252

(Maui County, 2008)

Housing value in the County of Maui had increased 111.96 percent from 2000 to 2006 when the median housing value was $529,700. Table 3-13 shows housing occupancy type and vacancy for Maui, Maui County, and the State of Hawaiʻi for the year 2000 and updated 2006 data for Maui County and the State of Hawaiʻi. Housing on Maui made up 94 percent of the total housing units of Maui County in 2000. Total housing units in Maui County increased by 12.8 percent from 2000 to 2006. For 2000, the rate of owner-occupied units on Maui and Maui County was 44 percent. For 2006, the rate of owner-occupied units for Maui County was approximately 59 percent, similar to that of the State of Hawai'i. The vacancy rate in 2006 was at 23.6 percent for Maui County and 13.5 percent for the State of Hawai'i.

Table 3-13. Housing.

	State of Hawaiʻi		Island of Maui	County of Maui	
	2000	2006	2000	2000	2006
Total housing units	460,542	500,021	53,210	56,377	63,601
Occupied	403,240	432,632	40,729	43,507	48,586
Vacant	57,302	67,389	12,469	12,870	15,015
Owner-Occupied	173,861	257,599	23,488	25,039	28,477
Rented	174,458	175,033	17,200	18,468	20,109

(County of Maui, Office of Economic Development, Maui County Data Book, 2005, U. S. Census Bureau 2006a, 2006b)

3.12.1.2 Employment, Economy, and Income

In the third quarter of 2007, Maui County experienced sharp increases in the number of unemployed people pushing the unemployment rate above 3.0 percent. In that same period, Maui County recorded 1,450 or 2.0 percent more jobs than in the same quarter of 2006. Professional and Business Services had the largest gain of 500 jobs, followed by Natural Resources, Mining and Construction, Food Services and Drinking Places, and Retail Trade gaining 350 jobs each. Accommodations lost 300 jobs, while Manufacturing lost 200 jobs (DBEDT, 2007).

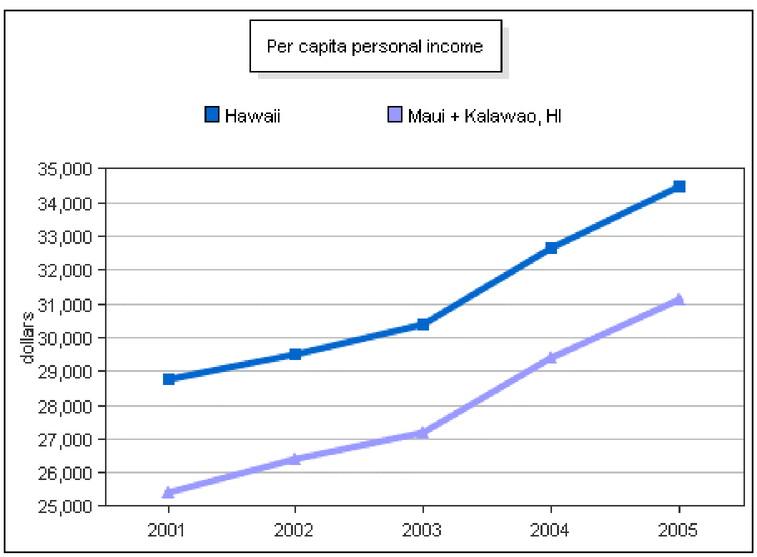
Table 3-14 presents the distribution of employment among the various industry sectors and the changes experienced in these sectors between 2001 and 2005 for Maui County and the State of Hawaiʻi. For 2001 and 2005, the construction, accommodation and food service, and government sectors were the major source of employment and personal income in both the State and County. The major increase in personal income in Maui County, between 2001 and 2005, came from the manufacturing (62.6 percent), government and government enterprise (45.0 percent), and construction (44.6 percent) sectors. In Hawaiʻi, the major increase in personal income came from the real estate and rental and leasing sector (67.7 percent), followed by the construction (58.1 percent) and government and government enterprise (36.6 percent) sectors. None of the sectors experienced a decline between 2001 and 2005 in Maui County or the State of Hawai'i (BEA, 2007a).

Table 3-14. Personal Income by Major Source and Earnings by Industry.

	Maui County			State of Hawai'i		
	2001	**2005**	**% Change**	**2001**	**2005**	**% Change**
Farm	$61,470	$70,229	14.25	$214,803	$217,252	1.14
Construction	$206,238	$298,255	44.62	$1,690,175	$2,672,914	58.14
Manufacturing	$106,937	$173,870	62.59	$786,597	$904,754	15.02
Wholesale Trade	$49,892	$70,242	40.79	$802,960	$1,033,547	28.71
Information	$49,983	$57,244	14.67	$708,607	$717,376	1.24
Finance and Insurance	$46,652	$55,611	19.20	$1,053,424	$1,224,711	16.26
Real Estate and Rental and Leasing	$91,102	$122,956	34.96	$650,677	$1,090,975	67.67
Arts Entertainment and Recreation	$86,367	$101,146	17.11	$367,229	$450,187	22.59
Accommodation and Food Service	$555,140	$758,156	36.57	$2,287,658	$2,966,018	29.65
Government, Government Enterprise	$370,448	$537,215	45.02	$8,086,480	$11,045,960	36.59

(BEA, 2007a)

As shown on the Figure 3-12, Hawai'i had kept a higher per capita personal income than Maui County between 2001 and 2005. For 2005, the per capita personal income of Hawai'i ($34,890) exceeded that of Maui County ($31,156) by $3,333 (10.7 percent). For 2001, the per capita personal income for Hawai'i ($28,759) exceeded that of Maui County ($25,398) by $3,361 (13.2 percent). Maui County experienced a higher growth in per capita personal income between 2001 and 2005, with a 15.7 percent increase, compared to 13.6 percent increase for the State. (BEA, 2007c)



(BEA, 2007b)

Figure 3-12. Per Capita Personal Income.

Table 3-15 shows the rates of employment from 1996 to 2006. This rate consistently decreased between 1996 and 2000 with an increased labor force in Maui County.

Table 3-15. Rate of Employment in Maui County.

	Labor Force	Unemployed	Percent Unemployed
1996	68,050	4,950	7.3
1999	71,400	4,050	5.7
2006	76,670	2,142	4.2

(Maui County Office of Economic Development, 2005, U. S. Census Bureau, 2006c)

3.12.1.3 Education

Maui District has a total of 57 schools, with 32 public and 21 private schools. The number of teachers in public schools for the school year 2004 to 2005 was 1,296, with an enrollment of 20,888 students. The number of high school enrollment in public schools for 2004 to 2005 was 6,164. The total number of degrees earned from Maui Community College (MCC) in 2005 was 899, including 561 associate degrees and 338 certificates of achievement. During fall 2005, there were 1,163 full-time students and 1,740 part-time students enrolled in MCC. The UH had a total of 56 distance-learning courses in 2005. (County of Maui, Office of Economic Development, 2006)

The anticipated scientific plan for HO facilities for the next decade is to ensure unobtrusive scientific access and to increase high-level skilled jobs and local educational benefits for both Maui and the international scientific communities. These are the sectors that are assumed to contribute to the local educational and economic environment in a truly meaningful way. The world's largest telescope devoted to global astrophysical education would be accessed electronically from around the world and would be partly controlled from Maui using the FTF. Also, the potential astronomical plans would enable visiting scientists to conduct experiments at the AEOS facility at HO. (UH IfA, 2005)

Faulkes Telescope Facility

The FTF within HO provides observations for students in Hawaiʻi and the United Kingdom (UK). The data is used by students in secondary schools and undergraduate institutions for research projects mentored by professional astronomers. When the primary clients of the telescope are unavailable (e.g., during school vacations and summers), observing time is made available to other serious amateur astronomers and educational users, such as the Bishop Museum. (UH IfA, 2001)

Teaching the basics of research is the primary goal of the FTF. The research undertaken by the students would be published in scientific literature. Data from the FTF is archived and available to the public for research and education. A collection of the spectacular images that help make astronomy a subject that has wide appeal would be made available to schools and publishers.

Current plans for the FTF include participation in the project by students from MCC, which range from controlling the telescope to assisting with telescope maintenance to analyzing observations.

University of Hawaiʻi Space Grant Program

The UH Space Grant program has previously sponsored students at MCC in astronomy-related projects. Additionally, future projects for Space Grant students associated with HO are being considered. IfA and MCC are also pursuing opportunities to develop training internships at HO.

IfA also supports amateur astronomers, as well as accommodates visitation requests to HO from public and private schools; however, no public tours are offered.

Towards Other Planetary Systems

In addition, HO was a key participant in the Towards Other Planetary Systems (TOPS) program, a five-year NSF-sponsored Teacher Enhancement program. Teachers learned basic astronomy content and began integrating State and National science/astronomy standards into their classrooms. In addition, a privately funded student component of the program was available to local high school students with interests in astronomy. The program gives students an opportunity to learn astronomy, to engage in hands-on activities, and to get an idea of what careers in astronomy and related sciences have to offer. (UH IfA, 2005b)

Center for Adaptive Optics

The Center for Adaptive Optics (CfAO), a National Science Foundation Science and Technology Center headquartered at the University of California-Santa Cruz, MCC, and the Maui Economic Development Board, Inc. (MEDB) began a partnership in 2002, which has now matured into a successful set of programs, with three major components:

1. The Akamai Internship Program,
2. The Professional Development Workshop and Teaching Fellowships; and,
3. An education/industry collaborative.

The partnership includes a range of academic, industry, and government partners, extending to Hawaiʻi Island, Kauaʻi, and Oʻahu. Current and past participating Maui partners are: the U. S. Air Force Maui Optical and Supercomputing Site, IfA, Oceanit, Trex Enterprises, Inc., Textron Systems, Akimeka, LLC, the Maui High Performance Computing Center, Maui Scientific Research Center, Boeing LTS, Northrop Grumman Corp., the Pacific Disaster Center, and the County of Maui. The goals of this partnership are to:

1. Advance local students, particularly Native Hawaiians and women, into the Maui technical and scientific workforce to immediately impact the workforce.
2. Develop courses and programs to prepare students for the local workforce by involving the scientific and technical community in teaching and mentoring.
3. Develop courses and programs that promote equity in science and technology, integrate awareness and respect of host culture, and open opportunities for students from underrepresented groups, particularly Native Hawaiians.

Akamai Internship Program: Advancing students from underrepresented groups

The CfAO Akamai Internship Program is designed for all community college and university undergraduates in Hawaiʻi –- and kamaʻāina studying on the mainland – who are interested in pursuing a career in science, technology, engineering or math (STEM) fields and have had to overcome barriers to achieve their educational and/or career goals. All students must be U.S. Citizens or permanent residents, and be at least 18 years old. The CfAO is committed to increasing diversity in the sciences. Underrepresented groups (African Americans, Native Americans, Hispanics, Pacific Islanders, women and persons with disabilities) are strongly encouraged to apply. Each student is matched with a research advisor and is integrated as a member of the advisor's research group with daily guidance by a research supervisor. Integrated into the program is a communication curriculum, which was expanded in 2006 to include the integration of Hawaiian cultural components, with consultation from Kahu Charles K. Maxwell, Sr.

The Maui program is a collaboration between the Center for Adaptive Optics, Institute for Astronomy, Maui Economic Development Board, MCC, the University of Hawaiʻi and local Maui industries. It is an intensive 8-week introduction to research method and tools with an emphasis on adaptive optics science. The program provides opportunities at various sites over the summer, with additional activities that will provide support and opportunities during the academic year. The interns will start with a 5-day short course in general optical principles and adaptive optics taught at MCC. Upon completions of the internship program, participants will be better prepared to pursue their educational and research career goals.

Working with the MEDB Women in Technology Project, the Akamai Internship Program has a strong focus on increasing the participation of women and underrepresented minorities (URM), such as Native Hawaiians. In 2006, 28 students (29 percent Native Hawaiian, 18 percent other URM, and 25 percent women) from Hawaiʻi had completed the Maui Akamai Program, with 12 working in part-time or full-time technical positions in Hawaiʻi, and an additional 14 enrolled in a science or technology degree program. The 2006 Akamai Maui interns selected included the highest participation from underrepresented groups (36 percent Native Hawaiian, 21 percent other URM, and 36 percent women).

Professional Development Workshop & Teaching Fellowships:
<u>Designing Curriculum to Promote Equity and Diversity in Science and Technology</u>

The Professional Development Workshop (PDW) brings graduate students and post-doctorates from CfAO's mainland sites together with community college faculty members and observatory personnel from Hawaiʻi for an intensive 5-day training on inquiry-based teaching methods. A major part of the workshop includes an opportunity for workshop participants to work in teams on their own teaching activities for CfAO educational programs, all of which are aimed at increasing participation of underrepresented groups.

All workshop participants sign on as “Teaching Fellows” in exchange for a fully funded workshop experience. The Teaching Fellows receive ongoing consultation after the PDW as they work on course design and a practical teaching experience. The PDW in combination with Teaching Fellowships is the engine behind the extremely productive teaching teams that staff CfAO short courses, internships, high school programs, as well as becoming “teaching assistants” for community college courses.

Each year approximately 40 instructors teach in these courses and programs; and, to date, more then 30 new inquiry-based laboratory units and 7 new courses have been developed. All courses and programs emphasize teaching strategies that engage all students and focus on achieving cultural and gender equity. Approximately one-third of all PDW participants teach in Hawaiʻi-based programs and courses; however, in the coming years the focus will change to create a PDW that specifically focuses on Hawaiʻi-based educational activities. The need for new courses, laboratory units, and other activities has grown considerably as MCC moves forward in developing new degree programs that will broadly serve the Maui community and increase the participation of Native Hawaiians in the technical fields. The PDW and Teaching Fellowships are ideally suited to meet this need, including the development of high school programs.

<u>Industry/Education Collaborative</u>

A key component to the success of the partnership comes from a strong collaboration with the technical and scientific community on Maui. Specific activities have been developed to engage this community, as well as mechanisms to obtain input on the courses and programs.

Activities include the Akamai Selection and Advisory Committee, the ARPA Maui Optical Station (AMOS) Technical Conference Student Session, the annual Maui Science and Technology Education Exchange (MSTEE), and a range of meetings throughout the year. For example, the 2006 MSTEE event included a working session where internship employers and direct supervisors worked with community partners and CfAO members to define internship projects, identify knowledge and skills necessary for a successful internship experience, and make recommendations for short-course topics.

The Akamai Internship Program has become a point of intersection between the technical and educational community. In 2005, more than 50 individuals from Maui's technical community contributed time to the Akamai Program. The collaborative has matured from years of experience, has clearly articulated shared goals and community-based leadership, and is now positioned with the necessary ingredients to sustain and expand the Maui-based initiatives.

3.12.2 Environmental Justice and Protection of Children from Environmental Health or Safety Risks

A discussion of environmental justice issues is presented in accordance with EO 12898, and a discussion relating to the protection of children from environmental health risks is presented in accordance with EO 13045, Protection of Children from Environmental Health Risks and Safety Risks, April 1997.

On February 11, 1994, President Clinton issued EO 12898, entitled Federal Actions to Address Environmental Justice in Minority and Low-Income Populations, February 11, 1994. This order requires that "each Federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities, on minority populations and low-income populations" (EO 12898, 59 CFR 7629 [Section 1-101]).

Ethnic data for Maui County and the State of Hawaiʻi for 2006 is shown in Table 3-16. The dominant ethnic group in 2006 in Maui County was Caucasian, at 37.4 percent of the total population. The second group is of Asian ethnicity (28.4 percent). The third ethnic group is comprised of Native Hawaiians and Other Pacific Islanders (10.5 percent). The dominant ethnic group for the State of Hawaiʻi is the Asian group, with 39.9 percent of the total population. The Native Hawaiian and Other Pacific Islander group makes up 8.7 percent of the total State population.

EO 13045 seeks to protect children from disproportionately incurring environmental health risks or safety risks that might arise from Federal policies, programs, activities, and standards. Environmental health risks and safety risks to children are those that are attributable to substances that a child is likely to come into contact with or to ingest.

The HO site is clearly defined and a posted sign at the entrance indicates that access to the area is restricted and off limits to unauthorized personnel. The only people who would typically occupy the HO site and proposed ATST project area would be employees of the various facilities or visiting members of the scientific community. Native Hawaiians are welcome to enter for cultural and traditional practices as indicated by the language on the sign.

Table 3-16. Population Percentage by Race/Ethnicity.

	Maui County	State of Hawai‘i
Total	141,300	1,285,498
Caucasian	52,894	337,507
African American	664	28,062
American Indian and Alaska Native	323	4,153
Asian	40,061	512,995
Native Hawaiian and Other Pacific Islander	14,796	111,488
Some Other Race	1,806	14,513
Two or More Races	30,756	276,780

(U. S. Census, 2006d, 2006e)

3.13 PUBLIC SERVICES

The ROI for determining the affected environment for public services include both HO and the Park road corridor.

3.13.1 Police Protection

In 1987, the Maui County Police Department (MPD) moved from its old location at 250 High Street in Wailuku, to the current location at 55 Mahalani Street in Wailuku. The station is named Hale Maka‘i. Police substations are located in various communities around the County. The closest police substation is located in Makawao approximately 29 miles from the summit of Haleakalā. A new police substation currently being constructed is located in Kula, which is the community closest to the summit but still approximately 22 miles away. The MPD has no jurisdiction over HALE activities. HALE Federal law enforcement officers are the exclusive policing authority within HALE.

3.13.2 Fire Protection

Volunteers from the plantation communities fought all fires prior to the establishment of the Maui Fire Department. The Wailuku Fire Station was established in 1924. The responsibilities of the Maui County Department of Fire Control are about the same as they were in 1924, to protect life, property and the environment from fires, hazardous material releases and other life-threatening emergencies. However, today the department protects all of Maui County. The Department of Fire Control has a fire fighting force of 275 fire fighters and a support staff of nine personnel.

The Department has fourteen fire stations throughout the County of Maui. There are ten fire stations on the island of Maui, three on the island of Moloka‘i and one on the island of Lana‘i. There are fourteen engine companies, two ladder companies, one rescue/HAZMAT company, four tankers, and three rescue boats. The island of Maui has ten engine companies, two ladder companies, one rescue/hazmat company, two rescue boats and two tankers. In addition, the department leases a helicopter for rescue and wild land firefighting. The closest fire station is located in Kula approximately 28 miles away from the summit of Haleakalā. Another fire station serving the Upcountry community is located in Makawao approximately 29 miles from the summit. These two fire stations, although the closest to HO, are beyond fire fighting capabilities for HO.

National Park Wildlife Firefighters work for the common goal of fire management, wildland fire use, fire prevention, and fire suppression. A militia comprised of approximately 10 to 12 wildland firefighters reside on Maui and are certified for this responsibility. Mr. Joe Molhoek from Hawai‘i Volcanoes National Park (HAVO) is the key contact (phone: 808-985-6042) in his role as the Fire Management Officer for Pacific Island Parks.

3.13.3 Schools

Maui District has a total of 53 schools, with 32 public and 21 private schools. The number of teachers in public schools for the school year 2004-2005 was 1,296, with an enrollment of 20,888 students. The number of high school enrollment in public schools for 2004-2005 was 6,164. The total number of degrees earned from Maui Community College (MCC) in 2005 was 899, including 561 associate degrees and 338 certificates of achievement. Education and schools are further discussed in detail in Section 3.12.1.3-Education.

The closest schools to the proposed ATST Project are located in the Kula community (Haleakalā Waldorf School, King Kekaulike High School, Kula Elementary School, the Carden Academy, and the Kamehameha Schools) and are approximately 25 to 27 miles from the summit of Haleakalā.

3.13.4 Recreational Facilities

The Haleakalā Visitor Center of HALE is located approximately two-thirds of a mile northeast of HO and is one of the main points of attraction for visitors of the mountain. Besides boasting a magnificent view of the crater, the Visitor Center also details the geology, archaeology, and ecology of the area as well as the wilderness protection programs in exhibits posted throughout the area. Overlooks with orientation panels and descriptive displays are located at Leleiwi, Kalahaku, and Pu‘u Ula‘ula along the park road between park headquarters and the summit. The rare Haleakalā silversword plant that can be seen at Kalahaku draws many nature enthusiasts.

Annually, 1.7 million visitors are attracted to and enjoy the summit, crater, and the 24,000 acres of pristine wilderness of HALE because of the excellent walking, hiking, and horseback riding opportunities available. Hikes can range from short self-guiding walks to rigorous backpacking for several days. Among the primary reasons for visiting HALE include engaging in sightseeing and scenic driving and watching the sunrise at the top of the summit. Camping is permitted at designated areas inside the crater floor adjacent to each of the three crater cabins (HALE, 1994 and 2004). Camp and picnic sites are available in the Park, such as in the Hosmer Grove Campgrounds. In addition, individual companies with Commercial Use Applications from HALE sponsor their own trips through the crater on a one-day or overnight basis. Hikers have also been known to traverse the trails found near Kalepeamoa. As of March 18, 2008, the NPS has issued a News Advisory that the moratorium of commercial downhill bicycle rides in Haleakalā National Park will continue pending a full evaluation of all impacts from the activity in the Park’s Commercial Services Plan (NPS, 2008a).

The Skyline Trail begins at the 9,750-foot elevation at the lowest point of the paved access road near the Saddle Area and continues for about 6.5 miles, ending at the Polipoli Spring State Recreation Area. Trails through the area are open to the public for hiking and related recreational activities except during times of extreme fire danger or inclement weather.

The Park Headquarters Visitor Center, Haleakalā Visitor Center, and the Kipahulu Visitor Center (located on the east side of Maui) have cultural and natural history exhibits. . In addition, these facilities have books, maps, and postcards for sale. Rangers are on duty during business hours to answer questions and assist visitors. Periodic, guided interpretive hikes and activities are available at both the Haleakalā Visitor Center and the Kipahulu Visitor Center.

There is no food or gas available within the Park. Restrooms are located at the Haleakalā Visitor Center, Kalahaku Overlook, Park Headquarters Visitor Center, and Hosmer Grove and are handicapped accessible. Limited emergency services are available at both the Park Headquarters Visitor Center and Headquarters. When snow and/or icy conditions warrant, the Park closes the road.

3.13.5 Healthcare Services

In 1998, Maui Memorial Hospital was officially renamed the Maui Memorial Medical Center. The hospital is located in Wailuku and approximately 50 miles from the summit, is the only full-service hospital on Maui offering a broad range of emergency services including complex diagnostic and treatment services. The formerly named Kula Hospital, located in Keokea, is approximately 40 miles from the summit. Beginning October 31, 2005, the newly named Kula Hospital and Clinic began providing urgent care and limited rural emergency care on a 24-hour, 7-day a week basis offering basic lab and X-ray services and an Emergency Department. The Kula Clinic portion of the facility is a comprehensive outpatient clinic with normal business hours Monday through Friday. Emergency medical service stations are located in Kula and Makawao, which dispatch emergency medical care.

3.14 Natural Hazards

Natural hazards in the State of Hawaiʻi consist of drought, earthquakes, high surf, high winds, storms and hurricanes, tsunamis, volcanoes, and wildfires (Pacific Disaster Center, 1967). Depending on the lower elevation areas affected by occurrences of these natural hazards, any part of the population could be affected.

Natural hazards at the higher elevations of Haleakalā consist of the potential for earthquake movement, hurricanes, high winds, snow, ice, extreme cold, which can produce hypothermia after even brief exposure to the cold conditions common on the summit, and hypoxia, which can occur because of the thinner air at the high elevation.

The 18.166 acres of HO is restricted to only a small number of employees of the various facilities working any time within a 24-hour period. The area outside of HO belongs to the HALE and is predominantly utilized by tourists and park personnel during the day. HALE closes the Park road whenever any of the weather conditions listed below becomes critical and serious enough to warrant protecting human life.

Drought

Although drought and the possibility of subsequent wildfires is a normal, recurrent feature of climate, it can occur in virtually all-climatic zones, with its characteristics varying significantly from one region to another. Drought is a temporary aberration and differs from aridity, since the latter is restricted to low rainfall regions and is a permanent feature of climate. Although it has scores of definitions, it originates from a deficiency of precipitation over an extended period of time, usually a season or more. It is also related to the timing and the effectiveness of precipitation. Other climatic factors such as high temperatures, high wind, and low relative humidity are often associated with drought and wildfires in many regions, including the Pacific basin (Pacific Disaster Center, 1967). Most days, clouds ring the mountain between 5,000 and 7,000 feet ASL. They form at the temperature inversion layer where warm air coming up the mountain from the ocean is trapped by cooler air above. The prevailing trade winds from the northeast also bring clouds and moisture to Haleakalā. Clouds can envelop the summit at any time, with or without rain.

Earthquake

Table 3-17 provides an overview of the effects of earthquakes based on their relative magnitude. Earthquake movement can sometimes be felt at the summit of Haleakalā. Hawaii's largest earthquakes, up to magnitude 7.5 to 8.1 (USGS), are associated with dike intrusions into the active volcanoes and expansion of the volcanoes across the old seafloor. While such events can be felt on Maui, they occur too far away to cause any damage. There are, however, other earthquakes that are potentially damaging; caused by the load of the Hawaiian Islands on the Pacific lithosphere. Since Hawaiian volcanoes are so large they are an immense burden on the lithosphere, and it sags beneath their weight (the phenomenon of isostasy). Sometimes, in addition to just sagging, the lithosphere will "creak", resulting in earthquakes. The last such earthquake of any size was the magnitude 6.7, which took place approximately 6 miles (10 km) southwest from Puakō, Hawaiʻi on October 15, 2006. Prior to this, there was a 6.2 Honomu event on April 26, 1973, beneath the Hamakua Coast of Hawaiʻi Island (USGS). Although this earthquake was 100 miles from Maui, it was felt on Haleakalā because of its depth. The Maui earthquake of 1938 had its epicenter somewhere to the north of Maui and was about magnitude 6.5. The Lanaʻi earthquake of 1871 had a magnitude of perhaps 6.8 and probably had its epicenter near Palaoa Point. Any repeat of the 1871 Lanaʻi earthquake would affect the project site. Mitigation of this risk is discussed in Section 4.17.14- Natural Hazards.

Table 3-17. Earthquake Magnitudes and Their Effects.

Richter Scale (magnitude)	Earthquake Effects
2.5 or less	Usually not felt, but can be recorded by seismograph.
2.5 to 5.4	Often felt, but only causes minor damage.
5.5 to 6.0	Slight damage to buildings and other structures.
6.1 to 6.9	May cause a lot of damage in very populated areas.
7.0 to 7.9	Major earthquake. Serious damage.
8.0 or greater	Great earthquake. Can totally destroy communities near the epicenter.

(MichiganTech, 2004)

Storms and Hurricanes

Hurricanes are classified according to their wind speed intensity. There is a direct relationship between the central pressure of a hurricane and its maximum wind speed — the lower the pressure, the stronger the winds. Hurricanes do not strike Hawaiʻi often, with most weakening before reaching Hawaiʻi, or passing harmlessly westward and south of the Islands. However, strong winds are always a potential threat from these rare storms, which can occur from June to November, with wind speeds increasing at the higher elevations such as the summit of Haleakalā (Pacific Disaster Center, web site). Storms at other times of the year can result in wind speeds in excess of 100 mph at the summit, along with rainfall measured in feet, rather than inches.

Temperature

The weather at the summit of Haleakalā is unpredictable, as weather changes rapidly at higher elevations. Intense sunlight, thick clouds, heavy rain and high winds are possible daily. Temperatures commonly range between 40 and 65 degrees Fahrenheit, but can be below freezing at any time of year with the wind chill factor. Hypothermia is a medical condition in which the victims' core body temperature has dropped significantly below normal (occurring below 95 degrees Fahrenheit) and normal metabolism begins to be impaired.

Ice, Snow

A thin coating of ice glaze, also known as black ice, forms when super cooled liquid precipitation, such as freezing rain or drizzle, fall onto exposed objects whose temperature is below or slightly above freezing. Generally, black ice is a thin sheet of clear ice or glaze, which is rather dark in appearance. This climatic condition can occur on the Haleakalā roadways making it dangerous for motorists, because, visually, the road appears wet, rather than icy. Under black ice conditions drivers should be prepared to expect little to no traction, little to no braking capability, extremely poor directional control, and the high possibility of skids.

The winter months of November to April are generally wetter and stormier than the rest of the year. Much of the island's rain falls during these months, and strong winds are common. In December 1990, a wind indicator near the summit broke at 128 miles per hour. Snow is a rare occurrence even during this time of the year, but it has been recorded in drifts as deep as 6 feet (HALE, 197?, stet). Ice and frost are much more common and can occur any time of the year. Snow conditions on Haleakalā roadways make driving hazardous for motorists.

Hypoxia

Hypoxia is a pathological condition in which the body as a whole (generalized hypoxia) or a region of the body (tissue hypoxia) is deprived of adequate oxygen supply. Hypoxia is often associated with high altitudes, where it is called altitude sickness. Altitude sickness, also known as acute mountain sickness, is a pathological condition that is caused by lack of adaptation to high altitudes, commonly occurring above 8,000 feet. The composition and temperature of the atmosphere at high altitudes is substantially different than at sea level due to two competing physical effects: 1) gravity, which causes the air to be as close as possible to the ground; and, 2) temperature of the air, which causes the molecules to bounce off each other and expand. These differences can affect living organisms, including humans. Symptoms of generalized hypoxia depend on its severity and speed of onset. They include headaches, fatigue, shortness of breath, nausea, unsteadiness, and sometimes even seizures and coma. Severe hypoxia induces a blue discoloration of the skin where deoxygenated blood cells lose their bright red color in favor of a dark blue/red color.

4.0 SUMMARY OF ENVIRONMENTAL CONSEQUENCES, CUMULATIVE EFFECTS AND MITIGATION

This section is an evaluation of the potential environmental effects of the proposed Advanced Technology Solar Telescope (ATST) Project whether implemented at the Mees site or the Reber Circle site, and the No-Action Alternative. This analysis identifies likely effects on the environment, including short- and long-term effects, and direct, indirect, and cumulative effects. The analysis of effects on resources focuses on environmental issues in proportion to their potential effects. Detailed consideration is given to those resources that have a potential for environmental effects. Interpretation of effects in terms of their duration, intensity, and scale are provided where possible. Effects identified under the No-Action Alternative are compared against baseline conditions of each resource discussed in Section 3.0-Description of Affected Environment.

Section Organization

Each section describes the methodology used for effects analysis and factors used to determine the significance of effects as described in:

1. Council on Environmental Quality (CEQ) Code of Federal Regulations (CFR), Title 40, Parts 1500 to 1508, Section 1508.8, where "Effects" include:

   (a) Direct effects, which are caused by the action and occur at the same time and place.

   (b) Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably known. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

   (c) Cumulative effects, which can result from individually minor, but collectively significant, actions taking place over time.

   Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions that may have both beneficial and detrimental effects, even if on balance, the agency believes that the effect would be beneficial.

2. Hawai‘i Administrative Rules (HAR) 343 §11-200-12, Significance Criteria.

   (a) In considering the significance of potential environmental effects, agencies shall consider the sum of effects on the quality of the environment, and shall evaluate the overall and cumulative effects of an action.

   (b) In determining whether an action may have a significant effect on the environment, the agency shall consider every phase of a proposed ATST Project, the expected consequences, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action. In most instances, an action shall be determined to have a significant effect on the environment if it:

      1. Involves an irrevocable commitment to loss or destruction of any natural or cultural resource,

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

Effects are described where they would occur for each resource, including direct, indirect, and cumulative effects. Direct effects would be caused by the proposed ATST Project, would result from implementation at either the Mees site or the Reber Circle site, and would occur at the same time and place. Indirect effects would be caused by the proposed ATST Project at either the primary or alternative sites, but would occur later in time or at a distance from the proposed ATST Project. Cumulative effects result from adding the total effects of past, present, and reasonably foreseeable future actions to effects likely caused by the proposed ATST Project. The No-Action Alternative is evaluated under the same parameters following the alternative analysis.

Section 4.15-Summary of Potential Effects of the proposed ATST Project summarizes potential beneficial and adverse effects on resources in the Region of Influence (ROI) from the proposed ATST Project.

Section 4.16-Other Required Analyses summarizes the National Environmental Policy Act (NEPA) requirement of additional evaluation of the project's effects regarding the relationship between local short-term uses of the environment and long-term productivity and any irreversible or irretrievable commitment of resources.

Section 4.17-Cumulative Effects to the Affected Environment discusses what the total effects on each resource are when the effects of the proposed ATST Project, at either alternative site, are added to the effects resulting from past, present, and reasonably foreseeable future actions.

Section 4.18-Mitigation discusses mitigations for effects of the proposed ATST Project and the cumulative effects resulting from the proposed ATST Project.

Terminology

To determine whether an effect is major, CEQ and HRS 343 regulations also require the consideration of context and intensity of potential effects (40 CFR 1508.27; HRS 343§11-200-9, 12). Context normally refers to the setting, whether local or regional, and intensity refers to the severity and duration of the effect. Each resource has its own effect intensity standards and are listed and explained in tables under each resource section. Effects are described by the following levels of significance:

1. Major,
2. Moderate,
3. Minor; or,
4. Negligible.

There may be both adverse and beneficial effects within a single resource category; for example, a project could interfere with a pre-existing land use such as recreation (an adverse effect), while expanding public access to different recreational resources (a beneficial effect). Where there are adverse and beneficial effects, both are described. Mitigation is identified in Section 4.18-Mitigation, where it may reduce the significance of an effect.

4.1 LAND USE AND EXISTING ACTIVITIES

The ROI for Land Use and Existing Activities includes the Haleakala High Altitude Observatories (HO) site, the adjacent FAA facilities, and the Park road corridor. Because land used for the proposed ATST Project is within the State Conservation District, the term “Land Use” is defined in HAR 13-5 as follows:

1. The placement or erection of any solid material on land if that material remains on the land more than fourteen days, or which causes a permanent change in the land area on which it occurs;
2. The grading, removing, harvesting, dredging, mining or extraction of any material or natural resource on land;
3. The subdivision of land; or,
4. The construction, reconstruction, demolition, or alteration of any structure, building, or facility on land.

For purposes of this section, harvesting and removing does not include the taking of aquatic life or wildlife that is regulated by State fishing and hunting laws nor the gathering of natural resources for personal, noncommercial use or pursuant to Article 12, Section 7 of the Hawaiʻi State Constitution or section 7-1, HRS relating to certain traditional and customary Hawaiian practices.

4.1.1 Methodology for Effect Assessment

The methods used to determine whether the proposed ATST Project would have a major effect on land use and existing activities is as follows:

1. Review and evaluate existing and past actions within the that part of the ROI that constitutes Conservation District lands to identify the proposed ATST Project’s potential effect on land use within the Conservation District.
2. Review and evaluate each alternative with respect to prior Conservation District Use Permits (CDUPs) granted for past and current actions, including records of past and present concerns

of Office of Conservation and Coastal (OCCL), which enforces such permits to identify ways in which the proposed ATST Project may affect land use and existing activities within State land.

3. Assess the compliance of each proposed alternative with applicable Federal, State, or County regulations concerning land use.

The thresholds of change for the intensity of an effect are defined as follows:

Effect Intensity	Intensity Description
Negligible	The proposed ATST Project would result in a change to a land use or the level and types of existing activities, but the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The proposed ATST Project would result in a change to a land use or the level and types of existing activities, but the change would be small and localized and of little consequence.
Moderate	The proposed ATST Project could result in a change to a land use or the level and types of existing activities; the change would be measurable and of consequence.
Major	The proposed ATST Project would result in a noticeable change to a land use or the level and types of existing activities; the change would be measurable and result in a severely adverse or major beneficial effect.
Duration:	**Short-term –** occurs only during the proposed ATST Project. **Long-term –** occurs after the proposed ATST Project.

4.1.2 Evaluation of Potential Effects at the Mees Site

DIRECT AND INDIRECT EFFECTS

If implemented at the Mees site, the proposed ATST Project would have minor, adverse, long-term effects on its current land use designated as Conservation District, General Subzone. No mitigation would be necessary. The proposed Mees site is undeveloped land in close proximity to other previously developed facilities for astronomy and advanced space surveillance. No changes to the identified land use within HO or along the Park road corridor would occur to complete the proposed ATST Project. Land would not be further subdivided, avoiding additional intensity or exhaustion of land uses within the Conservation District.

With the construction of an additional telescope facility, the level of existing telescope activities would increase but the change would be small and localized and of little consequence. The addition of the proposed ATST Project would not constitute an effect on the land use resources in such a manner that would affect the cultural or natural integrity of Haleakalā National Park (HALE), since HO has previously been used as a site for other observatory facilities under CDUPs issued by the DLNR. No SHPD records for HO indicate that prior actions have had adverse effects on cultural or historic resources within HO, and no terms or conditions have been imposed by DLNR on any past or present action to mitigate loss of visual, biological, or other resources. The proposed ATST Project would not hinder the Park's purpose "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as would leave them unimpaired for the enjoyment of future generations," (U.S. Code Title 16, 1, 2, 3, and 4) or prevent the NPS from continuing its conservation work to meet its guiding mission of preservation. The footprint of the proposed ATST Project would comprise of 0.74-acres, or 4 percent of the 18.166-acre HO property. The temporary construction activities and the operational activities of a fully commissioned facility would result in a change to the level of existing activities, but the change would be small and localized and of little consequence relative to the existing land use. It would have a minor, adverse, and long-term effect on land use within the ROI.

The HALE Park road corridor would continue to be used for access to HO. Activities proposed for the Mees site would not prevent public access to Skyline Drive or HALE, including Hosmer Grove, Park Headquarters Visitor Center, Halemauʻu Trailhead, Leleiwi Overlook, Kalahaku Overlook, Haleakalā Visitor Center (Pa Kaʻoao), and PuʻuʻUlaʻula Overlook.

The proposed ATST Project, if constructed at the Mees site, would support and be consistent with the goals and objectives of the following State, County, HO, and community plans:

1. The proposed ATST Project would comply with current HO management of cultural and biological resources consistent with the Institute for Astronomy (IfA) Long Range Development Plan (LRDP), under Section 9.3.2-Protection of Historical and Cultural Resources, and Hawaiʻi State Legislature, Status and Documents, HRS Chapter 344, State Environmental Policy.

2. The proposed ATST Project would be consistent with acceptable land uses designated by the Department of Land and Natural Resources (DLNR) Office of Conservation and Coastal Lands (OCCL) for the Conservation District, General Subzone.

3. The proposed ATST Project would be consistent with Maui County Code, Title 16-Building and Construction, Chapter 16.26-Building Code, Subsection 16.26.101.3 amended, which reads as follows:

   > "*101.3 Scope.* The provisions of this code shall apply to the construction, alteration, moving, demolition, repair, and use of any building or structure within the county, except those lands within the county that are designated by the State Land Use Commission to be within the conservation district boundaries or designated as Hawaiian Home Lands." (County of Maui, Title 16).

   This exception applies to repairs, refurbishment, structure, height, materials, etc., incumbent upon construction at HO. However, the proposed ATST Project would comply with most of the Maui County Code for Building and Construction.

4. The proposed ATST Project would be consistent with Maui County's General Plan (County of Maui, 1990) for growth in a manner sensitive to the protection and enhancement of cultural and historical resources and would also support economic diversity by continuing to provide jobs in Maui's high technology industry.

5. The proposed ATST Project would be consistent with the objectives identified in the Makawao-Pukalani-Kula Community Plan (County of Maui, 1996), including: complying with the IfA's LRDP land use provisions for HO, protecting cultural resources, protecting endangered biological resources, working to prevent the establishment and spread of invasive species, and participating in recycling.

The proposed ATST Project would have a major, adverse, long-term effect on the Federal Aviation Administration (FAA) Remote Communications Air/Ground (RCAG) facilities, which are located approximately 800-feet west of the MEES Solar Observatory. Because the FAA facilities are located at a lower elevation than the Proposed ATST Project, the construction of the proposed ATST Project may result in signal attenuation from the RCAG facilities due to physical obstruction by the ATST structures. Since the proposed ATST Project would result in a detectable change to the FAA's existing activities, FAA Obstruction Evaluation and Spectrum Management (11 CFR Part 77.35), FAA specialists working with NSF will address any potential issue involving a degradation of signal as a result of the proposed ATST Project. If there is such a degradation of signal, a resolution of the issue will be developed and accompanied by the appropriate level of NEPA compliance. In addition, NSF will work with the FAA to obtain adequate funding for implementation of the resolution. This would reduce the effects to negligible, adverse, and long-term.

4.1.3 Evaluation of Potential Effects at the Reber Circle Site

DIRECT AND INDIRECT EFFECTS

If implemented at the Reber Circle site, environmental consequences on land use and existing activities from development would be largely similar to those discussed for the Mees site. The proposed ATST Project would have minor, adverse, and long-term effects on its current land use designated as Conservation District, General Subzone. The level of existing telescope activities would increase but the change would be small and localized and of little consequence. Development would be on an already disturbed site currently not being used as opposed to a new site. This alternative would also be consistent with the aforementioned State, County, HO, and community plans.

The effects on the FAA RCAG facilities would be similar to those at Mees. The proposed ATST Project would have a major, adverse, and long-term effect on the FAA RCAG facilities, which are located approximately 900 feet west of the Reber Circle site. Because the FAA facilities are located at a lower elevation than the proposed ATST Project at Reber Circle, the construction of the proposed ATST Project may result in signal attenuation from the RCAG facilities due to physical obstruction by the ATST structures, about 15 degrees further north than the obstruction that would result from construction of the proposed ATST Project at the Mees site. The proposed ATST Project would result in a detectable change to the FAA's existing activities, but FAA specialists working with NSF will address any potential issue involving a degradation of signal as a result of the proposed ATST Project. If there is such a degradation of signal, a resolution of the issue will be developed and accompanied by the appropriate level of NEPA compliance. In addition, NSF will work with the FAA to obtain adequate funding for implementation of the resolution. This would reduce the effects to negligible, adverse, and long-term.

4.1.4 No-Action Alternative

DIRECT AND INDIRECT EFFECTS

There would be negligible, adverse effects on land use and existing activities under the No-Action Alternative, as the proposed ATST Project would not be constructed on HO property. The No-Action Alternative would not result in a change to a land use or the level and types of existing activities, any changes would be so small that it would not be of any measurable or perceptible consequence.

4.1.5 Summary of Effects to Land Use and Existing Activities

If implemented at the Mees or the Reber Circle site the proposed ATST Project would have a minor, adverse, and long-term effect on current land use designated as Conservation District, General Subzone. No mitigation would be necessary. There would be a major, long-term effect on FAA RCAG facilities. The ATST facility, if constructed at the Mees site, may result in signal attenuation from the RCAG facilities due to physical obstruction by the ATST structures. If implemented at the Reber Circle site, the proposed ATST Project would also have major, adverse, and long-term effects on FAA RCAG facilities.
FAA specialists working with NSF will address any potential issue involving a degradation of signal as a result of the proposed ATST Project. If there is such a degradation of signal, a resolution of the issue will

be developed and accompanied by the appropriate level of NEPA compliance. In addition, NSF will work with the FAA to obtain adequate funding for implementation of the resolution. This would reduce the effects to negligible, adverse, and long-term. Any mitigation that would be necessary would be implemented by the FAA. Under the No-Action Alternative, the proposed ATST Project would not be built and the land use and existing activities at HO would continue to function in its current configuration.

4.2 CULTURAL, HISTORIC, AND ARCHEOLOGICAL RESOURCES

This section discusses the potential environmental effects on cultural, historic, and archeological resources caused by the proposed ATST Project, whether implemented at the Mees site or the Reber Circle site. The ROI for cultural, historic, and archeological resources includes HO, the summit area within HALE (primarily for cultural resources), and the Park road corridor. The environmental effects are examined for (1) on-site construction and installation, and, (2) operation of the proposed ATST Project facility.

4.2.1 Methodology for Effect Assessment and for Assessing and Discussing Cultural Evaluation

Information to evaluate effects relevant to this section has been obtained through cultural resource research supplemented with ethnographic interviews and oral histories, the EIS scoping process and scoping meetings held in July 2005, consultations with the State Historic Preservation Division (SHPD) of the DLNR, consultation with the Office of Hawaiian Affairs (OHA), Section 106 consultation meetings held in January, March and May 2006, and formal and informal consultations with Native Hawaiian individuals, agency and group meetings during 2005 and 2006 (further discussed in Section 5.0-Notification, Public Involvement, and Consulted Parties), the September 2006 draft Environmental Impact Statement (DEIS) comment meetings, which included Section 106 issues, a Supplemental Cultural Impact Assessment (SCIA), and four additional Section 106 consultation meetings held in June and August 2008. In addition, existing studies on ethnographic, historic, and archeological resources within the ROI were reviewed. The information obtained has been considered in determining the level of effects on cultural, historic, and archeological resources.

The thresholds of change for the intensity of effects on cultural, historic, and archeological resources are defined as follows:

Effect Intensity	Intensity Description
Negligible	Effect is at the lowest levels of detection with neither adverse nor beneficial consequences and would neither alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. This is analogous to a determination of *no effect* under Section 106 of the NHPA.
Minor	**Adverse effect —** effect(s) result(s) in little, if any, loss of integrity and would be slight but noticeable, but would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. This is analogous to a determination of *no adverse effect* under Section 106 of the NHPA.
Moderate	**Adverse effect —** disturbance of a site(s) results in loss of integrity and effect(s) would be apparent and would alter resource conditions. There would be an interference with traditional access, site preservation, or the relationship between the resource and the affiliated group's practices and beliefs, even though the group's practices and beliefs would survive. The determination of effects for §106 would be *adverse effects*, however, these effects could be avoided, minimized, or mitigated to reduce the intensity of effects under NEPA from major to moderate.

Effect Intensity	Intensity Description
Major	**Adverse effect —** disturbance of a site(s) results in loss of integrity and effect(s) would alter resource conditions. There would be a block to, or great affect on, traditional access, site preservation, or the relationship between the resource and the affiliated group's body of practices and beliefs, to the extent that the survival of a group's practices and/or beliefs would be jeopardized. This is analogous to a determination of *adverse effect* under Section 106 of the NHPA, and measures to minimize or mitigate adverse effects cannot be agreed upon that would reduce the intensity of effects under NEPA from major to moderate.

4.2.2 Evaluation of Potential Direct and Indirect Effects at the Mees Site

Construction- and Operation-Related Effects at the Mees Site

***<u>Cultural Resources</u>*.** Following issuance of the September 2006 DEIS and in response to numerous comments, the SCIA was conducted by Cultural Surveys Hawaiʻi (Vol. II, Appendix F(2) and issued as a publicly distributed report. As concluded in the SCIA, it is apparent that immediate and cumulative effects are expected by the proposed ATST Project atop Haleakalā. Immediate and short-term effects to the summit of Haleakalā would be associated with activities directly related to the construction of the facility, itself, at either proposed site, as well as potential effects to the surrounding infrastructure during the construction phase (i.e. soil and construction staging areas and/or increased use of the roadways). For some Kanaka Maoli (Native Hawaiians), the physical excavation of the cinder in and of itself is seen as a desecration of the kinolau or body of Pele. There are disagreements within the community as to the degree to which this effect can be mitigated, if at all. Steps toward preservation and education with regard to Kanaka Maoli cultural beliefs and sense of place have been put forth in "Ku I Ka Mauna, Upright at the Mountain, Cultural Resources Evaluation for the Summit of Haleakalā" (CKM, 2003), a document prepared as a part of the IfA LRDP.

To limit the assessment of the cumulative and long-term effects of the proposed ATST Project undertaking to the 18.166-acre area would be difficult, as the overall size and color of the proposed facility would have a more wide-ranging effect. Therefore, the assessment needs to take into account the whole of the summit and crater area. Based on the testimony presented by the community, there is a necessity for some people to have an unimpeded view plane from mountain to ocean, particularly in the context of ceremonial activities. For example, unimpeded views are found at the east and west ahu within the HO. It is clear that the height and color of the proposed facility would impede the view plane and is seen by some as a personal affront to their cultural beliefs. For some Kanaka Maoli, the unaesthetic nature of the proposed ATST Project has led to further objections about another observatory as an additional "eye sore" to the summit area. It would compound the adverse effects of the already existing facilities.

The anticipated adverse effects on the summit area of Haleakalā that would result from the construction and day-to-day use of the proposed ATST Project facility brought forth strong opposition from the majority of the Native Hawaiian community who participated in the scoping and public comment period. Responses to the proposed ATST Project were deeply emotional and, for some, the idea of an additional building atop the summit was physically painful. Overall, there is a belief that to go forward with the proposed undertaking would be a desecration of a sacred site, with some equating the effects to building an observatory next to the Wailing Wall in Jerusalem or within the city of Mecca. For these people, the impact of the proposed ATST Project on cultural resources would be major, adverse, and long-term.

Although not nearly as prevalent, there was testimony in support of the proposed ATST Project, In most instances, supporters strongly rallied for education of Hawaii's youth and the possible opportunities that such a facility might bring to Native Hawaiians.

At the Mees site, the TCP is within the grading and leveling footprint, soil placement area, and the staging and lay down area (Figs. 2-7 to 2-9). During the course of Section 106 consultations, the issue of "cultural desecration" due to excavation of Haleakalā's material was raised on several occasions (e.g., March 28, 2006, Section 106 Meeting Iwado Court Reporters Transcript, p. 69, Vol. II, Appendices F(1)-Cultural and Historical Evaluation, p. 62, and F(2)-Supplemental Cultural Impact Assessment, p. 56). From those discussions, some Native Hawaiians would find the foundation excavation to be a "wound" to Haleakalā. The misinterpretation of site plans early in the scoping process inferred that the excavation would be some five stories in depth, which added to the perception that a deep wound would be inflicted on the mountain summit. More explicit information provided by the ATST Project personnel at later Section 106 meetings, indicating that the actual excavation would be no more than about 21 feet, did not appreciably alter the perception of wounding the summit. Nevertheless, for those who view any amount of excavation as desecration of a sacred site, the impacts on cultural resources would be major, adverse, and long-term, and no mitigation measures would lessen the impacts.

The effect of the construction and operation of the proposed ATST Project, which would be a 143-foot tall structure at Kolekole, is, as explained earlier, viewed by some Native Hawaiians to be a cultural desecration of a sacred site. Part of the cultural value of the summit area is the ability to see only mountain when viewing the summit area of Haleakalā, and the construction of the proposed ATST Project would result in a structure that would have a major, adverse, and long-term impact on cultural resources, as described by a number of Native Hawaiian individuals during the cultural resource evaluation process (e.g., Vol. II, Appendices F(1)-Cultural and Historical Evaluation, p. 23-28 and (F2)-Supplemental Cultural Impact Assessment, p. 56, and during the March 28, 2006, Section 106 Meeting Iwado Court Reporters Transcript, p. 67). Although the survival of Hawaiian cultural practices and beliefs are not in question, the structure would interfere with the relationship between the Native Hawaiians and Haleakalā. The construction of the structure, therefore, at either alternative site would, from this perspective, have a major, adverse, and long-term effect on cultural resources. Mitigation measures to minimize the effects on cultural resources are discussed in Section 4.18-Mitigation, although for these major impacts, no mitigation would minimize the effects.

In addition to the major, adverse effects of the 143-foot tall structure, on-going operations of the proposed ATST Project pose additional potential effects on cultural resources. These include future events such as potential turnover in operations personnel, with concomitant loss of individuals' knowledgeable of cultural preservation (although all personnel would require such training, in accordance with the LRDP), eventual need for exterior facility repairs that could require temporary changes to the appearance of the facility, e.g., scaffolding or paint stripping, or experiments requiring temporary structures within the building footprint that could be perceived as additional cultural desecration. On-going operations of the proposed ATST Project would have a major, adverse, and long-term effect on cultural resources; however implementation of mitigation measures would reduce the effect intensity to a moderate adverse, long-term level for these types of adverse impacts to cultural resources. Specifically, in accordance with IfA's preservation plan, all construction crewmembers would attend UH-approved "Sense of Place" training prior to working on the proposed ATST Project. In addition, a cultural specialist would provide oversight of all construction projects and set-aside areas for exclusive use by Kanaka Maoli to practice cultural and spiritual ceremonies (CKM, 2003, p. 16). The cultural specialist would be engaged at the earliest stages of the planning process, monitor the construction phase, and consult with and advise the on-site Project Manager with regard to any cultural or spiritual correction, including the disposition of rock and soil, rehabilitation of disturbed areas, and the appropriate prayers at the beginning and end of work. With implementation of these mitigation measures, the impacts on cultural resources would be reduced from major to moderate, adverse, and long-term.

Section 3.2.1-Cultural Resources outlines a variety of traditional cultural practices that have and continue to take place within the ROI. The sign at the entrance to HO states that Native Hawaiians are not restricted from practicing their traditional cultural practices within HO. Likewise, the NPS supports the perpetuation of traditional cultural practices within areas of HALE, as appropriate under NPS policy. A number of the traditional cultural practices that continue to take place within the ROI require silence/solace and uninterrupted view plane/sacred space. The amount of noise and construction-related activities associated with the proposed ATST Project would have a major, adverse, and short-term effect on the conduct of traditional cultural practices within the ROI. Specifically, the noise generated from the existing facilities at HO and the noise resulting from the construction and operation of the proposed ATST Project will have, during certain times of the day and during certain months, major, adverse impacts on the ability to conduct such practices. For example, such impacts would be major at Red Hill and areas adjacent to HO out to a distance of 2,500 feet (where noise would be attenuated to ambient levels). Mitigation measures imposed by the USFWS (pursuant to the Section 7 informal consultation) and HALE (pursuant to the mitigation measures to be included in the SUP), would reduce those noise levels to a negligible level during certain hours of the day and during certain months of the year due to restrictions on noise-generating activities. The relevant mitigation measures imposed by HALE include a limitation to conduct onsite and outdoor ATST-related construction activities during the time-frame from 30 minutes after sunrise to 30 minutes prior to sunset, and a limitation on the hours for wide load vehicles to traverse the Park road (such vehicles need to come through the Park during the night between approximately 8:00 p.m. and 4:00 a.m., and are prohibited from coming through the Park at night between April 20th and July 15th. The seasonal restriction on wide load traffic is also imposed by USFWS. Accordingly, during the timeframes in which these restrictions are imposed, impacts to traditional cultural practices at HO, Red Hill, and areas adjacent to HO out to 2500 feet will be reduced to a minor, adverse, and long-term level.

The presence of built facilities, people, and associated noise with operations-related activities at both the Mees and Reber Circle Sites will continue to have a noticeable impact on the conduct of traditional practices within the ROI. The effects from these activities are expected to be minor, adverse, and long-term.

With regard to conducting traditional cultural practices within the Park road corridor, the only ATST-related activities which have the potential to impact one's ability to practice traditional cultural practices is noise generated by ATST-related construction and operations traffic. As set forth in Section 4.10-Noise, ATST-related construction and operations traffic would result in only negligible, adverse, and long-term impacts. The wide load traffic restrictions imposed by HALE and USFWS (discussed above) would not reduce these noise impacts below this level. Therefore, the proposed ATST Project would result in negligible, adverse, and long-term impacts to one's ability to practice traditional cultural practices within the Park road corridor.

Recommendations from the SCIA.

Based on the information gathered during preparation of the SCIA, the overwhelming evidence from a cultural and traditional standpoint point toward a major, adverse, and long-term effect on some Native Hawaiian traditional cultural practices and beliefs. This determination of major, advers,e and long-term effect would apply to both the Mees and the alternative Reber Circle sites. To the majority of Native Hawaiians and non-Hawaiians who participated in this process, the proposed undertaking is immitigable and, therefore, following the No-Action Alternative and keeping both the Mees site and Reber Circle site in their current undeveloped state was strongly recommended.

In the event that the proposed ATST Project is approved and funding secured, the SCIA recommended that more time for mitigative proposals be allotted and the development of working relationships with Native Hawaiian groups be actively pursued. As Haleakalā plays a central role in the history and culture of Maui Island Kanaka Maoli, the SCIA found that it is imperative that there be open lines of communication and that efforts are made to hear, understand, and respect the cultural concerns and beliefs of the community during the course of project construction as well as throughout the operational time span of the facility itself.

Two proposals, submitted by Mr. Warren Shibuya and Kahu Charlie Maxwell, were put forth as a potential means to mitigate the effects of the proposed undertaking. While these individuals may not agree with or support the construction of the proposed ATST Project, there is a feeling that Native Hawaiians may be able to derive a benefit in the form of educational facilities from allowing for the use of the summit for astronomy and observation. Mr. Shibuya suggested policies that include: hiring Maui residents for all phases of work, establishing a Maui Solar and Hawaiian Cultural Center, to require ATST to develop a sunset clause, where, at a determined time, ATST would be removed and the site restored to its natural state; and, that all streets and facilities be given Hawaiian names.

Kahu Maxwell proposed the development of Hālau ʻImi ʻIke Hōkū, Center for Traditional Hawaiian Navigation and Astronomy. This Center would aim to bring traditional Hawaiian celestial knowledge together with modern science and astronomy. It would include a planetarium and provide scholarships to Maui residents for post high-school education.

Informal proposals presented in a talk-story format by the Kahikinui Homestead Community included full scholarships for Native Hawaiian students with an award preference to the students and youth of Kahikinui, as well as the development of a mentorship program between Native Hawaiian students and scientists working atop Haleakalā. The goal of the proposed programs would be to even the educational field and, as Kahu Maxwell points out in his proposal, make it possible for Native Hawaiians to become experts in astronomy. The implication in these proposals is that someday those studying and operating the observatory facility would be Kanaka Maoli.

Maui Community College (MCC) in Kahului, Hawai`i presented a mitigation proposal in response to the proposed ATST Project. As a mitigation initiative, the proposal requests funding to establish a program to be called "Akeakamai I Ka Lā Hiki Ola". The main goal of the program would be to improve the achievement success of Native Hawaiians in math and science, or more specifically, Science, Technology, Engineering, and Math (STEM), to grow workforce advancement and job opportunities for Native Hawaiians. The proposal originates from an underlying assumption of the value of the Sun as a primary source of energy and life itself, which is recognized by kupuna (elders) and scientists alike.

Historic Resources. At the Mees site, there are no historic sites within the grading and leveling footprint, soil placement area, and the staging and lay down area (Figs. 2-7 to 2-9), and therefore no recovery plan or preservation plan for specific sites within that footprint were necessary. As mentioned in Section 3.2.2-Historic Resources, the only historic site at HO is the Reber Circle site, Site 50-50-11-5443, the radio telescope foundation. Construction and operations of the proposed ATST Project would not result in any impacts to the Reber Circle site. Accordingly, the effects on historic resources from construction and operation activities are expected to be negligible, adverse, and long-term

The Park road corridor is a historic cultural landscape. It is the main access road to HO and would be traveled by all vehicles needing access to the Mees site. The Park road corridor is a functioning thoroughfare which is used on a daily basis and it is part of an historic roadway that has been evaluated by the NPS and Historic American Engineering Record (HAER) as eligible for listing in the National Register of Historic Places under Criterion "A" (for its development of the National Park System, the development of early NPS landscape architectural design styles, and the craftsmanship of the Civilian Conservation Corps (CCC) and under Criterion "C" (for its association with rustic Park design that characterized early NPS development during the 1930s). As explained in Section 3.2.2, the historic features of this roadway include: the road, itself, 1 bridge, 11 box culverts, and original culverts with mortared stone headwalls. In addition, the Park road corridor is within the boundaries of the Crater

Historic District, which is listed on both the SIHP (SIHP 50-50-11-12-1739) and on the NRHP. All vehicles involved in construction related activities would adhere to the Hawai‘i Department of Transportation (DOT) laws and regulations. According to the findings set forth in the recent road report prepared by the Federal Highway Administration (FHWA), the relatively small increase in traffic due to construction and operation activities — 2.8 percent and 1.4 percent, respectively (FHWA, 2009) — would have little measureable effect on traffic or wear to the Park road corridor, including the historic bridge and box culverts. Therefore, construction-related effects are expected to be minor, adverse, and short-term.

Operations-related effects on the Park road corridor would be less than the effects from construction-related activities, as the level of traffic related to the proposed ATST Project along the Park road corridor would be less (2.8 percent increase in traffic along the Park road corridor for construction-related traffic and 1.4 percent increase in traffic for operations-related traffic) (FHWA, 2009). The intensity of these effects on historic resources within the Park road corridor, however, would remain at minor, adverse, and short-term.

Archeological Resources. Archeological inspection of the Mees site indicates that this portion of the HO parcel was previously affected by earthmoving activities associated with the construction of the MSO facility in 1964, existing access road, weather tower structures, and other structures. Pushed rocks, push piles, and old cleared areas (bulldozed) were noted in the vicinity of the towers (Vol. II, Appendix A-Archaeological Field Inspection).

This portion of the proposed ATST Project site contains three features that are interpreted as relatively recent additions/modifications. Rocks noted in the construction of these features/modifications were not weathered like those contained in the many sites and features that have been previously documented elsewhere at HO. Therefore, any archeological resources that may have existed prior to 1964 are no longer present and it is not anticipated that effects would occur to archeological resources at HO.

It is anticipated that construction related operations at the Mees site would result in negligible, adverse, and long-term effects on archeological resources identified by inventory surveys described in Section 3.2.3-Archeological Resources. The grading and leveling, soil placement areas, and staging and lay down areas that would be employed for the Mees site would not affect any archeological features. In the event that Site 50-50-11-5443 is affected by soil placement from the proposed ATST Project, the Data Recovery Plan for Site 50-50-11-5443 (Vol. II, Appendix B(1) approved by the SHPD would be employed.

The construction activities at the Mees site would be conducted in accordance with the “Science City” Preservation Plan (Vol. II, Appendix B(2) that has been approved by the SHPD. The plan calls for passive preservation of sites during future activities.

In the event that a burial site is uncovered during construction of the proposed ATST Project, the requirements of HAR, Title 13, Subtitle 13, Chapter 300, Rules of Practice and Procedure Relating to Burial Sites and Human Remains would be followed.

The construction- and operations- related activities that would be employed for the Mees site would not affect any archeological resources. Therefore, there would be negligible, adverse, and long-term effects on archeological resources from the construction of the proposed ATST Project at the Mees site.

The construction and operations related activities that would be employed for the Mees Site would not impact any archeological resources within the Park road corridor. The relevant activities that have the potential to affect archeological sites within the Park road corridor include the ATST construction and operations related traffic. Such traffic is expected to remain on the Park road and, thus, would not impact any nearby archeological sites. Therefore, there would be negligible, adverse, and long-term effects on archeological resources along the Park road corridor from the Proposed Action.

4.2.3 Evaluation of Potential Effects at the Reber Circle Site

Construction- and Operation-Related Effects at the Reber Circle Site

Cultural Resources. By virtue of its height and location within HO, the construction of a project with the vertical elevation of the proposed ATST Project would be more visible from both HALE and populated communities on Maui than at the Mees site (Section 4.5-Visual Resources and View Plane). As explained above for the Mees site alternative, some Native Hawaiians would interpret the visibility of the proposed ATST Project from these vantage points as cultural desecration of a sacred site. The effects to those individuals would be similar or more pronounced at the Reber Circle site than if construction were at the Mees site. With the exception of the increased vertical elevation, the analysis set forth above for the Mees site applies equally to the Reber Circle Site with regard to impacts on cultural resources, including impacts to traditional cultural practices. Accordingly, the construction and operation of the proposed ATST Project at the Reber Circle site would result in major, adverse, and long-term effects on cultural resources.

Historic Resources. Construction at the Reber Circle site, which lies at the peak of Puʻu Kolekole, would have a major, adverse, and long-term impact on Site 50-50-11-5443 (UH IfA, 2005), which has been described in Section 3.2.3-Archeological Resources as the remnant of a 1952 radio telescope experiment. Site 50-50-11-5443 qualifies for significance under Federal and State historic preservation guidelines Criterion "A" because of its association with mid-20th century scientific studies at Haleakalā, and under Criterion "D" for its information content. If the proposed ATST Project were built at the Reber Circle site, site 50-50-11-5443 would be removed in accordance with the Archaeological Data Recovery Plan for Reber Circle, which was accepted by SHPD (Vol. II, Appendix B(1)-Data Recovery Plan for Site 5443). As a result, there would be major, adverse, and long-term effects on historic resources from the construction of the proposed ATST Project at the Reber Circle site. Applying, mitigation measures such as removing site 50-50-11-5443 in accordance with the Archaeological Data Recovery Plan, would, reduce the level of effects to moderate, adverse, and long-term.

Operations of the proposed ATST Project at the Reber Circle site would not likely result in any effects to historic resources, as the only historic resource in the vicinity is Site 50-50-11-5443, which would have already been removed during the construction phase. Therefore, the effects on historic resources based on operating the proposed ATST Project at the Reber Circle site would be negligible, adverse, and long-term.

As explained earlier, the Park road corridor would be traversed in the same manner as a result of construction- and operation-related activities whether the proposed ATST Project were built at either the Mees or the Reber Circle sites. Therefore, as was true of the effects under the Mees site alternative, effects on historic resources from construction and operational activities at the Reber Circle site are expected to be minor, adverse, and short-term.

Archeological Resources. The construction and operations related activities that would be employed at the Reber Circle site would not have any impact on archeological resources identified in the inventory surveys described in Section 3.2.3-Archeological Resources. Therefore, there would be negligible, adverse, and long-term effects on archeological resources from the proposed ATST Project at the Reber Circle site.

The construction and operations related activities that would be employed for the Reber Circle Site would not impact any archeological resources within the Park road corridor. The relevant activities that have the potential to affect archeological sites within the Park road corridor include the ATST construction and operations related traffic. Such traffic is expected to remain on the Park road and, thus, would not impact any nearby archeological sites. Therefore, there would be negligible, adverse, and long-term effects on archeological resources along the Park road corridor from the Proposed Action.

4.2.4 Evaluation of Potential Effects for the No-Action Alternative

There would be no affect to cultural, historic, and archeological resources under the No-Action Alternative, as the proposed ATST Project would not be constructed.

4.2.5 Summary of Effects on Cultural, Historic, and Archeological Resources

Cultural Resources
Construction and operation of the proposed ATST Project at either the Mees or Reber Circle sites would likely result in major, adverse, and long-term impacts on the cultural resources within the ROI. The location of a 143-foot tall structure at HO would be perceived by some Native Hawaiians as intrusive on the cultural sanctity of what is considered by some to be a sacred site; for these people, effects would be major, adverse, and long-term and could not be mitigated. Impacts on traditional cultural practices would also be major, adverse, and long-term, however, compliance with proposed mitigation measures required by USFWS and HALE for both sites would lessen the overall effect to minor, adverse, and long-term level during certain timeframes and certain months of the year. Effects on the cultural resources within the Park road corridor are expected to be minor, adverse, and long-term. Under the No-Action Alternative, there would be no effects to cultural resources within the ROI.

Historic Resources
There would be negligible, adverse effects from the construction and operation of the proposed ATST Project at the Mees site. There would, however, be major, adverse, and long-term impacts on historic resources from the construction of the proposed ATST Project at the Reber Circle site because the Reber Circle site is a significant historic site. Implementation of mitigation measures for these effects, however, could reduce the level of impacts from major to moderate, adverse, and long-term. With regard to operation-related activities, the effects at the Reber Circle site would be negligible, adverse, and long-term. Construction and operation of the proposed ATST Project at either site would result in minor, adverse, and long-term effects to the historic resources within the Park road corridor. Under the No-Action Alternative, there would be no effects on historic resources within the ROI.

Archeological Resources
There would be negligible, adverse, and long-term effects on the archeological resources at HO and within the Park road corridor from construction and operation of the proposed ATST Project at either the Mees site or the Reber Circle Site. Under the No-Action Alternative, there would be no effects on archeological resources within the ROI.

4.3 BIOLOGICAL RESOURCES

This section identifies potential direct and indirect biological effects that may result from implementing the proposed ATST Project at either the Mees or Reber Circle sites or the No-Action Alternative. The methods and significance criteria used in this analysis of the intensity and extent of effects on listed species that would result from construction and routine operation are described in the following section.

For evaluation of the potential effects on biological resources as a result of implementing the proposed ATST Project, the ROI would be primarily within both the HO and relevant areas within HALE, including the Park road corridor.

4.3.1 Methodology of Effect Assessment

The methods used to determine whether the proposed ATST Project would have effects on biological resources are as follows:

1. Review and evaluate existing and past actions to identify which actions within the ROI have resulted in diminished health, diversity, or population of biological resources, in order to evaluate the action's potential effects on biological resources.
2. Review and evaluate each alternative to determine its potential for effects on biological resources due to loss of habitat, noise, vibration, vehicular traffic, and the introduction of alien invasive species (AIS). Loss of habitat was evaluated based on what is known about existing and past loss of habitat within in the ROI. Noise and vibration were estimated from industry standards and applied to known thresholds for adverse effects on various species. Traffic estimates were based on known requirements for construction and operations of similar facilities and applied to potential effects from past and present actions. These methods were used to identify potential effects on the ecosystem and its component parts within and adjacent to HO, including damage to the existing natural habitats, excessive disturbance of flora and fauna and introduction of invasive species.
3. Assess the compliance of each alternative with applicable Federal, State, or County regulations that apply to preservation of biological resources.

Effects on biological resources were evaluated by determining sensitivity, significance, or rarity of each resource that would be adversely affected by the proposed ATST Project. Factors considered in determining whether an alternative would have an effect on biological resources include the extent or degree to which its implementation would do any of the following:

1. Substantially affect a rare, threatened, or endangered species or its habitat (HAR §11-200-12 and Endangered Species Act (ESA) 1973, Section 7 (a) 2, Interagency Cooperation).
2. Cause the "take" of a highly sensitive resource, such as a threatened, endangered, or special status species.
3. Result in non-concurrence with the National Science Foundation (NSF) based on a determination of No Adverse Effect in the Informal Consultation Document by the U.S. Fish & Wildlife Service (USFWS).
4. Reduce the population of a sensitive species, as designated by Federal and State agencies, or a species with regional and local significance by reducing numbers, altering behavior, reproduction, or survival, or by destroying or disturbing habitat.
5. Have an adverse effect on the ʻuaʻu (Hawaiian Petrel) habitat.
6. Conflict with Hawaiʻi Coastal Zone Management Program policies.
7. Introduce or increase the prevalence of AIS; or,
8. Cause long-term loss or effect of a substantial portion of local habitat.

The thresholds of change for the intensity of an effect are defined as follows:

Effect Intensity	Intensity Description
Negligible	Biological resources would not be affected or the effects would be below or at the lower levels of detection.
Minor	The effects on biological resources would be detectable. Effects to biological resources would be small. Mitigation may be needed to offset adverse effects and would be relatively simple to implement and likely be successful.
Moderate	The effect on biological resources would be readily apparent and result in a change to the resource over a relatively wide area. Mitigation measures would be necessary to offset adverse effects and likely be successful.
Major	The effect on biological resources would be readily apparent and substantially change the character of the biological resource over a large area. Extensive mitigation measures to offset adverse effects would be needed and their success could not be guaranteed.

4.3.2 Evaluation of Potential Effects at the Mees Site

Locating the proposed ATST Project at the Mees site would result in construction and a minimal increase in HO-wide operations. What follows is a discussion of each of the potential effects that may result from locating the proposed ATST Project at the Mees site.

DIRECT AND INDIRECT EFFECTS

Construction-Related Effects at the Mees Site

Effects on Native and Non-Native Botanical Resources Including AIS

HO and the Park road corridor contain biological ecosystems that are both unique and fragile. In assessing the effects within the ROI, it is important to note that considerable efforts have been expended in recent years to keep feral animals off the upper slopes of HALE (a feral animal control fence encloses Haleakalā Crater and much of Manawainui),and there are extensive staff and volunteer efforts to check the spread of AIS.

Within HO, surveys were conducted at various times to assess its botanical habitats (Section 3.3.1-Botanical Resources). These surveys were done as part of earlier HO development activities, the LRDP for HO, and more recently as part of the EIS assessment of the affected environment for the proposed ATST Project. Even so, the brief, approximately 10-year span of available data cannot reliably predict all the effects from construction of the proposed ATST Project. However, identifiable effects on those resources from earlier actions are useful in assessing what is likely to occur during construction.

According to the botanical survey of HO conducted in 2005, there were more non-native plants on the HO site relative to similar adjacent "pristine" areas of HALE, Kahikinui Forest Reserve, and Kula Forest Reserve. The report cited a number of reasons. To some extent, development seems to promote plant growth, both native and non-native. This is likely due to disturbance to the soil from construction, additional water sources from discharge pipes and gutters, and protection from the elements by objects such as building foundations and sidewalks. Both native and non-native plants are able to find refuge in otherwise inhospitable locations. Considering the effects from earlier construction of facilities at HO, the effect on botanical resources has been detectable, with an increase in weeds and non-native species. However, since native species still flourish at HO and since small incidental benefits such as protection from the elements do occur at HO, the overall effects on botanical resources from construction of the proposed ATST Project could be said to be minor, adverse, and long-term.

Botanical resources along the Park road corridor can be grouped into the alpine and subalpine shrubland habitat zones, depending upon elevation. The upper, alpine zone largely contains the botanical diversity described above for HO. The lower elevations, below about 8,500 feet, are within the subalpine shrubland habitats; historically, both have been suppressed by feral goats and are recovering well in their absence. Non-native grasses, especially velvetgrass (*Holcus lanatus*) are common and persistent between native shrubs (Medeiros, et al, 1998).

Throughout the history of HALE, there has been encroachment by non-native botanical species. Since some of these threats gain entry through the road corridor as seed or pod hitchhikers on vehicles and people, and construction at the Mees site would contribute a small portion of the traffic and an even smaller portion of the overall threat to botanical species, the overall effects on botanical resources within Park road corridor would be considered negligible, adverse, and long-term.

Introduction or proliferation of AIS has been identified as a potential threat for most special status species located in the ATST ROI. The introduction of AIS from the proposed ATST Project originates from the same two major sources as elsewhere on Haleakalā. Equipment, supplies, and containers with construction materials that originate from elsewhere, such as the other islands or the mainland, could be infested by unwanted species when they arrive in Kahului. Secondly, vehicular traffic for the Mees site would increase during construction and operation of the proposed ATST Project, thereby increasing potential for the introduction of AIS, even though this increase in traffic is not expected to be major. These unwanted introductions are not anticipated to be major for the proposed ATST Project, given the mitigations described in Section 4.18.3-Biological Resources. In addition, provisions to control the introduction of AIS would be included in the SUP issued by HALE for ATST Project-related traffic along the Park road corridor. Overall, the effects on AIS would be minor, adverse, and long-term.

Effects on Endangered, Threatened, Proposed, and Candidate Plant Species

‘Ahinahina (Haleakalā Silversword). There are a number of ‘ahinahina plants, 382 hectares (ha) (944 acres (ac) of designated Haleakala ‘ahinahina critical habitat, and one ha (2 ac) of *Geranium multiflorum* designated critical habitat, within the action area of the ATST project including the Park road corridor. In 2002, nine live ‘ahinahina and three dead ‘ahinahina flower stalks were located on HO property. All of the live plants were at the MSSC site. Despite being quite large, up to 50 cm (20 in) in diameter, these nine live ‘ahinahina apparently were all less than five years old and grew since construction of the facility. The live ‘ahinahina were located in landscaped areas, alongside retaining walls, on a steep slope just below the parking area, and in the MSSC leach field. There were also three dead ‘ahinahina flower stalks on the UH property. HALE service personnel placed two stalks near the MSSC leach field. The other dead ‘ahinahina flower stalk was located near the former LURE Observatory (now Pan-STARRS, PS-1) and was alive in 1991. In the most recent botanical survey, no ‘ahinahina were found within the Mees site, and therefore there would be negligible, adverse, and short-term effects from the proposed ATST Project.

Geranium multiflorum. In addition the proposed ATST Project would have no effects on the Haleakala ‘ahinahina or its critical habitat, and on *Geranium multiflorum* critical habitat. The USFWS does not have any information that would indicate that the Haleakalā ‘ahinahina plants and *Geranium multiflorum* critical habitat within the proposed ATST Project area would be affected. In providing for vehicle steam cleaning, invasive species inspections, and rapid response to on-site discoveries of introduced species, the proposed ATST Project is providing the best available level of protection against habitat-modifying invasive insects, plants, and other pests.

Effects on Endangered, Threatened, Proposed, and Candidate Avifaunal Species

‘Ua‘u. Construction activities that could induce ground vibration (i.e., heavy equipment grading, excavating, drilling, and compacting) could disrupt resident avifaunal resources at HO, adversely affecting ‘ua‘u nesting and fledging success. Confirmed causes of ‘ua‘u mortality could arise from construction include nest collapse, predation by introduced predators, road-kills, collision into such objects as buildings, utility poles, fences, lights, and vehicles (UH IfA, 2005). No effect was observed on nesting or fledgling success of ‘ua‘u from two previous construction efforts, the Faulkes Telescope Facility (FTF) in HO in September 2002 and the new HALE restroom facility in September 2003. ‘Ua‘u were at the colony during both construction activities, but excavation took place during non-nesting season when the ‘ua‘u were not on site. No reports of earlier effects to the other two special status species (‘ope‘ape‘a, or Hawaiian Hoary Bat, and nēnē, or Hawaiian Goose) in the HO area have been reported.

While the proposed ATST Project would be constructed close to a few of the currently identified ‘ua‘u burrows on the south slope of HO, negligible, adverse, and short-term effects are anticipated on most avifaunal resources. The potential effects on the special status species during construction of the proposed ATST Project is discussed below, along with mitigative measures necessary to prevent or limit effects on these species or ‘ua‘u burrows within the immediate vicinity of the proposed facility.

Effects from construction could include the potential for disturbance of the habitat, in which the ‘ua‘u would not remain in their burrows during the nesting season. Construction noise, vibration, or human proximity could affect the nesting habits of the ‘ua‘u to the extent that they may not return to, remain in, or otherwise utilize the burrows that are inhabited each year. Construction activity also has the potential of causing burrow collapse, directly related to excavation, vibration, or other human activities. Collapse of a burrow could result in ‘ua‘u mortality.

During informal consultation with the USFWS, however, it was determined that with the mitigation measures implemented by NSF (Section 4.18-Mitigation), the proposed ATST Project has “reduced potentially adverse effects for the Hawaiian petrel...to a level of discountable effects” and would therefore have “… negligible adverse long-term effects on that species” (USFWS 2007). Formal consultation would take place in the event that a “take” were to occur in the future and the causes would be investigated and addressed. An incidental “take” permit statement would be added to the findings of a re-initiated Section 7 consultation, if necessary.

Road Noise Effects to Incubating Adults. From April 20 through July 15, only two trucks, with maximum sound production of 83 (decibel scale) dBA (measured at 50 feet, pursuant to the Environmental Protection Agency (EPA) standards) would make one round trip each to the ATST site, per day throughout the construction period of the project. Approximately 11 ‘ua‘u burrow entrances, located closer than 15 meters (50 feet) to the road may be exposed to sound levels higher than 83 dBA, resulting from ATST construction trucks, four times per day. Approximately 149 additional ‘ua‘u burrow entrances are located within the road corridor of the Action Area, where they may be exposed to truck noise levels, at burrow entrances, of 65 dBA or greater. An estimated 600 to 900 vehicles, including buses and touring vans access the Park road corridor per day (Cathleen Natividad Bailey personal communication), in addition to the two trucks and seven to eight passenger vehicles scheduled to visit the ATST construction site during the ‘ua‘u incubation period. Although Natividad Bailey’s (personal communication) data analysis was not yet complete, preliminary reports suggest that egg neglect has not resulted in ‘ua‘u mortality at Haleakalā, due to noise disturbance or otherwise. The birds occupying burrows close to the road may be habituated to the vehicle noise. In 2002 and 2003, Natividad Bailey (HALE, 2003) documented two egg mortalities which were both attributed to infertility.

Noise Effects to Incubating Petrels. Because construction is not expected to produce noise that is louder than ambient wind noise at the burrow entrance or at the nest chamber between April 20 and July 15, disturbance of incubating adult birds by construction site noise is not anticipated.

Because birds occupying burrows adjacent to the Park road corridor appear to be habituated to traffic noise caused by the 600 to 900 vehicles that access the Park each day, and because only two truck round trips would be associated with the ATST project during the incubation period, the ATST construction project is not likely to result in any ‘ua‘u egg loss. The monitoring protocols developed to document egg neglect would yield additional information regarding petrel incubation behavior.

Vibration Effects to Incubating Petrels. The incorporation of the noise standard between April 20 and July 15, limiting maximum equipment noise to 83 dBA (at five feet), would eliminate the use of any equipment at the construction site which would cause a vibration greater than 0.0019 in/sec at any of the closest burrows during this period. Fewer than 20 percent of people can perceive a vibration with a peak particle velocity (PPV) of 0.0019 in/sec (Turunen-Rise et al 2003, Klaeboe et al 2003). The two round-trips taken by trucks per day during this period may produce noticeable vibration at the burrow sites along the road. Because the duration of the vibration would be limited, and because the birds are exposed to vibration from 600 to 900 vehicles, including buses, which produce vibration amplitudes which are identical to trucks (Jensen, 1993), we do not believe that the effects of these two vehicles on the incubating birds would be measurable.

Construction Effects During Nestling Period. Construction activities that would produce daily prolonged loud noises and vibration are scheduled to coincide with the nestling period (July 1 through the end of November). ‘Ua‘u nestlings have been observed on their nests, in their burrows, and near their burrow entrances during this period. Adults visit the burrows at night to feed the nestlings and would presumably be unaware of any noise disturbance. The noise generated by construction equipment and vehicles are expected to increase startle, alarm, and alert behavior and disturb the day time sleep of nestlings occupying burrows within 780 meters (2,560 feet) of the construction site and within 122 meters (400 feet) of the Park road corridor. The closest burrow entrance is 12 meters (40 feet) from the outer edge of the construction site. The noise level at a point 12 meters (40 feet) away from an operating crane is 84 dBA when the crane is operating, and 101 dBA when the rock hammer is in use. Topographical shielding between the line of sight view of the construction site, and the burrow entrance, cuts 9 dBA off of the noise level (Fein, unpublished) so that the maximum noise level at any burrow entrance would be 92 dBA. Sound attenuation of 0.625 dBA per inch of burrow depth (KCE, unpublished data) would result in a maximum noise level of 85 dBA within the nest chamber of the burrow closest to the construction site.

A potential consequence of increased noise and vibration could be nest abandonment by juvenile ‘ua‘u. No references to chick abandonment of their nests due to noise or vibration disturbance were found in literature review using CSAMultiSearch (2007). We do not expect ‘ua‘u chicks to abandon their nest, where they are fed, due to the noise and vibration associated with the ATST construction activities. ‘Ua‘u chicks, exposed to noise and vibration associated with the Park road corridor and past construction projects on Haleakalā have not resulted in a documented and published decrease in chick survival or in chick nest abandonment.

To reduce the risk of transporting non-native species or seeds to the project site, NSF has proposed the following measures. The Haleakalā Observatories Long Range Development Plan for the prevention of introduction of invasive exotic weed species would be followed during the construction, maintenance, and use of the ATST. In order to ensure that destructive, non-native species are not introduced to HALE or the HO site, the ATST Project Site Manager would cooperate with HALE staff in developing and implementing a construction worker education program that informs workers of the damage that can be done by unwanted introductions. In addition, all construction vehicles would be steam cleaned to remove all organic matter and insects before they are transported into HALE. Any equipment, supplies, and containers with construction materials originating from outer islands, the mainland, or an international port, would be checked for infestation by unwanted species by a qualified biologist or agricultural inspector prior to departure from that port and again prior to unloading at Kahului Harbor or Airport (University of Hawaii 2005).

Nēnē. Nēnē may be affected by human activities through the application of pesticides and other contaminants, ingestion of plastics and lead, collisions with stationary or moving structures or objects, entanglement in fishing nets, loss of habitat, disturbance at nest and roost sites, attraction to hazardous areas through human feeding and other activities, and mortality or disruption of family groups through direct and indirect human activities. None of these activities are anticipated to occur within the normal habitat of the nēnē in connection with the construction of the proposed ATST Project. Therefore, negligible, adverse, and short- or long-term effects on the nēnē are anticipated.

NSF requested USFWS concurrence with its determination that the proposed ATST Project is not likely to adversely affect the nēnē. Based on vehicle use and nēnē fatality estimates provided by Natividad Bailey (personal communication), one nēnē is killed on the road at HALE, for every 224,454 round-trips taken by vehicles through the Park. Based on the USFWS calculation, during the 31-year life of the ATST project, a total of 66,294 vehicle round-trips would be taken to the project site (11,544 during construction and 54,750 during operation and use). By combining the average nēnē fatality rates due to vehicles driving the Park road corridor and the ATST vehicle use data, USFWS calculated that there would be a collision with 0.3 nēnē during the 31-year life of the project. To further reduce the chance of a collision with a nēnē, all drivers accessing the ATST site during the life of the proposed ATST Project would receive a nēnē briefing from the IfA. Drivers would receive a refresher briefing regarding the nēnē at the beginning of this species' breeding season approximately November 1 of each year. These measures would further reduce the probability of affecting this endangered species within the action area and overall would result in a negligible, adverse, and long-term effect.

<u>Effects on Other Endangered, Threatened, Proposed, and Candidate Faunal Species</u>

'Ope'ape'a. Additional threats to the 'ope'ape'a identified by the USFWS include direct and indirect effects of pesticides, predation, alteration of prey availability (introduced insects), and roost disturbance (USFWS, 1998). The Mees site would not change the current operating procedures or the associated effects on the ecosystem and would have a negligible, adverse, and long-term effect.

<u>Effects on Other Native and Introduced Fauna</u>

Occasionally, feral goats, rats (*Rattus rattus*) cats, and mice have been seen or captured at HO, but not many other fauna have been present. The Park road corridor below the summit area has a much more abundant diversity of species that are not listed as Federal- or State-threatened or endangered species. Avian species are particularly abundant and those which are likely to be found along the Park road corridor include, but are not limited to, quails, francolins, pheasants, chukars, plovers, sandpipers, doves, pigeons, short-eared owls, northern mockingbird, common myna, house finch, common Amakihi (*Hernignathus virens*)**,** Iiwi, (*Vestiaria coccinea*), (Conant and Stemmermann Kjargaard, 1984). Introduced fauna that could be observed closer to the summit area and along the upper Park road corridor include the chukar *(Alectoris chukar)*, the feral goat *(Capra hircus)*, the Polynesian rat *(Rattus exulans)*, and the roof rat *(Rattus rattus)* (AFRL, 2005). The Indian mongoose *(Herpestes auropunctatus)* is occasionally observed on the summit. Cats (Felis catus) and mice (Mus musculus) are also found along the Park road corridor, with cats occasionally seen crossing the Park road (HALE, unpublished data).

Although the location of HO is at an elevation high enough to be outside the range of many of these species, the proposed ATST Project would maintain daily refuse management during construction which would not promote rat and mice populations. During construction of the proposed ATST Project, noise limits and strict on-road use only of traffic would not be likely to jeopardize bird habitats or other fauna in the Park road corridor, and the effects on those resources would be negligible, adverse, and long-term.

Operations-Related Effects at the Mees Site

Effects on Native and Non-Native Botanical Resources Including AIS

To some extent, development at HO seems to promote plant growth, both native and non-native. Given the disturbance to the soil from construction, additional water sources from discharge pipes and gutters, and protection from the elements by objects such as building foundations and sidewalks, both native and non-native plants are able to find refuge in otherwise inhospitable locations (Vol. II, E-Botanical Survey). It is assumed that this trend would continue if the proposed ATST Project were to become operational. Loss of numbers and diversity of native plants has already occurred at HO, as reported in the botanical survey (2005) and, therefore, it is anticipated that botanical resources would experience the same minor, adverse, and long-term effects from operations of the proposed ATST Project at the Mees site.

Effects on Endangered, Threatened, Proposed, and Candidate Plant Species

ʻAhinahina. There have been no ʻahinahina found during the most recent survey at the Mees site. It is not anticipated that additional surveys would identify any plants around the Mees site, but if they were to be found after operations commenced at the proposed ATST Project, the USFWS would be contacted for consultation and arrangements to protect them from damage or loss. It is anticipated that operations of the proposed ATST Project at the Mees site would have negligible, adverse, and long-term effects on the small ʻahinahina population found at HO.

Geranium multiflorum. In addition, operations of the proposed ATST Project would have no effects on the Haleakalā on the *Geranium multiflorum* critical habitat. The USFWS has provided data on Species of Concern for the Proposed ATST Project site and the Park road corridor and it does not include this plant species.

Effects on Endangered, Threatened, Proposed, and Candidate Avifaunal Species

ʻUaʻu. The lack of a significant difference in ʻuaʻu burrow activity and nesting success between sites near HO and those away from HO suggest that current activities do have negligible, adverse effects on nesting ʻuaʻu (HALE unpublished report). Confirmed causes of adult ʻuaʻu mortality outside of the ROI include predation by introduced predators and collision with objects such as buildings and vehicles, utility poles, fences, and lights. Although these risks exist at HO, ʻuaʻu mortality has not been documented.

Nēnē. Mortality or disruption of family groups through direct and indirect human activities is unlikely as a consequence of operations at the Mees site, since none of these threats have been observed at the site as a consequence of other operations at HO. There would still be a risk to 0.3 nēnē per year on the Park road from vehicle collisions arising from ATST operations. This would be considered negligible, adverse, and long-term.

ʻOpeʻapeʻa. Operations of the proposed ATST Project would not change the current low potential for adverse effects to the ʻOpeʻapeʻa, since it is rarely seen at the site. However, it is possible that at some time during the lifetime of the project, a bat would collide with the facility. With rare over-flights, the risk is seen as low and would be negligible, adverse, and long-term.

Effects on Other Native and Introduced Fauna

The proposed ATST Project would maintain daily refuse management during construction which would not promote rat and mice populations. During construction of the proposed ATST Project, noise limits and strict on-road use only of traffic would not be likely to jeopardize bird habitats or other fauna in the Park road corridor, and the effects on those resources would be negligible, adverse, and long-term.

Effects from Stormwater, Wastewater Treatment, and Electrical Power Requirements
Rainwater falling on structures of the proposed ATST Project would be captured, piped to a cistern, and stored for domestic and cooling use. After use, an individual treatment plant would be installed underground. This plant would utilize aeration and biologically accelerated treatment to achieve effluent standards (biological oxygen demand, total suspended solids, and pH levels) acceptable for infiltration directly to ground. Effluent would be disposed of in an on-site infiltration well (Fig. 2-16). Therefore, negligible, adverse, and long-term effects on biological resources are anticipated from stormwater or wastewater.

The most common objects that ‘ua‘u collide with are fences, utility lines, and poles. Human-made lights may confuse flying ‘ua‘u, causing them to become disoriented. There are no known instances of ‘ua‘u becoming confused by human-made lights near HO or within HALE. Utility lines would be placed underground from the proposed substation. Therefore, operations would have negligible, adverse, and long-term effects.

Effects from Vehicular Traffic
A recovery plan (USFWS, 2004) for the nēnē identifies collisions with vehicles as a potential threat, stating that fourteen nēnē were killed by cars in HALE from 1988 to 1998, and it was anticipated that an additional 10 nēnē may have succumbed during the period from 1998 to 2005 as a result of current activities which includes traffic associated with approximately 1.7 million annual visitors to HALE (HALE, 2006).

During the heavy construction phase for the proposed ATST Project (approximately 2009 to 2011), an average of about nine round trips per day by construction-related vehicles is estimated. This is a temporary increase in traffic that would end when construction is completed. The current daily operational workforce level of 15 to 30 individuals at the HO site generates an average of 95.9 round trips per day to HO. After construction and during the preliminary operational phase of ATST, six to ten individuals would be added to the workforce. It is anticipated that this number would be maintained during the operational phase. This could result in 5 to 25 additional round trips per day. This increase is small relative to the total number of round trips per day from traffic accessing both HO and HALE and, therefore, effects are anticipated to be negligible, adverse, and long-term. (HALE visitor effect is assessed as approximately 1.7 million visitors per year (HALE, 2006), on average 2,300 visitors per day. Assuming two visitors per vehicle, this means approximately 1,150 vehicle round trips per year. So, the increase would be less than or about equal to one percent.)

4.3.3 Evaluation of Potential Effects at the Reber Circle Site

Locating the proposed ATST Project at the Reber Circle site would result in construction and a minimal increase in HO-wide operations. The following is a discussion of each of the potential effects that may result from locating the proposed ATST Project at the Reber Circle site.

Construction-Related Effects at the Reber Circle Site

Construction at the Reber Circle site would result in the same effects on biological resources as at the Mees site with a few exceptions, as described below.

Effects on Endangered, Threatened, Proposed, and Candidate Plant Species

'Ahinahina. There have been 'ahinahina close to the Reber Circle site. The 'ahinahina identified in the 1991 survey was found again during a more recent survey. The lone 'ahinahina is located near an existing small building and appeared to have been dead for some time after having gone to flower before dying. The dead 'ahinahina flowering stalk skeleton was not observed and it is not known where it went. The area around the 'ahinahina plant was searched for seeds, but none were found. While no other plants have been found in the immediate area, future surveys would be necessary to identify young plants should the Reber Circle site be chosen. Overall, negligible, adverse effects to this species is anticipated if the proposed ATST Project were to be built at the Reber Circle site.

Effects on Endangered, Threatened, Proposed, and Candidate Avifaunal Species

'Ua'u. Only minor differences in construction effects exist between the Mees site and the Reber Circle site. However, the Reber Circle site is a greater distance from 'ua'u burrows and is on previously developed land. The Reber Circle site would require more excavation for site leveling (about 5,000 cubic yards, compared to about 2,500 cubic yards). Although the potential for adverse effect on that avian biological resource is slightly less at the Reber Circle site than at the Mees site, the potential still exists. Therefore, the same mitigation is proposed in Section 4.18.4-Biological Resources. With the implementation of the USFWS mitigation measures, the effects on 'ua'u are anticipated to be negligible, adverse, and long-term.

4.3.4 No-Action Alternative

Under the No-Action Alternative, no construction would take place and operations would continue unaltered. Therefore, the proposed ATST Project would result in no additional effects. Effects resulting from previous construction and current operations at HO, which include those described below, would continue to occur.

Construction-Related Effects

No new construction would take place under the No-Action Alternative; therefore, there would be no continuation of the 'ua'u monitoring program. This would have a minor, adverse, and long-term effect on the ability to assess the health, numbers, and behavioral characteristics of the colony population. Botanical species, both native and non-native, would continue to grow at HO. No change in distribution would be anticipated with the No-Action Alternative.

Operations-Related Effects on Endangered, Threatened, Proposed, and Candidate Avifaunal Species

The lack of significant difference in 'ua'u burrow activity and nesting success between sites near and away from HO suggest that current activities at HO do not have adverse effects on nesting 'ua'u (HALE unpublished report). Confirmed causes of adult 'ua'u mortality include predation by introduced predators, collision with unnatural objects, such as buildings and vehicles, utility poles, fences, and lights. While these risks exist at HO and records show one reported instance of an 'ua'u flying into a building (HALE unpublished report), there have been no 'ua'u fatalities resulting from past construction or current operation. Furthermore, the nests that are near HO are somewhat protected from non-human predators and HALE regularly maintains predator control traps within a limited radius near the area.

Nēnē would continue to be affected by human activities through the application of pesticides and other contaminants, ingestion of plastics and lead, collisions with stationary or moving structures or objects, entanglement in fishing nets, habitat degradation, disturbance at nest and roost sites, attraction to hazardous areas through human feeding and other activities, and mortality or disruption of family groups through direct and indirect human activities. None of these threats have been identified as a consequence of operation at HO.

Effects on Other Endangered, Threatened, Proposed, and Candidate Faunal Species

Threats to the ‘ope‘ape‘a include direct and indirect effects of pesticides, predation, alteration of prey availability (introduced insects), and roost disturbance (USFWS, 1998). Similarly, there have been no reported effects on the ‘ope‘ape‘a as a result of HO operations. Therefore, there would be no effects on sensitive species under the No-Action Alternative.

Effects from Stormwater, Wastewater Treatment, and Electrical Power Requirements

Rainwater falling on most structures within HO is captured, piped to cisterns, and stored for domestic use. After domestic use, the wastewater is treated to achieve effluent standards acceptable for discharge directly to the ground through seepage pits. This is a temporary diversion from the natural system, since there are no surface water bodies on the property. Ultimately, water is returned to the natural system to facilitate recharge. The effects on stormwater, wastewater treatment and electrical power requirements would continue to be minor, adverse, and long-term.

Effects from Vehicular Traffic

The current daily operational workforce at HO averages from 15 to 30 individuals, which result in only a small increase of vehicular traffic entering and leaving HALE compared to the approximately 1.7 million annual visitors at HALE (HALE, 2006). That level of traffic activity would continue under the No-Action Alternative.

Effects from the Introduction of AIS

Introduced fauna that could be observed within HO and surrounding areas include the chukar *(Alectoris chukar),* the feral goat *(Capra hircus),* the Polynesian rat *(Rattus exulans),* and the roof rat *(R. rattus)* (U.S. AFRL, 2005). The Indian mongoose *(Herpestes auropunctatus)* is occasionally observed on the summit. The introduction of these species was not a result of HO construction or operation, but the risk of inadvertently introducing alien species accompanying individuals and vehicles entering HALE and HO would continue under the No-Action Alternative.

4.3.5 Summary of Effects on Biological Resources

Botanical species would be removed during construction, but there would be no loss of any endangered or threatened species. The Proposed Action would have negligible, adverse effects on the ‘ahinahina population at HO or elsewhere in the ROI.

Potential major, adverse effects from construction could include the disturbance of the ‘ua‘u habitat at HO, where birds would not be willing to remain in their burrows during the nesting season. Construction noise, vibration, or human proximity could affect the nesting habits of the ‘ua‘u to the extent that they may not return to, remain in, or otherwise utilize the burrows that are inhabited each year.

Construction activity has the potential of causing burrow collapse, directly related to excavation, vibration, or other human activities. Collapse of a burrow could result in ‘ua‘u mortality. Mitigations measures to these potential major, adverse effects are described in Section 4.18.3-Biological Resources.

The No-Action Alternative would result in a negligible, adverse effect on the monitoring of the Kolekole ‘ua‘u colony and less information would be available on their behavior and population.

4.4 TOPOGRAPHY, GEOLOGY, AND SOILS

The ROI for topography, geology, and soils is considered to be HO and the Park road corridor.

4.4.1 Methodology of Effect Assessment

The methods used to determine whether the proposed ATST Project would have a major effect on the topography, geology, and soils are as follows:

1. Review and evaluate existing and past actions to identify what effects they have had on topography, geology, and soils within the ROI in order to evaluate the proposed ATST Project's potential effect on the topography, geology, and soils.
2. Review the historical data on topographic changes due to past and present actions. Geology was evaluated by survey of geologic resources, and soils were investigated by professional analysis so that the potential for each alternative of the proposed ATST Project could be assessed to determine whether it would adversely affect the ecosystem and its component parts within and adjacent to HO and the Park road corridor, including damage to the existing topography, geology, and soils.
3. Assess the compliance of each alternative with applicable Federal, State, or County regulations to ensure that any effects of the proposed ATST Project on topography, geology, or soils would not result in regulatory non-compliance.

Environmental consequences of the proposed ATST Project alternatives would have similar effects on topography, geology and soil (i.e., erosion removal). Therefore, to reduce redundancy, the resource areas are discussed under one heading. However, methodologies for assessing intensities are different and are presented separately.

Topography

The effect analysis and the conclusions for possible effects to the topography at HO and along the Park road corridor were based on historical topographic data for the proposed ATST Project areas onsite inspections, and professional judgment. Predictions about short- and long-term site effects were based on previous studies of effects on topography from similar projects and recent scientific data. The thresholds of change for the intensity of an effect are defined as follows:

Effect Intensity	Intensity Description
Negligible	The proposed ATST Project would result in a change to the topography, but the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The proposed ATST Project would result in a change to the topography but the change would be small and localized and of little consequence.
Moderate	The proposed ATST Project would result in a change to the topography; the change would be measurable and of consequence. Mitigation may be needed to offset adverse effects and would be relatively simple to implement and likely be successful.
Major	The proposed ATST Project would result in a noticeable change to the topography; the change would be measurable and result in a severely adverse or major beneficial effect.
Duration: **Short-term** – occurs only during construction period. **Long-term** – occurs even after the construction period.	

Geology

The effects analysis and the conclusions for possible effects to geological resources were based on the site survey of known and potential geological resources at the Mees and Reber Circle sites and along the Park road corridor, published data, and professional judgment. Where possible, map locations of geological resources were compared with the locations of proposed construction of the ATST and modifications of existing facilities. Predictions about short- and long-term site effects were based on previous studies of effects to geological resources from similar projects and recent scientific data. The thresholds of change for the intensity of an effect are defined as follows:

Effect Intensity	Intensity Description
Negligible	The proposed ATST Project would result in a change to a natural physical resource, but the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The proposed ATST Project would result in a change to a natural physical resource, but the change would be small and localized and of little consequence.
Moderate	The proposed ATST Project could result in a change to a natural physical resource; the change would be measurable and of consequence.
Major	The proposed ATST Project would result in a noticeable change to a natural physical resource; the change would be measurable and result in a severely adverse or major beneficial effect.
Duration: **Short-term** – occurs only during construction period. **Long-term** – occurs even after the construction period.	

Soils

All available information on soils potentially affected in various areas of HO was compiled through a soil investigation (Vol. II, Appendix K-Soil Investigation). Where possible, map locations of sensitive soils were compared with locations of proposed developments and modifications of existing facilities. Predictions about short- and long-term site effects were based on previous projects with similar soils and recent studies. Soil information relevant to the Park road corridor was gathered from existing resources (Foote, et al). The thresholds of change for the intensity of an effect are defined as follows:

Effect Intensity	Intensity Description
Negligible	Soils would not be affected or the effects to soils would be below or at the lower levels of detection. Any effects to soils would be slight.
Minor	The effects to soils would be detectable. Effects to soil area would be small. Mitigation may be needed to offset adverse effects and would be relatively simple to implement and likely be successful.
Moderate	The effect on soil would be readily apparent and result in a change to the soil character over a relatively wide area. Mitigation measures would be necessary to offset adverse effects and likely be successful.
Major	The effect on soil would be readily apparent and substantially change the character of the soils over a large area in and out of the Park. Mitigation measures to offset adverse effects would be needed, extensive, and their success could not be guaranteed.
Duration: **Short-term** – occurs only during construction period. **Long-term** – occurs even after the construction period.	

4.4.2 Evaluation of Potential Effects at the Mees Site

Construction of the proposed ATST Project at the Mees site would require excavation and would result in excess soil placed at locations outside the proposed ATST footprint (Section 2.5.3-Construction Activities). The material would be spread over a soil disposal area that would not affect the topography. There are no anticipated major, adverse, and long- or short-term effects on topography, geology, and soils at HO or along the Park road corridor from this action.

DIRECT AND INDIRECT EFFECTS

Construction-Related Effects at the Mees Site

An estimated 2,500 cubic yards of soils and rock would be removed during the construction of the level pad and approximately 2,150 cubic yards of soil would be removed during initial excavation activities to accommodate the foundation systems and during trenching activities for utilities installation. The removal of material would not be of any measurable or perceptible consequence to the existing topography in the ROI.

The construction activities under the proposed ATST Project include land clearing, demolition, grading/leveling, excavating, soil retention and placement, construction, paving, and other site improvement activities which may increase the potential for soil erosion and off-site transport of sediment. Soil disturbance from construction activities would occur within a specified area and would not extend beyond the limits of the proposed ATST Project, thereby minimizing the potential for adverse effects from erosion. During construction, excavated material would be placed in the designated locations that have already been identified as unlikely to adversely affect stormwater drainage or infiltration and every effort would be made to implement BMPs as recommended in the Stormwater Management Plan (SWMP) for HO (Vol. II, Appendix L) to prevent erosion, excessive losses of soil, and reduce the potential for off-site sedimentation. Short-term, minor, adverse effects on soils from erosion could be expected during construction of the ATST at the Mees Site.

Park resources are not expected to be affected during the construction of the ATST at the Mees site as all construction-related vehicles are anticipated to remain on the existing pavement within the Park road corridor and are not expected to deviate from the road onto adjoining soils. (Specific anticipated effects on the Park road corridor during construction are discussed in Section 4.9.2-Evaluation of Potential Effects at the Mees Site.) Accordingly, the effects on soils within the Park road corridor are anticipated to be negligible, adverse, and short-term.

Operations-Related Effects at the Mees Site

The construction of the proposed ATST Project would result in increased impervious areas, which would increase the potential for soil erosion during the operation phase of the proposed ATST Project. The combined capacity of the existing underground holding tank and cistern is, however, adequate to capture rainwater flowing off the roof and building surfaces during a 5-year rain event. Additionally, runoff from the paved service yard would be directed to the existing stormwater drainage system, reducing the potential for erosion. Furthermore, the operation of the ATST facility at the Mees Site would implement the BMPs recommended in the SWMP for HO (Vol. II, Appendix L), which should further reduce the threat of erosion.

4.4.3 Evaluation of Potential Effects at the Reber Circle Site

Construction of the proposed ATST Project at the Reber Circle site would require excavation and would result in excess soil placed at locations outside the ATST footprint (Section 2.5.3-Construction Activities). The material would be spread over a soil disposal area that would not affect the topography.

There are no anticipated major, adverse, and long- or short-term effects on topography, geology, and soils at HO or along the Park road corridor.

DIRECT AND INDIRECT EFFECTS

Construction-Related Effects at the Reber Circle Site

An estimated 5,000 cubic yards of soils and rock would be removed during the construction of the level pad and approximately 2,150 cubic yards of soil would be removed during initial excavation activities to accommodate the foundation systems and during trenching activities for utilities installation. The removal of material for leveling would be approximately twice what is required for the Mees site and would result in slight changes to the existing topography; however the changes would be localized and would not affect the overall topography of the area within the ROI.

Soil disturbance from construction activities would occur within a specified area and would not extend beyond the limits of the proposed ATST Project, thereby minimizing the potential for adverse effects from erosion. During construction, excavated material would be placed in the designated locations that have already been identified as unlikely to adversely affect stormwater drainage or infiltration and every effort would be made to implement BMPs as recommended in the Stormwater Management Plan (SWMP) for HO (Vol. II, Appendix L) to prevent erosion, excessive losses of soil, and reduce the potential for off-site sedimentation. Minor, adverse, and short-term effects on soils from erosion would be expected during construction of the ATST at the Reber Circle Site. The effects on the soils within the Park road corridor are anticipated to be the same as those articulated for the Mees site; the Park road corridor would be utilized in the same manner if the proposed ATST Project were built at either of the alternative sites and, thus, the anticipated effects to soils within the Park road corridor would be negligible, adverse, and short-term if the project were to be built at the Reber Circle site.

Operations-Related Effects at the Reber Circle Site

The effects on topography, geology, and soils from the operations at the Reber Circle Site are anticipated to be similar to those described for the Mees Site. The amount of impervious area would be slightly higher than that of the Mees Site since the existing MSO facility would remain. However, facilities would also be constructed to capture runoff. Therefore, negligible, adverse, and long-term effects from erosion on soils would also be expected during the operation phase of the proposed ATST Project if it were located at the Reber Circle site.

4.4.4 No-Action Alternative

DIRECT AND INDIRECT EFFECTS

There would be negligible, adverse, or beneficial effects to topography, geology, and soils under the No-Action Alternative, as the proposed ATST Project would not be constructed.

4.4.5 Summary of Effects on Topography, Geology, and Soils

The potential adverse effects on the topography, geology, and soils would be minor, adverse, and short-term during construction and negligible and long-term during operation of the proposed ATST Project at either the Mees or Reber Circle sites.

4.5 VISUAL RESOURCES AND VIEW PLANE

The ROI for consideration of effect on visual resources encompasses certain portions of the landmass of Maui, HO, and other areas within HALE (including the Park road corridor) from which structures at HO are visible.

4.5.1 Methodology of Effect Assessment

The methods used to determine whether the proposed ATST Project would have a significant effect on visual resources are as follows:

1. Review and evaluate existing and past actions to identify what effects they have had on the visual resources within the ROI, so that an assessment of the proposed ATST Project's potential effect on visual resources can be modeled and predicted.
2. Review and evaluate each alternative from the perspective of field measurements, computer modeling, graphic renderings, and comparisons of models to known sources of visual effects within the ROI to identify the potential of the proposed ATST Project to adversely affect visual resources within the ROI.
3. Assess the compliance of each alternative with applicable Federal, State, or County regulations, and in particular, NEPA and HAR 343 Title 11, 200-12, item 12 concerning substantial affects to scenic vistas and view planes.

As explained in Vol. II, Appendix J(4)-Proposed ATST Project and Alternatives: Supplemental Description of the ATST Equipment and Infrastructure, operations of the proposed ATST Project during the daytime, when ground heating and turbulence is at a maximum, would require that it be placed above the turbulent boundary layer on the ground, making the maximum height of the structure 143 feet above ground level, and that it be painted white. A structure of that size and color would be visible from either the Mees site or the Reber Circle site within certain view corridors along the Park road corridor and it would be visible from certain populated and unpopulated areas of Maui.

To assess the potential effect of the proposed ATST Project to the viewshed within the ROI, two additional methods were employed.

1. Viewshed visibility was computer-modeled using software (RadioMobile) designed to identify point-to-point line-of-sight mapping. The 4-kilometer (2.5-mile) radius visibility viewshed map is shown in Figure 4-1. The viewshed for the proposed ATST Project at the Mees site is shown in Figure 4-2 and the alternative Reber Circle site is shown in Figure 4-3. As is the case with the Advanced Electro-Optical System (AEOS) and the Maui Space Surveillance System (MSSS) (Fig.4-4), it shows that the proposed ATST Project would be visible from most areas within the Central Valley and from some parts of windward and leeward communities.

2. The second method of evaluating potential effects on the Maui viewshed was the use of photographic renderings. Digital photos from various locations on Maui were taken during various times of the year and times of day (to account for changes in atmospheric transparency and lighting) and were then mathematically analyzed to provide accurate positional information for the proposed ATST Project within the HO complex.

   Using ATST architectural plans and field measurements at HO as the basis for layered graphic software renderings, correctly scaled and oriented digital images of the proposed ATST Project were prepared and an artist's renderings of the proposed ATST Project were inserted into the photographs. For the Mees site location, the renderings are shown in Figures 4-5 to 4-15. For photographs taken at distant locations outside HALE, inserts have been included that show how the proposed ATST Project would appear if the viewer were to use optical enhancement, i.e., binoculars, telescope, telephoto camera lens, etc.

The combination of all the above viewshed assessments methods provides a comprehensive prediction of the potential visual effect the proposed ATST Project would have within the ROI. While ATST would be clearly visible as the largest structure within HO from the Puʻu Ulaʻula (Red Hill) Overlook (Fig. 4-14) and from elsewhere in HALE, it would be less prominent from other locations on Maui. Distance, atmospheric transparency, terrain blocking, and other facilities in the foreground would reduce the visibility of the proposed ATST Project such that in some locations it would be difficult to distinguish between ATST and the other existing facilities at HO (Fig. 4-5 at Pukalani and Fig. 4-13 at Keonekai). At some locations, such as Wailuku (Fig. 4-9) and Kahikunui (Fig. 4-15), the proposed ATST Project at the Mees site would be seen more directly, without as much terrain blocking or other intervening facilities. From Kaupo, the proposed ATST Project facility would not be visible (Fig. 4-16).

The thresholds of change for the intensity of effects on visual resources are defined as follows:

Effect Intensity	Intensity Description
Negligible	Effects to the visual quality of the landscape would be at or below the level of detection; changes would be so slight that they would not be of any measurable or perceptible consequence to the observer.
Minor	Effects to the visual quality of the landscape would be detectable, localized, and would be small and of little consequence to the observer. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate	Effects to the visual quality of the landscape would be readily detectable, localized, with consequences at the regional level. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
Major	Effects to the visual quality of the landscape would be obvious, with substantial consequences to the visitor use and experience in the region. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.
Duration:	**Short-term –** occurs only during the construction period. **Long-term –** occurs even after the construction period.

To assess effects on visual resources in the analyses below, a combination of quantitative and qualitative evaluations was used. The quantitative evaluations include such information as estimates of how much the actual view planes are affected by past and present actions at HO, based on objective physical effects. For the purpose of this EIS, a value of less than 1 percent is considered to be negligible, less than 10 percent considered a minor effect, more than 10 percent but less than 20 percent is considered to be moderate, and more than 20 percent considered to be a major effect. The qualitative evaluation seeks to describe in what ways those visual resources are affected from an aesthetic viewpoint. Although independently assessed, the two evaluations result in one effect intensity. The evaluation is also dependent on location within the ROI. For example, the past and present effects of HO on the visual resources at Puʻu Ulaʻula might be considered quite different from the effects along the lower part of the Park road corridor, which could in turn be different from the effects on the visual resources and view plane at sea level on windward Maui.

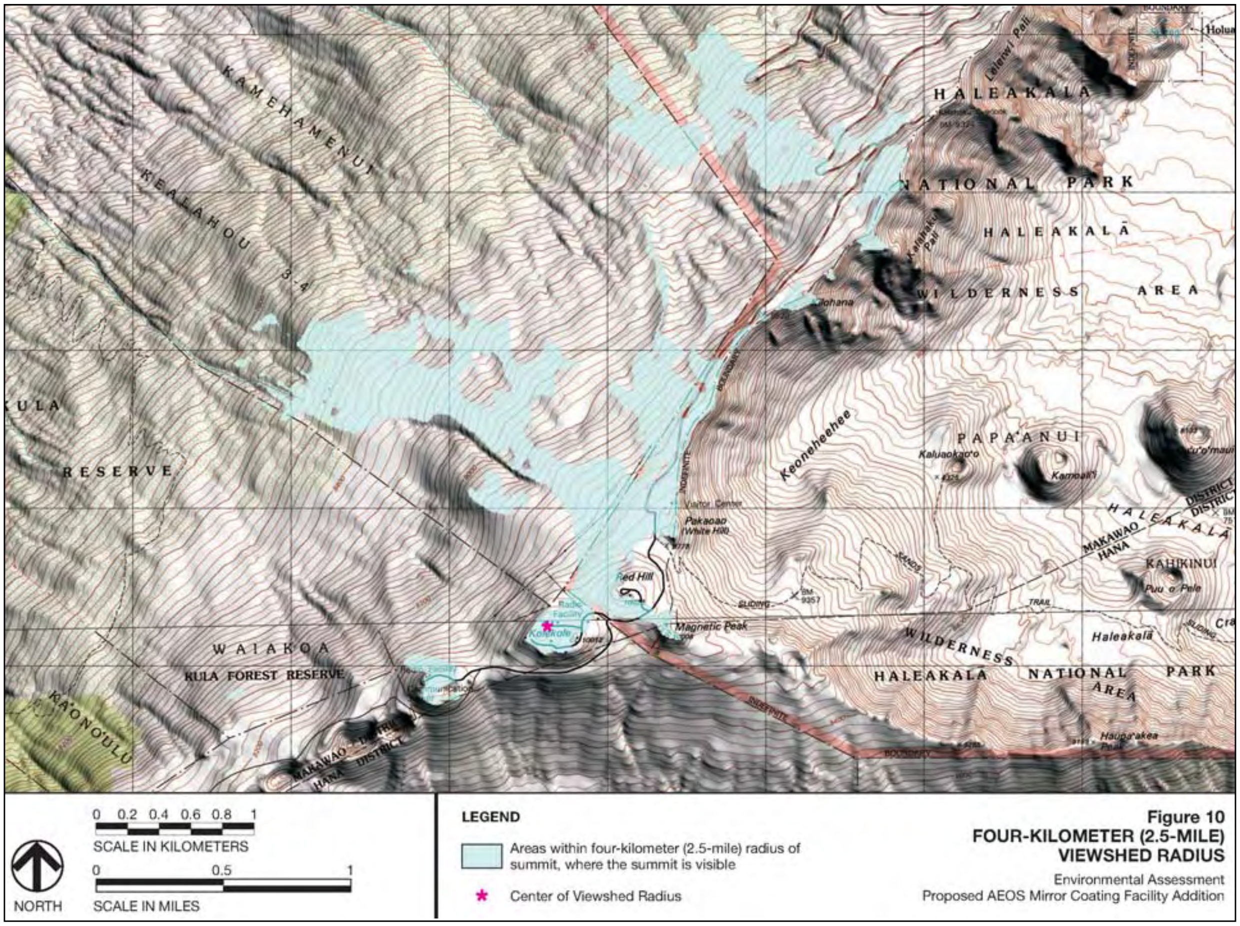


Figure 4-1. Viewshed Radius, 4-kilometer (2.5-mile).

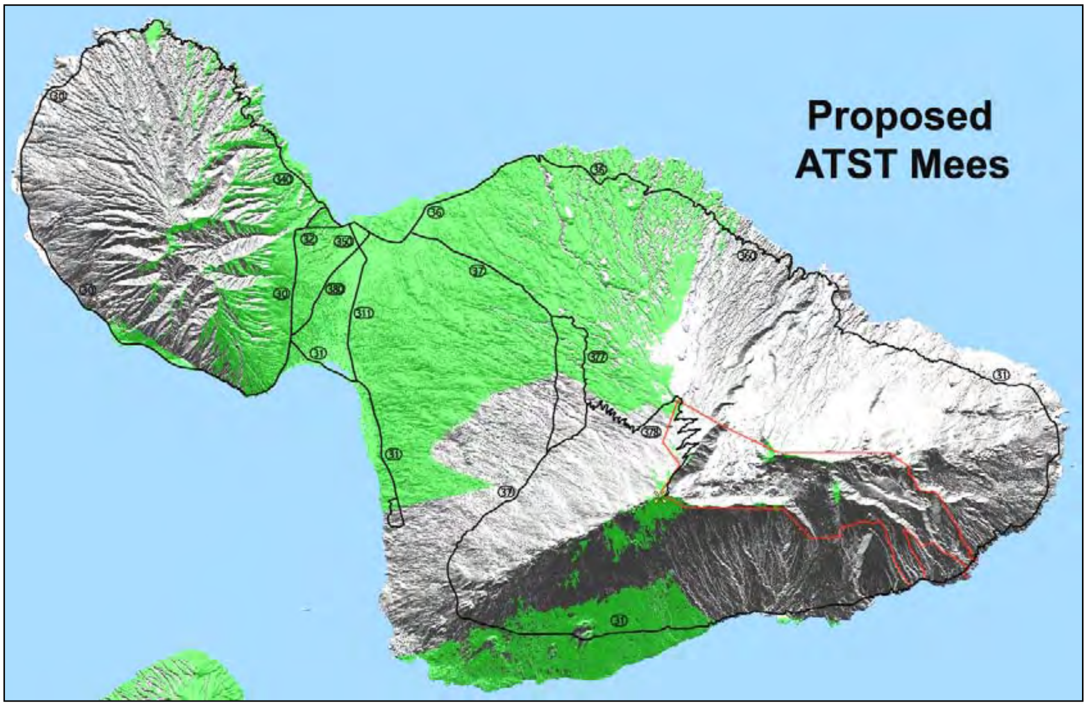


Figure 4-2. Mees Site Viewshed.

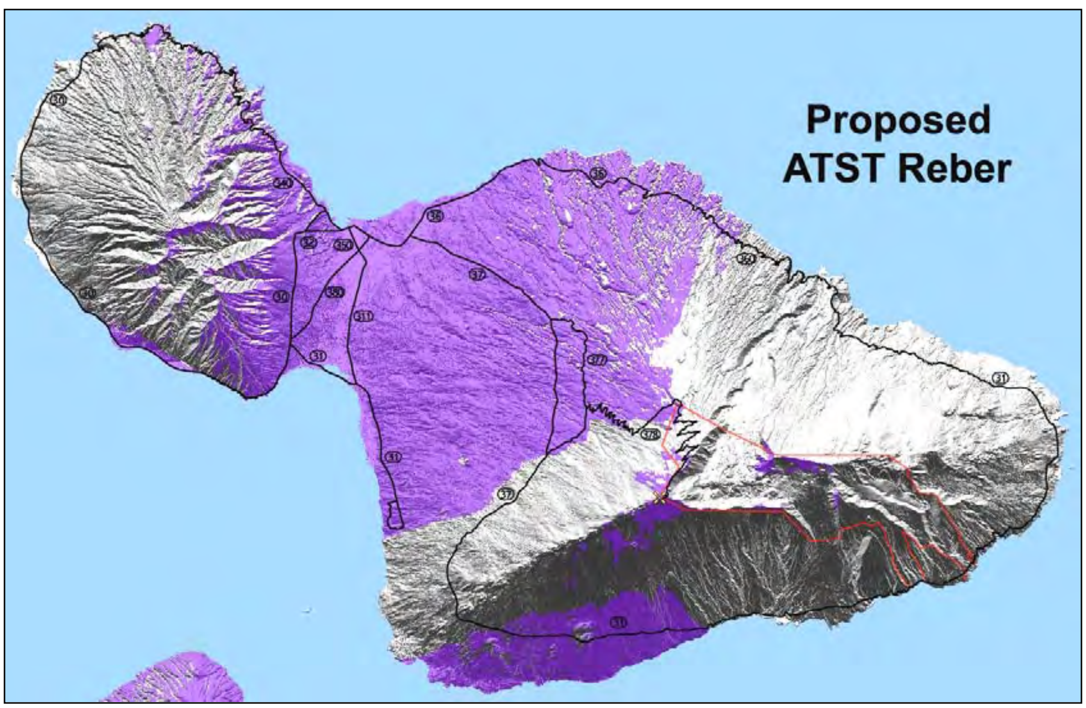


Figure 4-3. Reber Circle Site Viewshed.

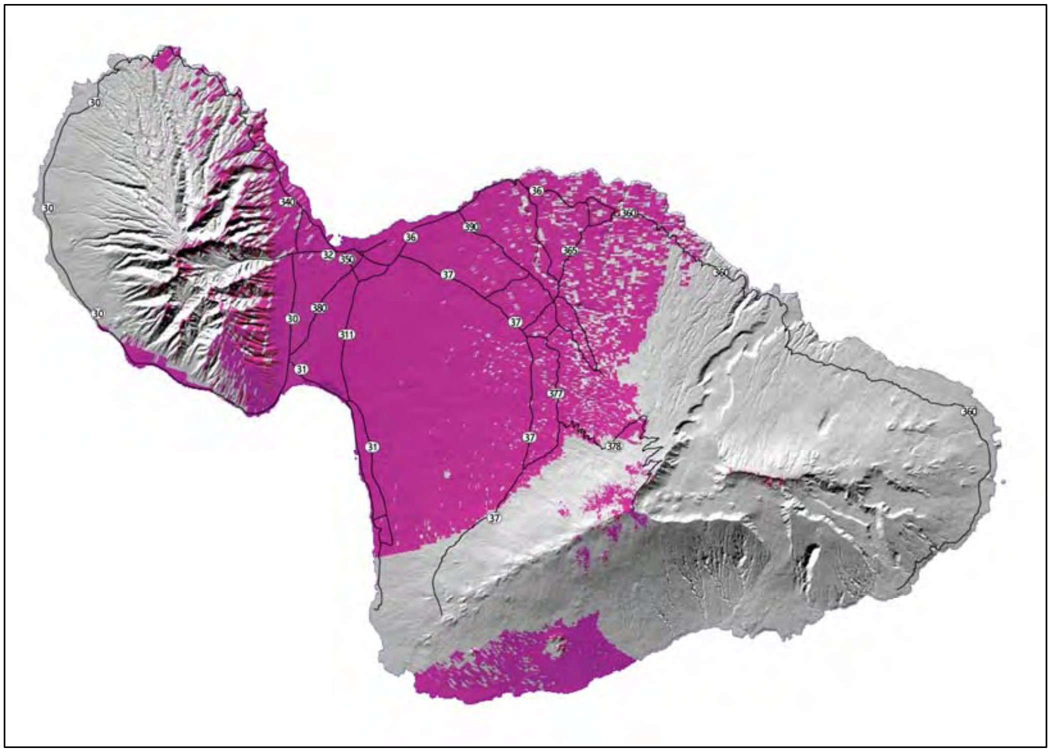


Figure 4-4. AEOS and MSSS Viewshed.

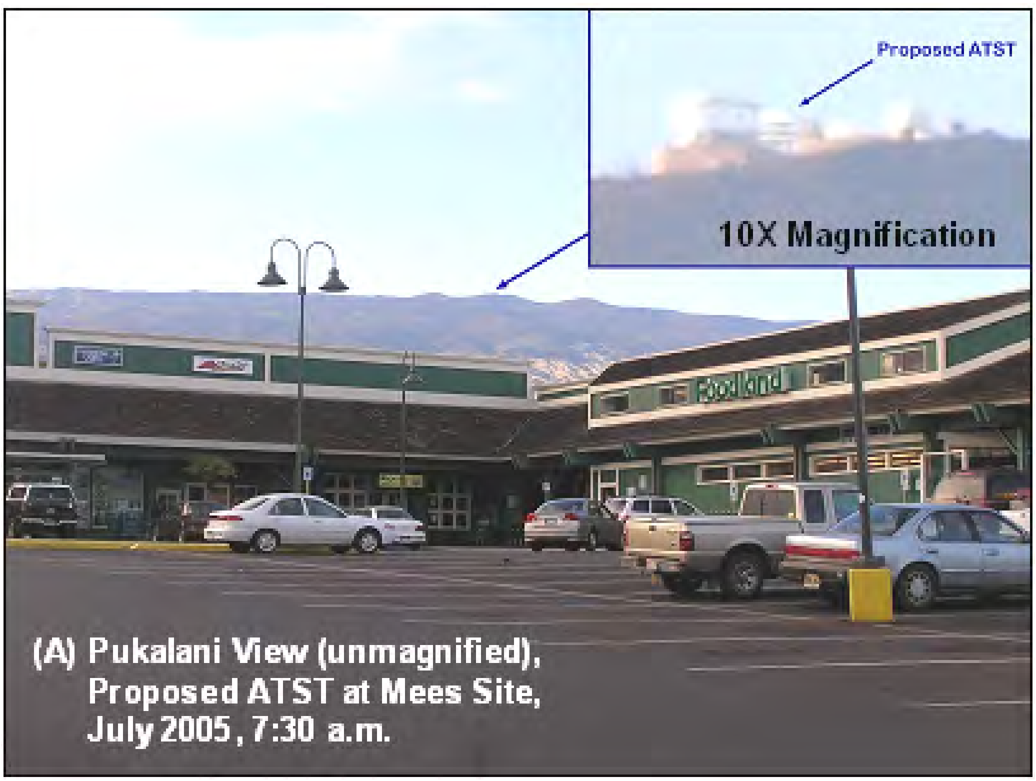


Figure 4-5. Mees Site Rendering From Pukalani Terrace Shopping Center, July 2005.

Figure 4-6. Mees Site Rendering From ‘A‘apueo Drive, Kula, April 2006.

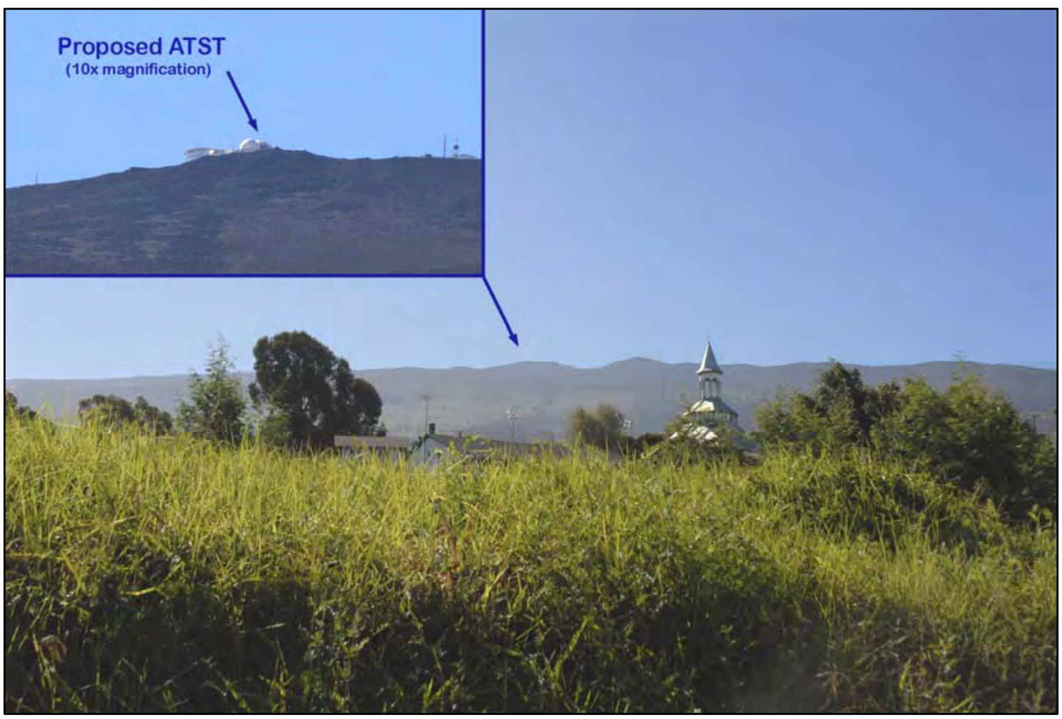


Figure 4-7. Mees Site Rendering From Kula Hwy., Below Holy Ghost Church, April 2006.

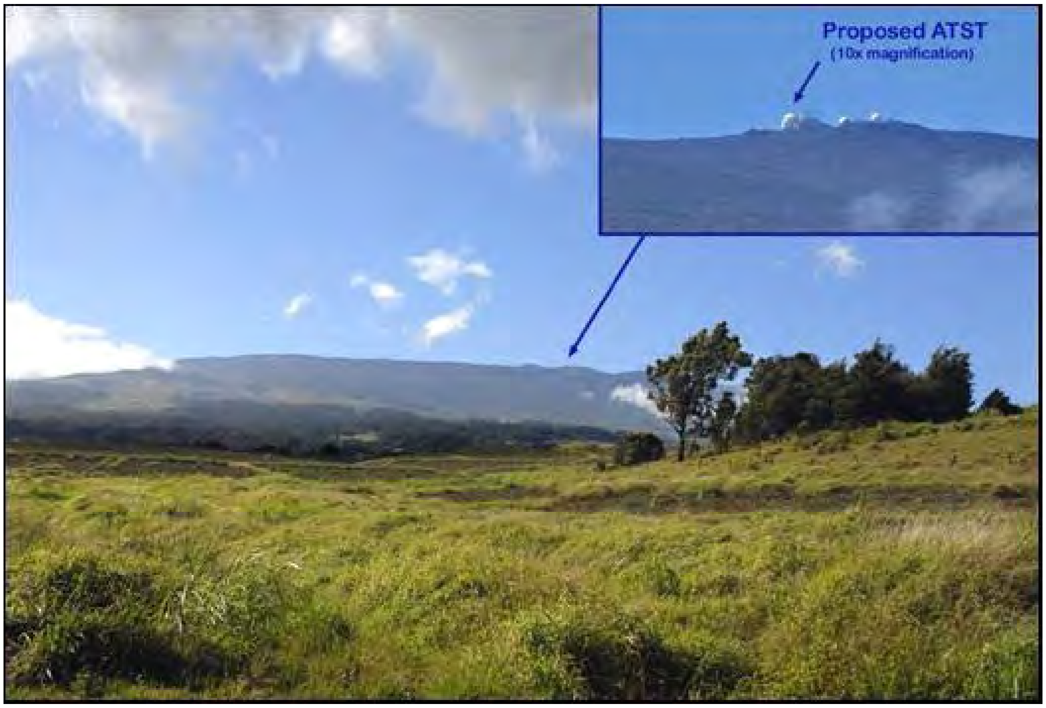


Figure 4-8. Mees Site Rendering From Lower Piiholo Road, Olinda, April 2006.

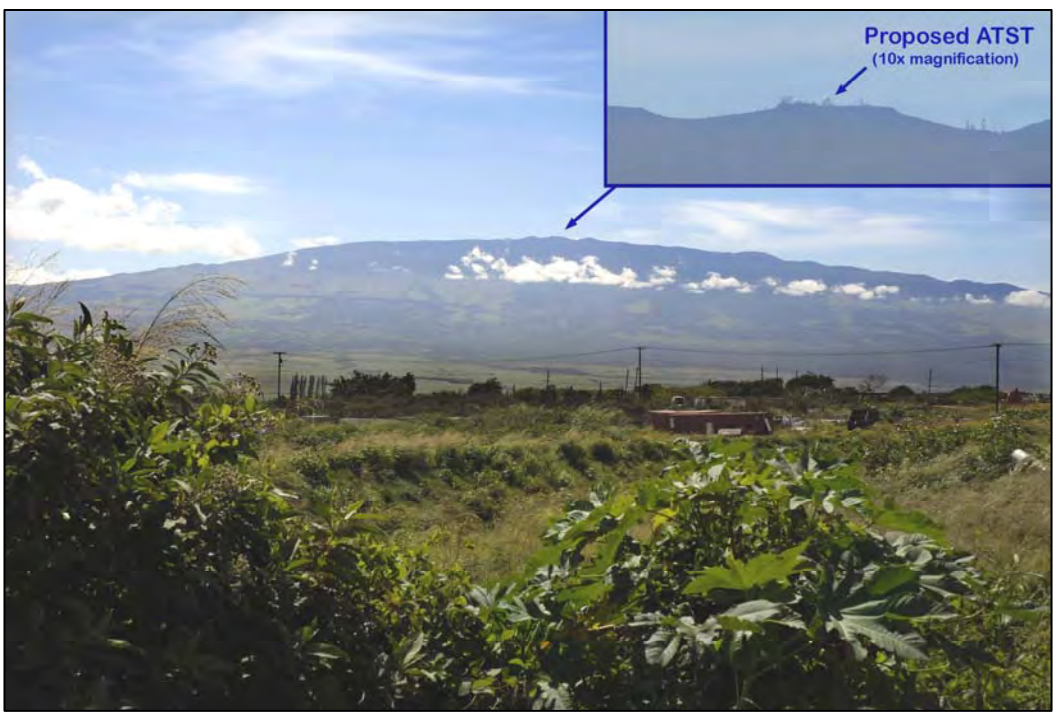


Figure 4-9. Mees Site Rendering From High Street and Kuikahi Drive, Wailuku, April 2006.

Figure 4-10. Mees Site Rendering From Ma'alaea Harbor, August 2005.

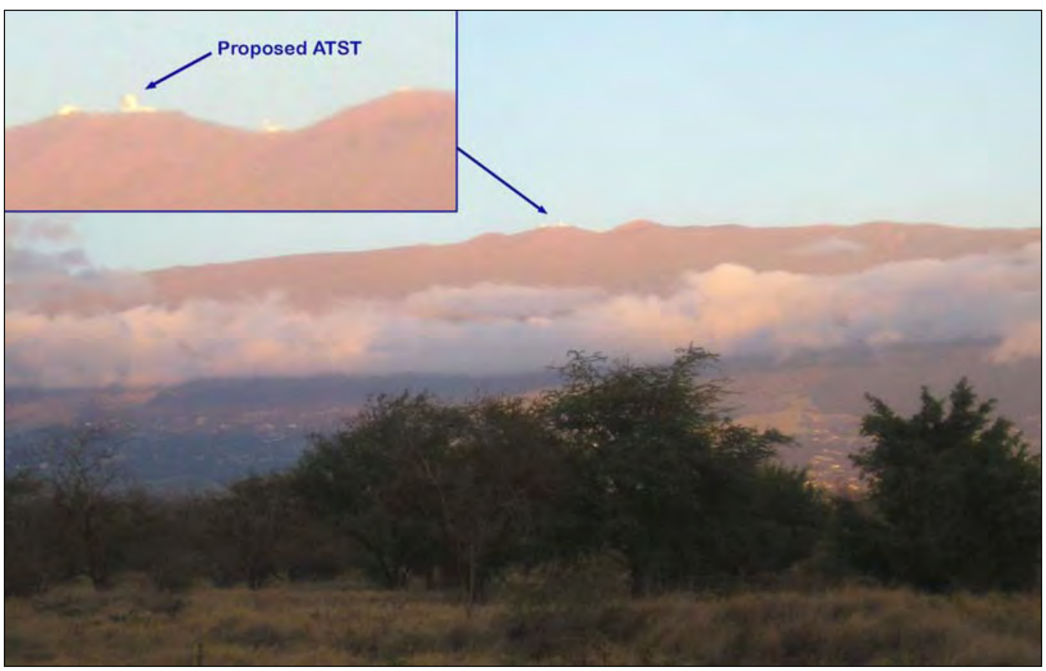


Figure 4-11. Mees Site Rendering From Mokulele and Pi'ilani Highways., Kihei, September 2005.

Figure 4-12. Mees Site Rendering From Lipoa Parkway, Kihei, August 2005.

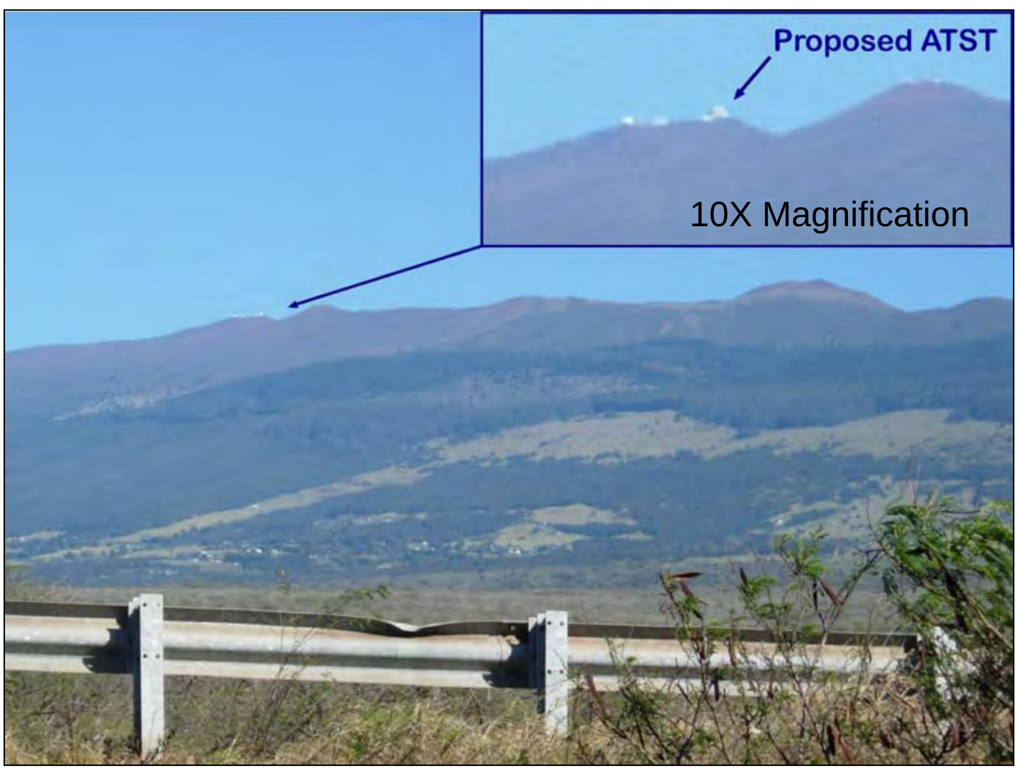


Figure 4-13. Mees Site Rendering From Keonekai, Kihei, March 2006.

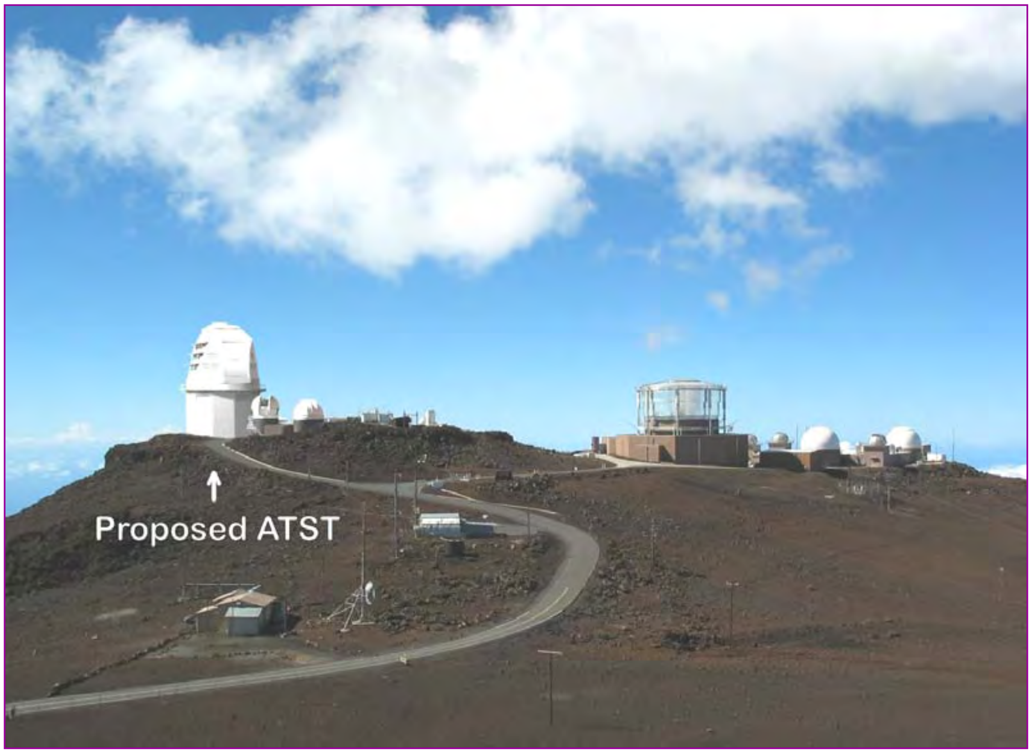


Figure 4-14. Mees Site Rendering, View From Pu‘u Ula‘ula (Red Hill) Overlook.

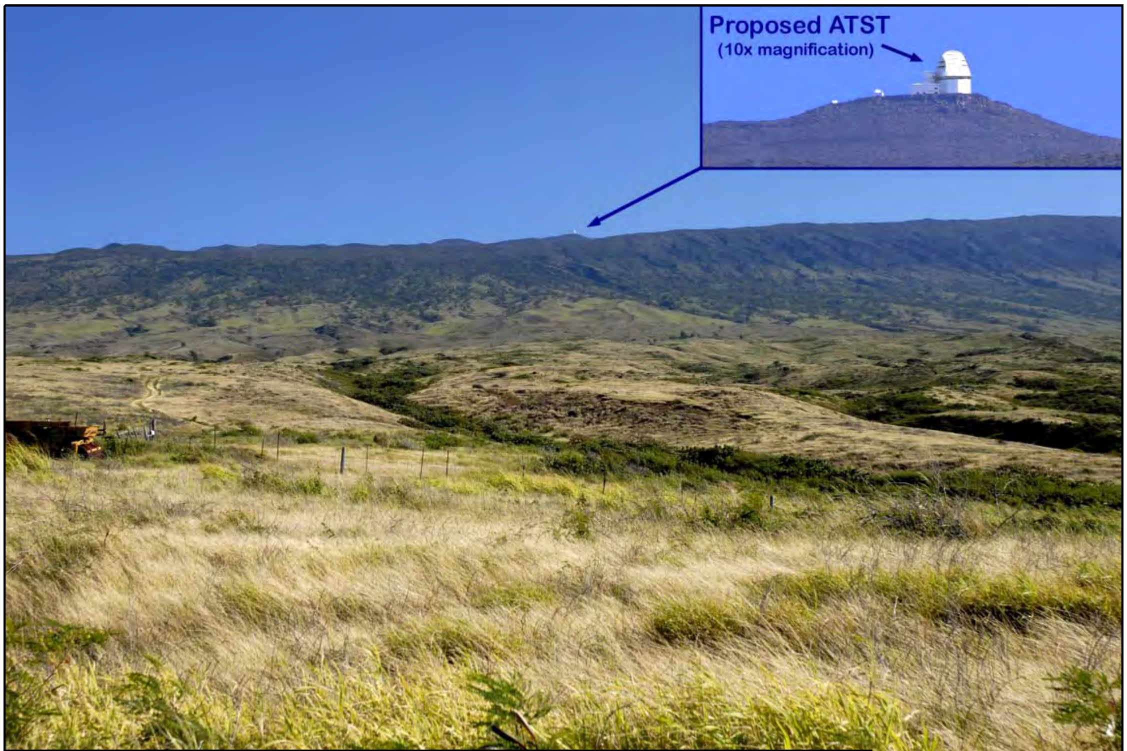


Figure 4-15.
Mees Site Rendering, View From Kahikinui and
Map Showing Photographer Location, May 11, 2006.

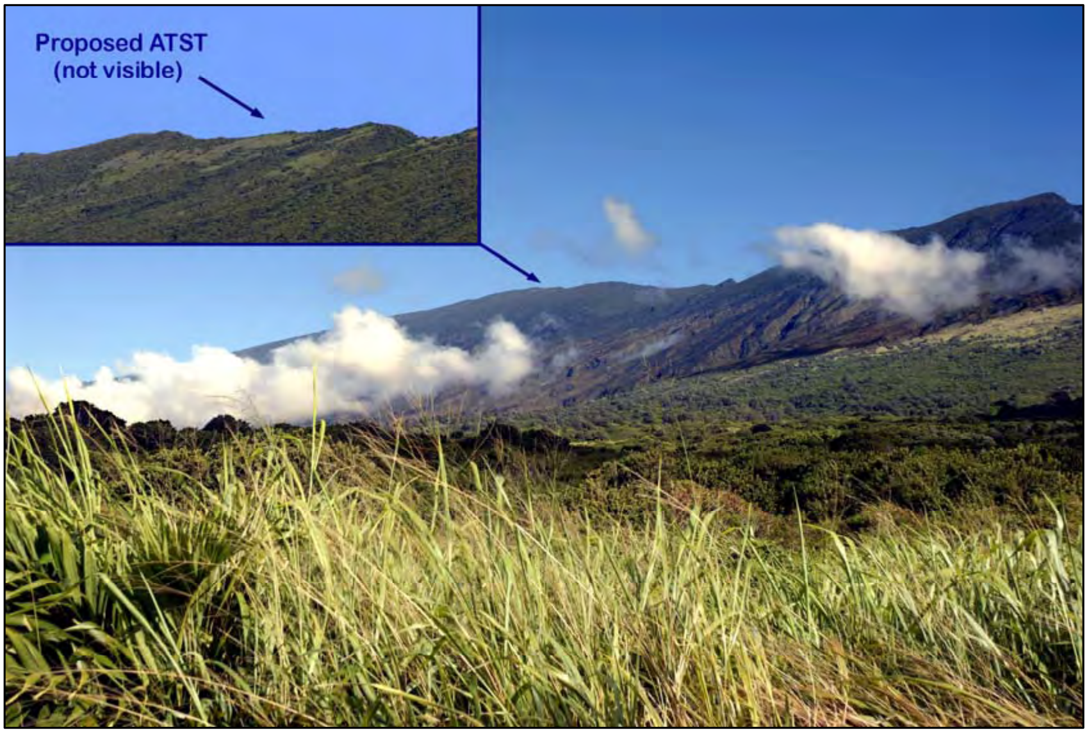


Figure 4-16. View From Kaupo, May 11, 2006.

4.5.2 New Viewshed Survey

In response to comments concerning potentially more extensive visual effects from ATST on HALE visitors, e.g., discrepancies between the DEIS viewshed study and a subsequent one conducted for HALE, a new, more detailed viewshed study of the proposed ATST Project was undertaken in 2007 to 2008. The purposes of the new study were:

1. to verify the accuracy of the earlier DEIS viewshed study with both higher resolution modeling and ground-truth data in order to confirm that if ATST is constructed in either the proposed primary Mees location or alternative Reber Circle location at HO, it would not be visible from any maintained visitor trail within the HALE crater, and thus would not significantly effect that visitor attraction;
2. to characterize the visibility of the proposed ATST project from the HALE road so that the visual effect to visitor experience could be evaluated; and,
3. to provide a higher resolution, e.g., more detailed ATST viewshed map for the entire island of Maui to evaluate potential visual effects with greater fidelity.

Confirmation of Ground Level

The first step in this process was to reconfirm ground level elevation for the proposed ATST Project facility at both the primary Mees sire and the alternative Reber Circle site in HO. A number of comments received after publication of the DEIS questioned both construction ground level and the final elevation of ATST at the primary and alternative sites. Spot land surveys at HO had been conducted by Unemori Engineering in 1987, Gima, Yoshimori and Miyabara Architects/Engineers in 1992, and Akamai Land

Surveys in 2005. All of these were used as a datum reference to the Kolekole survey pin located in HO (Fig. 4-17), which has an established elevation of 10,013 feet (Fig. 4-18) according to the documented history by the National Geodetic Survey (NGS) (Table 4-1). Land surveys all agree that ground level for the proposed ATST Project facility at the Mees primary site after grading would be 9,980 feet and would be 9,996 feet at the alternative Reber Circle site. With the planned height of the proposed ATST Project facility at 142 feet 10 inches, the top of the facility at the primary Mees site would be at an elevation of 10,122.5 feet and at the alternative Reber Circle site it would be 10,138.8 feet.

Modeling of Existing Buildings

After reconfirming ground levels for the proposed facility, three existing summit buildings were modeled and observed in the field in order to validate the crater-mapping model that would be used for predicting visibility of the proposed ATST Project. National Elevation Dataset (NED) 1/3 arcsecond data was acquired from the U.S. Geological Survey (USGS) Seamless Data Distribution System (SDDS). This is the highest resolution, best quality elevation data available (NED, http://ned.usgs.gov/). With this data, Global Mapper 8 viewshed modeling software was used to create model viewshed maps for the Haleakalā Puʻu Ulaʻula Overlook building, the Haleakalā Visitor Center building, and the AEOS Observatory. This software was used to predict line-of-sight from these buildings to locations on the Park road and throughout the entire crater area. The NED 1/3 arcsecond data has a resolution of approximately 10 meters horizontally and +/-7 meters vertically. The results were superimposed over existing Haleakalā maintained trail maps and global positioning system (GPS) points were chosen on the trails to verify the prediction results.

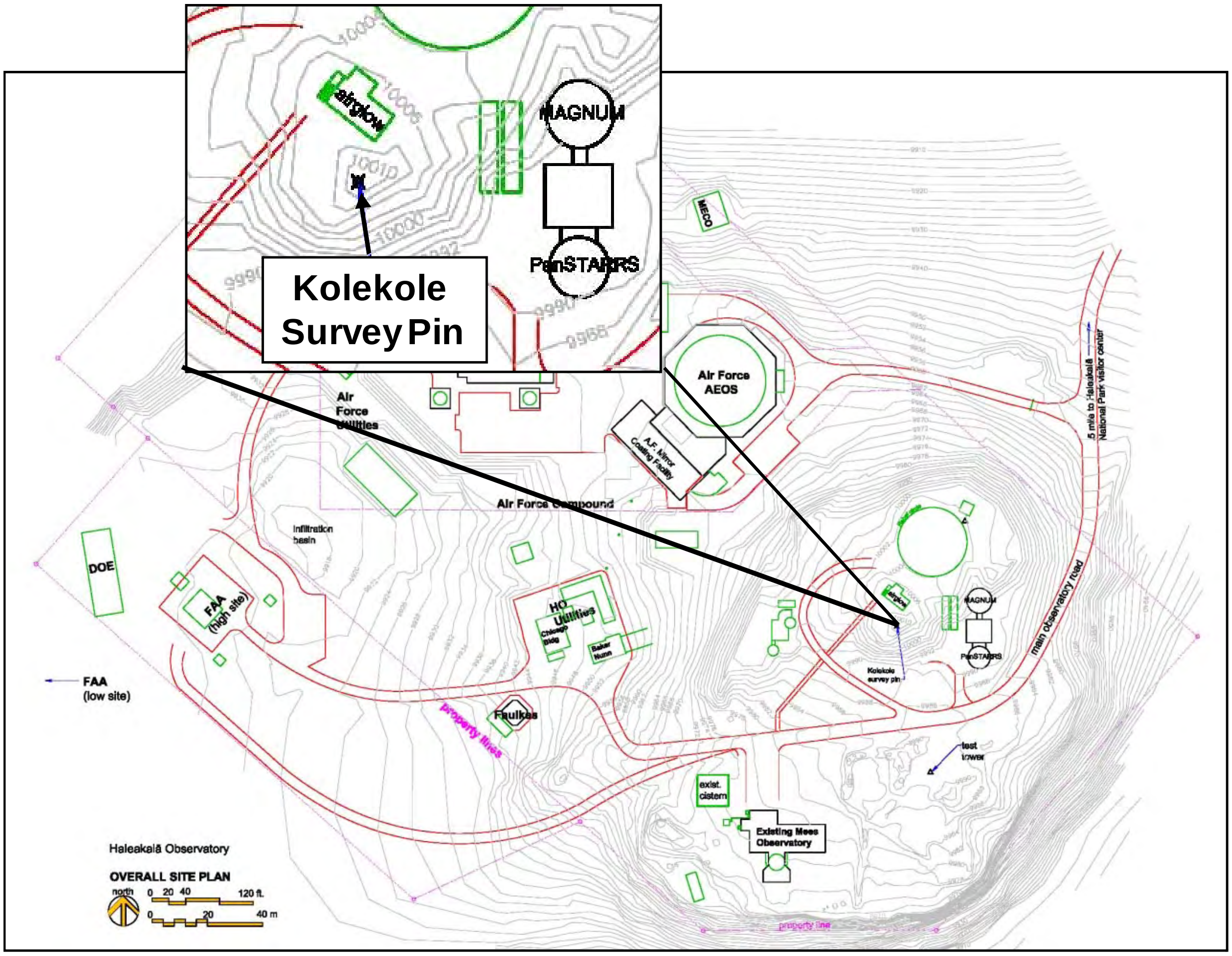


Figure 4-17. Location of Kolekole Survey Pin in HO.

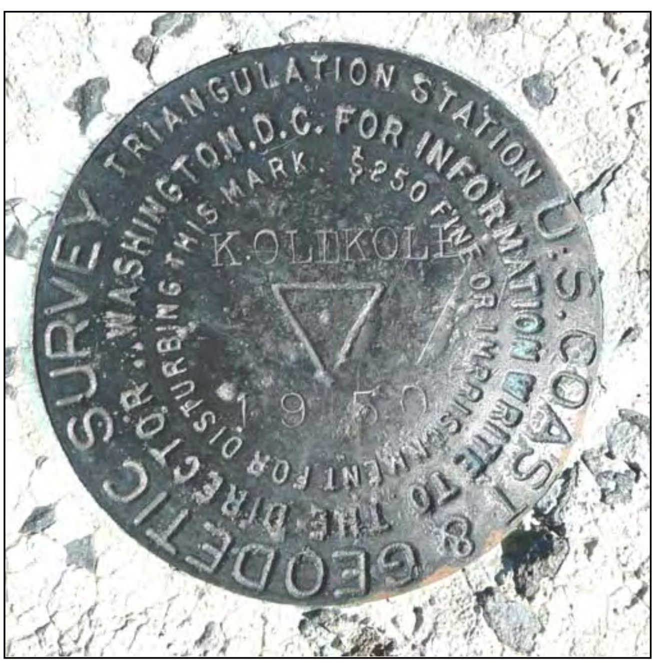


Figure 4-18. Photo of Kolekole Survey Pin.

Table 4-1. NGS Documented History of Kolekole Reset TU2862.

N 20° 42.439 W 156° 15.371 (NAD 83) **Altitude: 10013** **Designation: KOLEKOLE RESET** **Marker Type: survey disk** **Setting: in rock outcrop** **Stability: Most reliable and expected to hold position/elevation well.**
1/1/1876 by HIGS (MONUMENTED) DESCRIBED BY HAWAII GEODETIC SURVEY 1876 IN CENTRAL PART OF EAST MAUI, IN HONUALA DISTRICT, ON A HIGH POINT IN THE ROCKY RIDGE SOUTHWEST OF THE HIGHEST POINT OF HALEAKALA. MARKED BY AN IRON STAKE LET INTO THE ROCK AND COVERED WITH A CAIRN OF STONES.
1/1/1950 by CGS (MONUMENTED) RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1950 (CTH) LOCATED IN THE CENTRAL PART OF EAST MAUI, IN HONUALA DISTRICT, ON A HIGH POINT SOUTHWEST OF THE HIGHEST POINT OF HALEAKALA. ON THE HIGH POINT OF A LAVA OUTCROP ABOUT 25 FEET SOUTHEAST OF A CONCRETE BUILDING USED BY THE TELEPHONE COMPANY. THE ORIGINAL STATION WAS ESTABLISHED BY THE HAWAIIAN GOVERNMENT SURVEY IN 1876, AN IRON PIN LET INTO THE ROCK. THIS PIN WAS TIED OFF AND REPLACED WITH A STANDARD DISK SET IN A CONCRETE POST PROJECTING 3 INCHES ABOVE THE SURFACE, STAMPED KOLEKOLE 1950. REFERENCE MARK NO.1 IS SOUTH OF THE STATION, ABOUT 8 FEET IN FROM THE EDGE OF THE RIM. A STANDARD DISK SET IN ROCK OUTCROP, STAMPED KOLEKOLE NO 1 1950. REFERENC MARK NO.2 IS EAST NORTHEAST OF THE STATION. A STANDARD DISK SET IN A BURIED BOULDER THAT PROJECTS 2-1/2 FEET ABOVE THE GROUND. STAMPED KOLEKOLE NO 2 1950. TO REACH FROM KAHULUI--GO SOUTHEASTERLY ON PAVED ROAD TO THE OBSERVATION HOUSE AT HALEAKALA CRATER. TURN RIGHT AND GO SOUTH ON PAVED ROAD TO END THEN CONTINUE SOUTH ON BLADED ROAD TO CONCRETE BUILDING AND STATION. REFERENCE MARK NO.3 IS NORTH OF THE STATION. A STANDARD DISK SET IN A BURIED BOULDER 2-1/2 FEET IN DIAMETER PROJECTING SIX INCHES ABOVE THE GROUND. STAMPED KOLEKOLE NO 1 1950. HEIGHT OF LIGHT ABOVE STATION MARK 3.77 METERS.
1/1/1962 by CGS (MONUMENTED) RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1962 (CAB) THE STATION AND THREE REFERENCE MARKS WERE RECOVERED IN GOOD CONDITION AND AS DESCRIBED. THE DISTANCE AND DIRECTIONS CHECKED THE DATA, ON THE 1950 RECOVERY NOTE, TO REFERENCE MARKS 1 AND 2. REFERENCE MARK 3 WAS BEHIND A BUILDING AND WAS NOT TAKEN. A 15 FOOT STAND IS REQUIRED TO SEE REFERENCE MARK 3. THE TO REACH IS ADEQUATE.
1/1/1969 by CGS (MONUMENTED) RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1969 (CAA) THE STATION MARK AND THREE REFERENCE MARKS WERE RECOVERED AS DESCRIBED AND FOUND TO BE IN GOOD CONDITION. THE DISTANCE AND DIRECTION TO THE REFERENCE MARKS WAS NOT CHECKED AT THIS TIME BUT A DIFFERENT TO REACH WAS ESTABLISHED. A NEW DESCRIPTION FOLLOWS. THE STATION IS LOCATED ATOP HALEAKALA CRATER IN AN AREA KNOWN AS SCIENCE CITY IN THE WEST EDGE OF HALEAKALA NATIONAL PARK. TO REACH THE STATION FROM THE PARK HEADQUARTERS, GO SOUTHWEST UP WINDING ASPHALT ROAD FOR 9.3 MILES TO A SIDE ROAD RIGHT, JUST BEFORE REACHING AN OBSERVING POINT. TURN RIGHT ALONG ASPHALT ROAD FOR 0.45 MILE TO A FORK. KEEP LEFT FORK FOR 0.2 MILE TO A FORK. KEEP RIGHT FORK FOR 0.15 MILE TO A SIDE ROAD RIGHT. CONTINUE AHEAD FOR 0.05 MILE TO A FORK. KEEP RIGHT FORK FOLLOWING HORSESHOE DRIVE FOR 0.05 MILE TO A WHITE BUILDING ON THE RIGHT AND STATION ABOUT 25 FEET SOUTH OF THE BUILDING. THE STATION MARK IS A STANDARD DISK, STAMPED KOLEKOLE 1950, SET IN THE TOP OF A CONCRETE MONUMENT WHICH PROJECTS ABOUT 3 INCHES. IT IS 25 FEET SOUTH OF A WHITE BUILDING. REFERENCE MARK 1 IS A STANDARD DISK, STAMPED KOLEKOLE NO 1 1950, CEMENTED IN A DRILL HOLE IN OUTCROPPING ROCK. IT IS 30 FEET SOUTH OF THE SOUTHEAST CORNER OF THE UNIVERSITY OF HAWAII BUILDING AND 8 FEET NORTH OF THE SOUTH EDGE OF THE HILL. REFERENCE MARK 2 IS A STANDARD DISK, STAMPED KOLEKOLE NO 2 1950, CEMENTED IN A DRILL HOLE IN A BOULDER WHICH PROJECTS ABOUT 2-1/2 FEET. REFERENCE MARK 3 IS A STANDARD DISK, STAMPED KOLEKOLE NO 3 1950, CEMENTED IN A DRILL HOLE IN A BOULDER WHICH PROJECTS ABOUT 6 INCHES. IT IS JUST NORTHWEST OF A SMALL BUILDING. NOTE--ABOUT A 15 FOOT STAND WOULD BE NEEDED OVER THE STATION TO SEE REFERENCE MARK 3. AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN 19.5 MILES SOUTHWEST OF KAHULUI.

Table 4-1. NGS Documented History of Kolekole Reset TU2862. (cont.)

1/1/1969 by CGS (MONUMENTED) RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1969 (RCM) STATION WAS RECOVERED AND ALL MARKS FOUND IN GOOD CONDITION, HOWEVER RM 3 IS BLOCKED BY A BUILDING. *A DISCREPANCY WAS NOTED IN THE DISTANCE TO RM 2. IT WAS DOUBLE-CHECKED AND THE 1969 DISTANCE IS CORRECT.* DISTANCE TO RMS 1 AND 3 WAS NOT CHECKED. A COMPLETE DESCRIPTION FOLLOWS-- STATION IS LOCATED ON SUMMIT OF HALEAKALA, ON A POINT SLIGHTLY LOWER THAN HIGHEST PART, ON A ROCKY POINT AT SOUTHWEST SIDE OF A LOW, SILVER-COLORED, CONCRETE BLOCK BUILDING, ABOUT 1400 FEET SOUTHWEST OF RED HILL. TO REACH STATION FROM THE POST OFFCE AT PUKALANI, GO SOUTHEAST ON STATE HIGHWAY 37 FOR 0.35 MILE. TAKE LEFT FORK AND FOLLOW HIGHWAY FOR 28.4 MILES TO FORK ON SUMMIT. TAKE RIGHT FORK AND GO 0.1 MILE TO STATION. STATION MARK IS A STANDARD DISK STAMPED KOLEKOLE 1950, SET IN THE TOP OF A 14-INCH-DIAMETER, CONCRETE MONUMENT PROJECTING 3 INCHES FROM GROUND. IT IS 19 FEET SOUTH OF SOUTHEAST CORNER OF BUILDING. REFERENCE MARK NUMBER ONE IS A STANDARD DISK STAMPED KOLEKOLE NO 1 1950, CEMENTED IN A DRILL HOLE IN FLAT RED LAVA ROCK PROJECTING 12 INCHES FROM GROUND. IT IS ON EDGE OF BLUFF AND ON SOUTH SIDE OF A GRAVELLED AREA, 38 FEET SOUTHEAST OF SOUTHEAST CORNER OF A WHITE CONCRETE BUILDING WITH A RADAR DOME ON TOP AND 12 FEET NORTHWEST OF THE WEST 1 OF A ROW OF ANTENNAE. REFERENCE MARK NUMBER TWO IS A STANDARD DISK STAMPED KOLEKOLE NO 2 1950, CEMENTED IN A DRILL HOLE IN THE TOP OF A LARGE ROCK OUTCROP THAT PROJECTS 2-1/2 FEET FROM GROUND. IT IS 21 FEET SOUTH OF THE END OF A MACADAM DRIVE AND 7 FEET LOWER THAN STATION MARK. REFERENCE MARK NUMBER THREE IS A STANDARD DISK STAMPED KOLEKOLE NO 3 1950, CEMENTED IN A DRILL HOLE IN A SMALL BEDROCK OUTCROP IN FRONT OF THE ENTRANCE OF A SMALL, BROWN, STONE BUILDING OF AN AERONAUTICAL COMMUNICATIONS CO. SATELLITE TRIANGULATION STATION 011 IS A STANDARD DISK STAMPED SATELLITE TRIANG STATION 011 1966, SET IN THE TOP OF A 16-INCH-DIAMETER CONCRETE MONUMENT FLUSH WITH GROUND. IT IS 9 FEET SOUTH OF THE EDGE OF A LARGE, CONCRETE CIRCLE, 53.5 FEET SOUTH OF SOUTH SIDE OF THE COMMUNICATIONS CO. BUILDING, AND 10 FEET LOWER THAN STATION MARK.
1/1/1975 by NGS (MONUMENTED) RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1975 (CLN) THE STATION MARK AND REFERENCE MARKS 1, 2, AND 3 WERE RECOVERED IN GOOD CONDITION AND THE DIRECTIONS FROM THE STATION MARK TO THE REFERENCE MARKS AND THE DISTANCES TO REFERENCE MARKS 1 AND 2 MEASURED ON THIS DATE AGREED FAIRLY WELL WITH THE 1950 MEASUREMENTS. A BUILDING IS LOCATED BETWEEN THE STATION MARK AND REFERENCE MARK 3 SO THE DISTANCE AND DIRECTION WERE CALCULATED FROM A TRAVERSE THROUGH REFERENCE MARK 2 AND THE DISTANCE WAS FOUND TO BE 0.212 M. LONGER THAN THE 1950 MEASUREMENT BUT ONLY 21 MM. SHORTER THAN THE DISTANCE OBTAINED BY CALCULATIONS FROM MEASUREMENTS MADE BY THE ARMY MAP SERVICE IN 1966. A DIRECTION TO AZ MK SAT TRIANG 011 WAS MEASURED ON THIS DATE. VARIOUS BUILDINGS AND OBSERVATORIES HAVE BEEN BUILT NEAR THE STATION SITE AND THE OBSERVATORIES IN THE IMMEDIATE VICINITY OF THE STATION ARE OPERATED BY THE INSTITUTE FOR ASTRONOMY OF THE UNIVERSITY OF HAWAII. A COMPLETE DESCRIPTION FOLLOWS-- THE STATION IS LOCATED IN THE HALEAKALA SCIENCE RESERVE ON THE SOUTHWEST RIM OF HALEAKALA CRATER ON THE ISLAND OF MAUI AND IS AIRLINE ABOUT 21 MILES SOUTHEAST OF KAHULUI AND 19 MILES WEST OF HANA. TO REACH THE STATION FROM THE KAHULUI AIRPORT GO SOUTHERLY ON HIGHWAYS 37, 377, AND 378 FOR 38 MILES TO THE HALEAKALA SCIENCE RESERVE AND THE STATION SITE. THE STATION MARK IS A C AND GS TRIANGULATION STATION DISK STAMPED KOLEKOLE 1950 SET IN THE TOP OF A 0.4 METER CONCRETE CYLINDER IN AN OUTCROP OF LAVA ABOUT 1-1/4 METERS ABOVE THE SURROUNDING GROUND AND IS 31.7 METERS NORTHWEST OF THE SOUTHWEST CORNER OF THE UNIVERSITY OF HAWAII LURE OBSERVATORY BUILDING AND 6.3 METERS SOUTH OF THE SOUTH CORNER OF THE UNIVERSITY OF HAWAII AIRGLOW OBSERVATORY BUILDING. REFERENCE MARK 1 IS A C AND GS REFERENCE MARK STAMPED KOLEKOLE NO 1 1950 CEMENTED IN A DRILL HOLE IN AN OUTCROP OF LAVA PROJECTING 0.1 METER ABOVE THE GROUND AND IS 21.3 METERS SOUTH-SOUTHWEST OF THE SOUTHEAST CORNER OF THE UNIVERSITY OF HAWAII SOLAR OBSERVATORY BUILDING AND ABOUT 11 METERS LOWER THAN THE STATION MARK. REFERENCE MARK 2 IS A C AND GS REFERENCE MARK DISK STAMPED KOLEKOLE NO 2 1950 CEMENTED IN A DRILL HOLE IN AN OUTCROP OF LAVA PROJECTING 0.8 METER ABOVE THE GROUND AND IS 7.3 METERS EAST OF THE EAST CORNER OF THE AIRGLOW OBSERVATORY BUILDING AND ABOUT 2 METERS LOWER THAN THE STATION MARK. REFERENCE MARK 3 IS A C AND GS REFERENCE MARK DISK STAMPED KOLEKOLE NO 3 1950 CEMENTED IN A DRILL HOLE IN AN OUTCROP OF LAVA PROJECTING 0.2 METER ABOVE THE GROUND AND IS 5.3 METERS NORTH OF THE WEST CORNER OF THE AERONAUTICAL RADIO INCORPORATED BUILDING AND ABOUT 2 METERS LOWER THAN THE STATION MARK. AZ MK SAT TRIANG 011 IS A C AND GS AZIMUTH MARK DISK STAMPED SATELLITE TRIANG STATION 011 1966 CEMENTED IN A DRILL HOLE IN THE TOP OF A ROCK WALL BESIDES THE PATH LEADING TO THE OBSERVATION BUILDING ON THE TOP OF RED HILL AND IS 4.8 METERS NORTHWEST OF THE OUTERMOST PIPE COLUMN AT THE ENTRANCE TO THE BUILDING. TO REACH THE MARK FROM THE STATION GO NORTHEAST ON THE ROAD 0.4 MILE TO A SIDE ROAD ON THE LEFT. TURN LEFT AND GO WESTERLY 0.15 MILE TO A PARKING AREA. WALK NORTHEAST ABOUT 50 YARDS UP A FLIGHT OF STEPS TO THE RED HILL OBSERVATION BUILDING AND THE MARK. AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN 19 MILES WEST OF HANA.

Table 4-1. NGS Documented History of Kolekole Reset TU2862. (cont.)

1/1/1986 by (GOOD) RECOVERED 1986 RECOVERED IN GOOD CONDITION.
8/7/1993 by NOS (GOOD) RECOVERY NOTE BY NATIONAL OCEAN SERVICE 1993 (JGF) RECOVERED AS DESCRIBED.
CONTROL TEXT • The horizontal coordinates were established by GPS observations and adjusted by the National Geodetic Survey in November 1994. The horizontal coordinates are valid at the epoch date displayed above. The epoch date for horizontal control is a decimal equivalence of Year/Month/Day. • The orthometric height was determined by GPS observations and a high-resolution geoid model. • The X, Y, and Z were computed from the position and the ellipsoidal ht. • The Laplace correction was computed from DEFLEC99 derived deflections. • The ellipsoidal height was determined by GPS observations and is referenced to NAD 83. • The geoid height was determined by GEOID99.

Site visits were made to the crater during September 2007 through January 2009. Within the crater, 84 waypoints were created along the maintained crater trails (Table 4-2). Each waypoint entry included a variety of data, such as position (LAT/LON), elevation, and Estimated Position Error (EPE). EPE, recorded in feet, is the expected error from a benchmark location based on the satellite fix quality of the GPS unit at the time the waypoint was created. During the field measurements, 500+ digital photographs were taken at both normal (wide) and zoom (10X) to determine actual visibility of the three buildings from the 84 waypoints (Figs. 4-19 to 4-22). Voice recordings were also made to add specific information to each waypoint.

Table 4-2. Crater Trails Waypoint Viewshed Results.

		Pu'u Ula'ula Bldg		Visitor Center Bldg		AEOS			
Crater Trails GPS Waypoint	EPE in feet (GPS Error)	Predicted Visibility	Actual Visibility	Predicted Visibility	Actual Visibility	Predicted Visibility	Actual Visibility	Line-of-Sight (LOS) Picture Numbers	NOTES (Error % may include Map Data resolution as well as GPS Estimated Position Error (EPE)
6	No EPE pic	YES	YES	YES	YES	NO	NO	A7,A16,A17	"Viewshed Crater Pic" #s
7	No EPE pic	YES	YES	YES	YES	NO	NO	A24-26	
8	19.4	YES	YES	YES	NO	NO	NO	A40,A41,A43	Within Error %
9	33	YES	YES	NO	NO	NO	NO	A44,A46-48	
10	22.3	YES	YES	YES	NO	NO	NO	A49,A-50,A52	Within Error %
11	No EPE pic	YES	YES	NO	NO	NO	NO	A53,A54	
12	24.2	YES	YES	YES	YES	NO	NO	A58,A59,A61	Within Error %
13	19.3	YES	YES	NO	NO	NO	NO	A62,A64,A65	
14	19.7	NO	YES	NO	NO	NO	NO	A66,A67,A69	Within Error %
15	29.6	YES	YES	YES	YES	NO	NO	264-266	
16	31.3	YES	YES	YES	YES	NO	NO	261-263	
44	25	NO	NO	NO	NO	NO	NO	24-26	
45	23.6	NO	NO	NO	NO	NO	NO	27-29	
47	26.1	YES	NO	NO	NO	NO	NO	34-37	Within Error %
48	21.1	YES	NO	NO	NO	NO	NO	38,39	Within Error %
49	21.2	YES	YES	NO	NO	NO	NO	40-42	OFF TRAIL ~20FT from Wpt 48
50	17	YES	YES	NO	NO	NO	NO	44-47	
51	37	YES	YES	NO	NO	NO	NO	48-50	
52	36.6	YES	NO	NO	NO	NO	NO	51,52	Within Error %
53	14.7	YES	YES	NO	NO	NO	NO	53-55	
54	18.3	YES	YES	NO	NO	NO	NO	56-58	
55	19.3	YES	NO	NO	NO	NO	NO	59-61	
57	No EPE pic	YES	YES	NO	NO	NO	NO	67-69	
58	17.4	NO	NO	NO	NO	NO	NO	,78,79	
59	18.1	YES	YES	NO	NO	NO	NO	81-83	
60	19.1	YES	YES	YES	YES	NO	NO	84-86	
61	18	YES	NO	YES	NO	NO	NO	87,88	Within Error %, See 1st Sample Pic
62	No EPE pic	YES	YES	YES	YES	NO	NO	89-91	
63	19.9	YES	NO	YES	NO	NO	NO	98,99	Within Error %
63A	16.1	YES	YES	YES	YES	NO	NO	100-102	
64	13.8	YES	YES	YES	YES	NO	NO	114,115	
65	16.6	YES	YES	YES	YES	NO	NO	116-119	
66	17.5	YES	YES	YES	YES	NO	NO	131-134	See 2nd Sample Pic
69	30.2	YES	YES	YES	YES	NO	NO	138,139	
70	19.6	YES	YES	YES	YES	NO	NO	142,143	
71	19.4	YES	YES	YES	YES	NO	NO	145-147	
72	22.4	YES	YES	YES	YES	NO	NO	151-155	
73	21.8	YES	YES	YES	YES	NO	NO	156-158	Pic158 is 25ft farther- only see VisCtr
74	22.5	NO	NO	NO	NO	NO	NO	160,161	
75	16	NO	NO	NO	NO	NO	NO	168,169	
76	17.5	NO	NO	NO	NO	NO	NO	170-172	
77	35.3	NO	NO	NO	NO	NO	NO	184,185	
78	39	NO	NO	NO	NO	NO	NO	186,188-190	
79	35.5	YES	YES	YES	YES	NO	NO	192-195	Unmaintained Trail
80	29.8	YES	NO	YES	NO	NO	NO	196,197	Within Error %
81	27	YES	YES	YES	YES	NO	NO	198-200	
83	45.2	YES	NO	YES	NO	NO	NO	202,203	Within Error %
84	45.3	YES	YES	YES	YES	NO	NO	204-206	
85	47.8	YES	YES	YES	YES	NO	NO	208-209	
86	26.9	YES	YES	YES	YES	NO	NO	214-217	
87	26.5	YES	YES	YES	YES	NO	NO	218-220	
88	15.7	YES	YES	YES	YES	NO	NO	221-224	
90	15.8	YES	NO	YES	NO	NO	NO	225,226	Within Error %
91	16.3	NO	YES	NO	YES	NO	NO	229-231	Within Error %, See 3rd Sample Pic
92	23.6	YES	YES	YES	YES	NO	NO	236-240	

Table 4-2. Crater Trails Waypoint Viewshed Results. (cont.)

		Pu'u Ula'ula Bldg		Visitor Center Bldg		AEOS			
Crater Trails GPS Waypoint	**EPE in feet (GPS Error)**	**Predicted Visibility**	**Actual Visibility**	**Predicted Visibility**	**Actual Visibility**	**Predicted Visibility**	**Actual Visibility**	**Line-of-Sight (LOS) Picture Numbers**	**NOTES** (Error % may include Map Data resolution as well as GPS Estimated Position Error (EPE))
93	17.4	YES	YES	YES	YES	NO	NO	243-246	Unmaintained Trail
94	15.5	NO	NO	NO	NO	NO	NO	250,252,253	
95	17.9	NO	NO	NO	NO	NO	NO	254,255	
96	17	YES	NO	YES	NO	NO	NO	256,257	Within Error %
97	35.6	YES	YES	YES	YES	NO	NO	267-269	See 4th Sample Pic
99	20	NO	NO	NO	NO	NO	NO	273,274	
100	40	NO	NO	NO	NO	NO	NO	276-278	
101	35.1	YES	YES	YES	YES	NO	NO	279-282	
102	35.6	YES	YES	YES	YES	NO	NO	283-287	
103	33.7	YES	NO	YES	NO	NO	NO	288,289	Within Error %
104	32.8	YES	NO	YES	NO	NO	NO	292-294	Within Error %
105	53.1	YES	YES	YES	NO	NO	NO	295-297	Within Error %
106	52.6	YES	NO	YES	NO	NO	NO	298-300	Within Error %
107	46.3	YES	YES	YES	YES	NO	NO	301-304	
108	40.8	YES	YES	YES	YES	NO	NO	310-312	
109	25.3	YES	NO	YES	YES	NO	NO	313-316	Within Error %
110	28	NO	NO	NO	NO	NO	NO	324,325	
111	48.3	NO	NO	NO	NO	NO	NO	326,327	
112	34.8	YES	NO	YES	YES	NO	NO	328-330	Within Error %
113	54.1	YES	YES	YES	YES	NO	NO	331-333	
114	56.2	YES	YES	YES	YES	NO	NO	334-336	
115	34.3	YES	NO	YES	NO	NO	NO	337-338	Within Error %
116	30	NO	NO	NO	NO	NO	NO	346,347	
117	27.8	YES	YES	YES	YES	NO	NO	350-355	
118	26.2	YES	YES	YES	YES	NO	NO	360-364	
119	32.6	YES	YES	YES	YES	NO	NO	374-376	
120	34.3	YES	YES	YES	NO	NO	NO	377-380	Within Error %
121	21.2	NO	NO	NO	NO	NO	NO	381-383	
122	22.1	NO	NO	NO	NO	NO	NO	385,386	

Correlation for Crater Trails		
65/84 (77%)	**68/84** (80%)	**84/84** (100%)

Figure 4-19. Sample Photo, Picture #88, Waypoint 61.

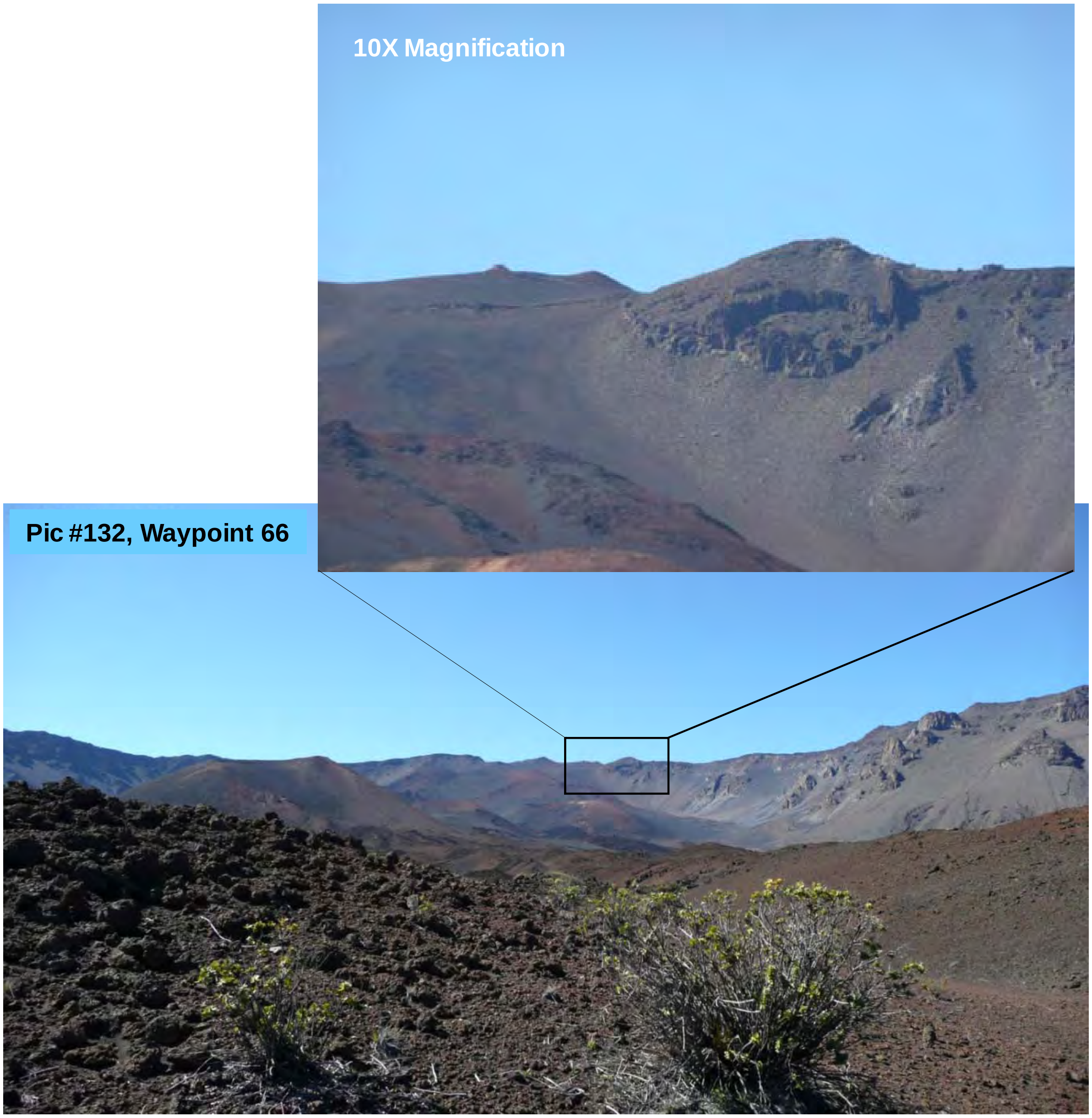


Figure 4-20. Sample Photo, Picture #132, Waypoint 66.

Figure 4-21. Sample Photo, Picture #231, Waypoint 91.

Figure 4-22. Sample Photo, Picture #267, Waypoint 97.

Using a GPS receiver, 45 waypoints (Table 4-3) were also created along the Park road from Hosmer Grove to Pu‘u Ula‘ula Overlook and the same data was obtained for those locations (Figs. 4-23 to 4-25).

Table 4-3. Crater Road Waypoint Viewshed Results.

		Pu'u Ula'ula Bldg		Visitor Center Bldg		AEOS		ATST Mees		
Crater Road GPS Waypoint	EPE in feet (GPS Error)	Predicted Visibility	Actual Visibility	Predicted Visibility	Actual Visibility	Predicted Visibility	Actual Visibility	Predicted Visibility	Line-of-Sight (LOS) Picture Numbers	NOTES Error % may include Map Data resolution as well as GPS Estimated Position Error (EPE)
123	No EPE pic	NO	NO	NO	NO	NO	NO	NO	90	
124	No EPE pic	NO	NO	NO	NO	NO	NO	NO	91	
125	No EPE pic	NO	NO	NO	NO	NO	NO	NO	92	
126	No EPE pic	NO	NO	NO	NO	NO	NO	NO	93	
127	No EPE pic	NO	NO	NO	NO	NO	NO	NO	94	
128	No EPE pic	NO	NO	NO	NO	NO	NO	NO	95,96	
130	No EPE pic	NO	NO	NO	NO	NO	NO	NO	98	
131	No EPE pic	NO	NO	NO	NO	YES	YES	NO	99-101	
132	No EPE pic	NO	NO	NO	NO	YES	YES	NO	102-104	
133	No EPE pic	YES	NO	NO	NO	YES	YES	YES	105-107	Within Error %
134	No EPE pic	YES	NO	NO	NO	YES	NO	YES	108-109	Within Error %
135	No EPE pic	NO	NO	NO	NO	NO	NO	NO	110	
136	No EPE pic	NO	NO	NO	NO	NO	NO	YES	111	
137	No EPE pic	NO	NO	NO	NO	NO	NO	NO	112	
138	No EPE pic	NO	NO	NO	NO	NO	NO	NO	113	
139	No EPE pic	NO	NO	NO	NO	NO	NO	NO	114	
140	No EPE pic	YES	YES	NO	NO	NO	NO	NO	115-117	
141	No EPE pic	NO	NO	YES	NO	YES	NO	YES	118	Within Error %
142	No EPE pic	YES	NO	NO	NO	YES	YES	YES	119-121	Within Error %
143	No EPE pic	YES	NO	NO	NO	YES	YES	YES	122-125	Within Error %
144	No EPE pic	NO	NO	YES	NO	YES	NO	YES	126-127	Within Error %
145	No EPE pic	YES	YES	YES	YES	YES	YES	YES	128-133	
146	No EPE pic	YES	YES	YES	YES	YES	YES	YES	134-138	
147	No EPE pic	NO	NO	YES	NO	YES	NO	YES	139-140	Within Error %
148	No EPE pic	YES	YES	YES	YES	YES	YES	YES	141-143	
149	No EPE pic	YES	YES	YES	YES	YES	YES	YES	144-153	
150	No EPE pic	YES	YES	YES	YES	YES	YES	NO	154-156	
151	No EPE pic	YES	YES	YES	YES	YES	YES	NO	157	
152	No EPE pic	YES	YES	YES	YES	YES	YES	NO	158	
157	No EPE pic	NO	NO	NO	NO	NO	NO	NO	196	
158	No EPE pic	NO	NO	NO	NO	NO	NO	NO	197	Within Error %
159	No EPE pic	NO	NO	YES	YES	YES	YES	YES	198-205	
185	35.6	NO	NO	NO	NO	NO	NO	NO	350-352	
186	36.2	YES	YES	NO	NO	YES	YES	YES	353-357	
187	35.6	NO	NO	NO	NO	NO	NO	NO	358-359	
188	35.2	NO	NO	NO	NO	NO	NO	NO	360-362	
189	17.4	NO	NO	NO	NO	YES	NO	NO	363-366	Within Error %
192	No EPE pic	NO	NO	NO	NO	YES	YES	YES	1042,1043	
193	No EPE pic	NO	NO	NO	NO	YES	YES	YES	1045,1047	
199	13.8	NO	NO	NO	NO	YES	NO	NO	501-507	Within Error %
200	27.7	NO	NO	NO	NO	YES	YES	NO	509-511	
202	15.8	YES	NO	NO	NO	YES	NO	YES	519-524	Within Error %
203	17	YES	NO	NO	NO	YES	YES	YES	532,537-541	Within Error %
204	15.7	NO	NO	NO	NO	YES	YES	NO	545-47,549-51	
205	18.8	NO	NO	NO	NO	NO	NO	YES	552-56,59,62-64	

Correlation for Crater Road		
37/45 (82%)	**42/45** (93%)	**38/45** (84%)

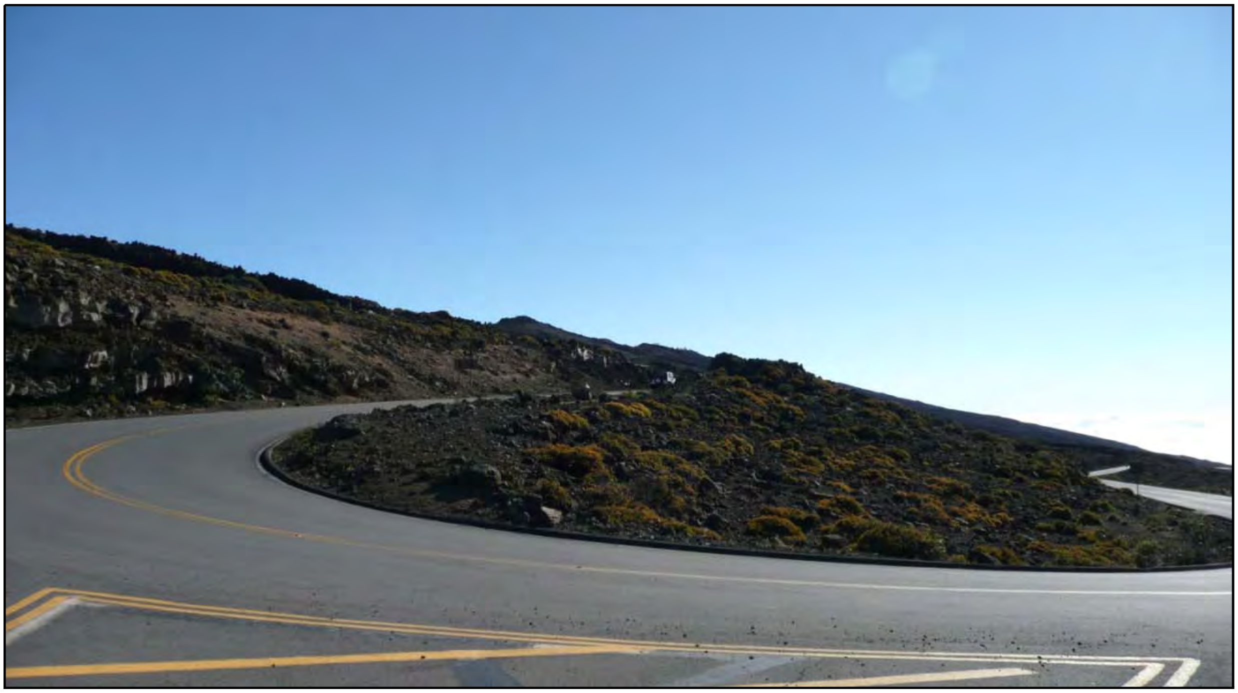


Figure 4-23. Sample Photo, Picture #105, Waypoint 133 – Crater Road.

Figure 4-24. Sample Photo, Picture #129, Waypoint 145 – Crater Road.

Figure 4-25. Sample Photo, Picture #153, Waypoint 149 – Crater Road.

The field GPS Waypoint information and other data were transferred to Lowrence MapCreate 7 software. Then, LAT/LON data for each Waypoint was entered into the Global Mapper 8 software. At this point, Predicted Visibility of the three existing facilities (Figs. 4-26 to 4-28) was compared with Actual Visibility to determine the accuracy of the mapping software.

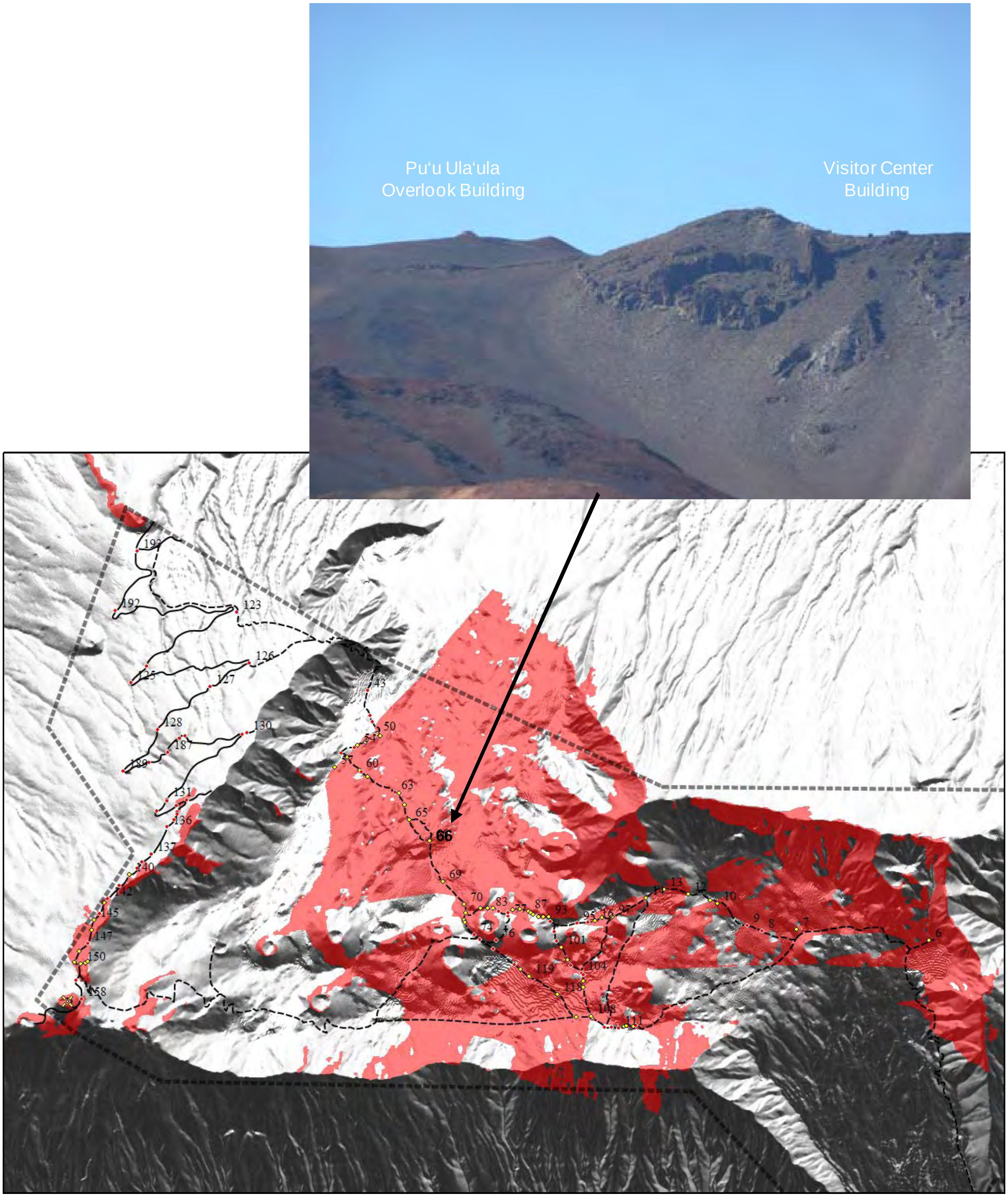


Figure 4-26. Viewshed Map for Pu'u Ula'ula Overlook Building With One Waypoint Photo.

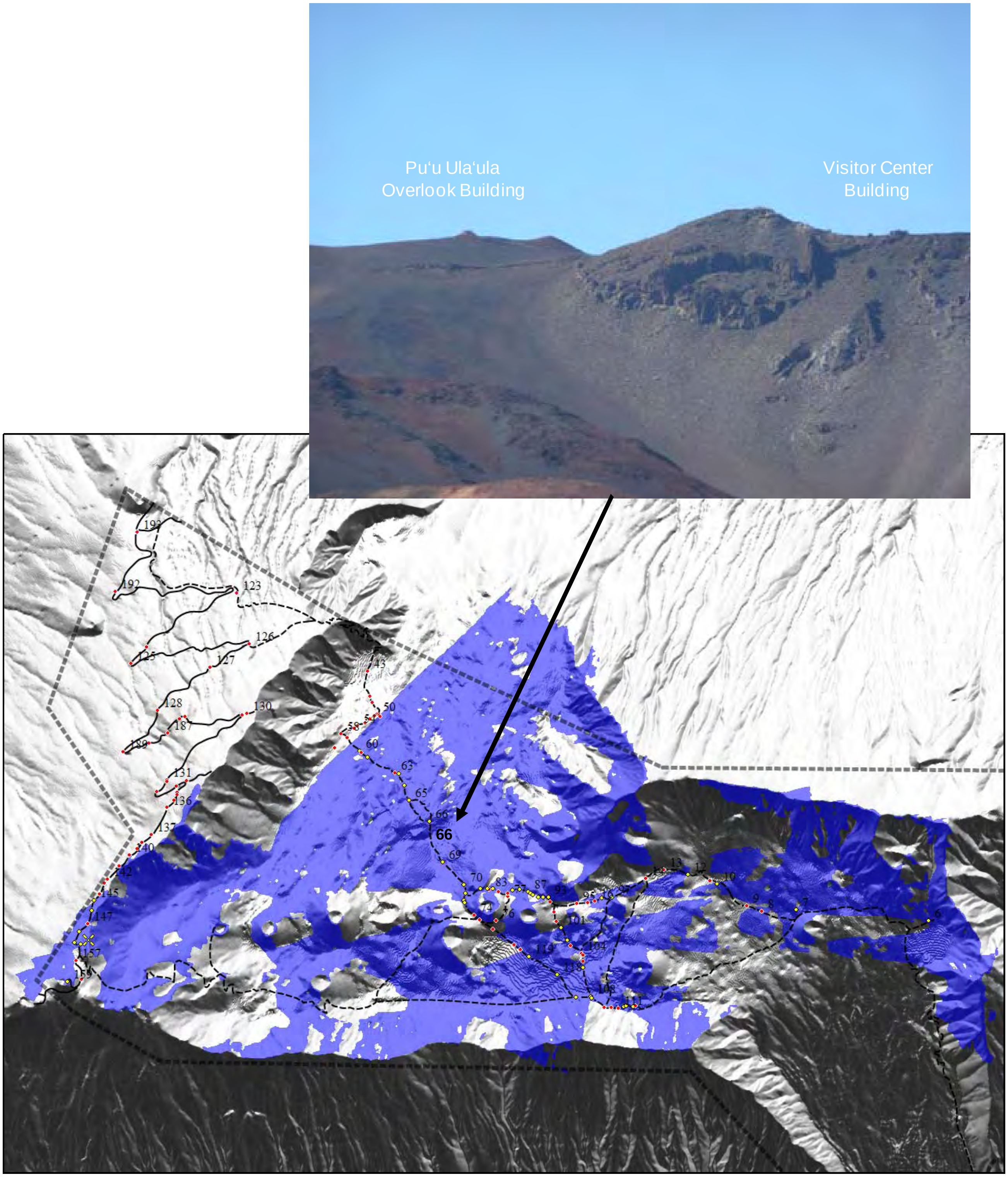


Figure 4-27. Viewshed Map for Haleakalā Visitor Center Building With One Waypoint Photo.

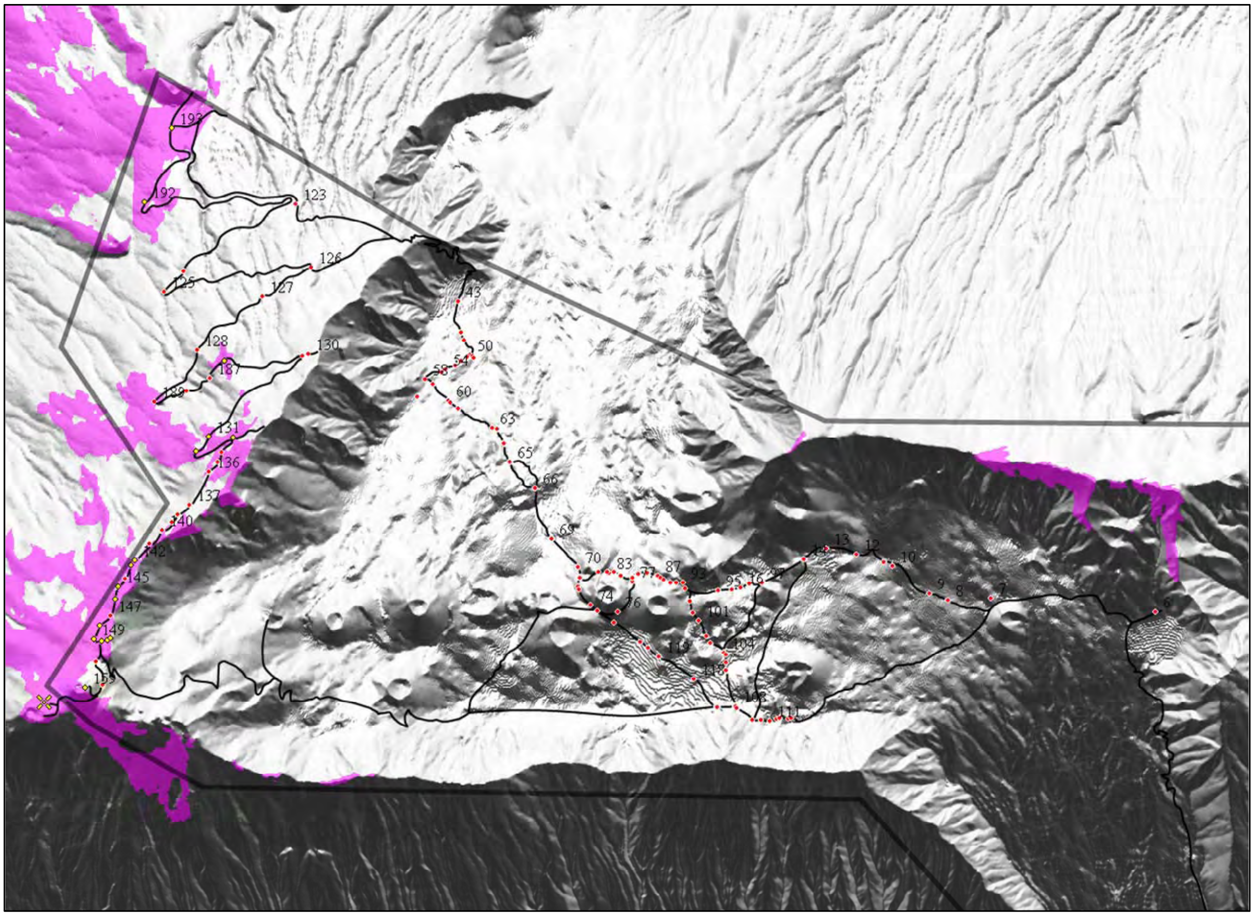


Figure 4-28. Viewshed Map for AEOS Observatory.

As shown in Table 4-4, predicted viewshed results coincided with actual visibility for 102 out of 129 (79%) waypoints for the Pu‘u Ula‘ula Overlook Building, in 110 out of 129 (85%) for the Haleakalā Visitor Center building, and in 122 out of 129 (95%) for AEOS. All discrepancies fell within the EPE and/or the NED and/or the 1/3 arcsecond resolution. The prediction model and field observations concur that AEOS cannot be seen from maintained trails anywhere in the crater.

Table 4-4. Correlation of Predicted and Actual Visibility for Crater and Crater Road.

Pu'u Ula'ula Overlook Building	Haleakalā Visitor Center Building	AEOS Facility
102/129 (79%)	110/129 (85%)	122/129 (95%)

Crater Viewshed

With the accuracy of Global Mapper modeling software established, viewshed maps were modeled for the Proposed ATST Project building at both the primary Mees location and the alternate Reber Circle location. To compensate for NED resolution uncertainties, predicted visibility was plotted for ATST building heights up to 153 feet, which did not alter the viewshed coverage. The results are shown in the viewshed maps of Figures 4-29 and 4-30.

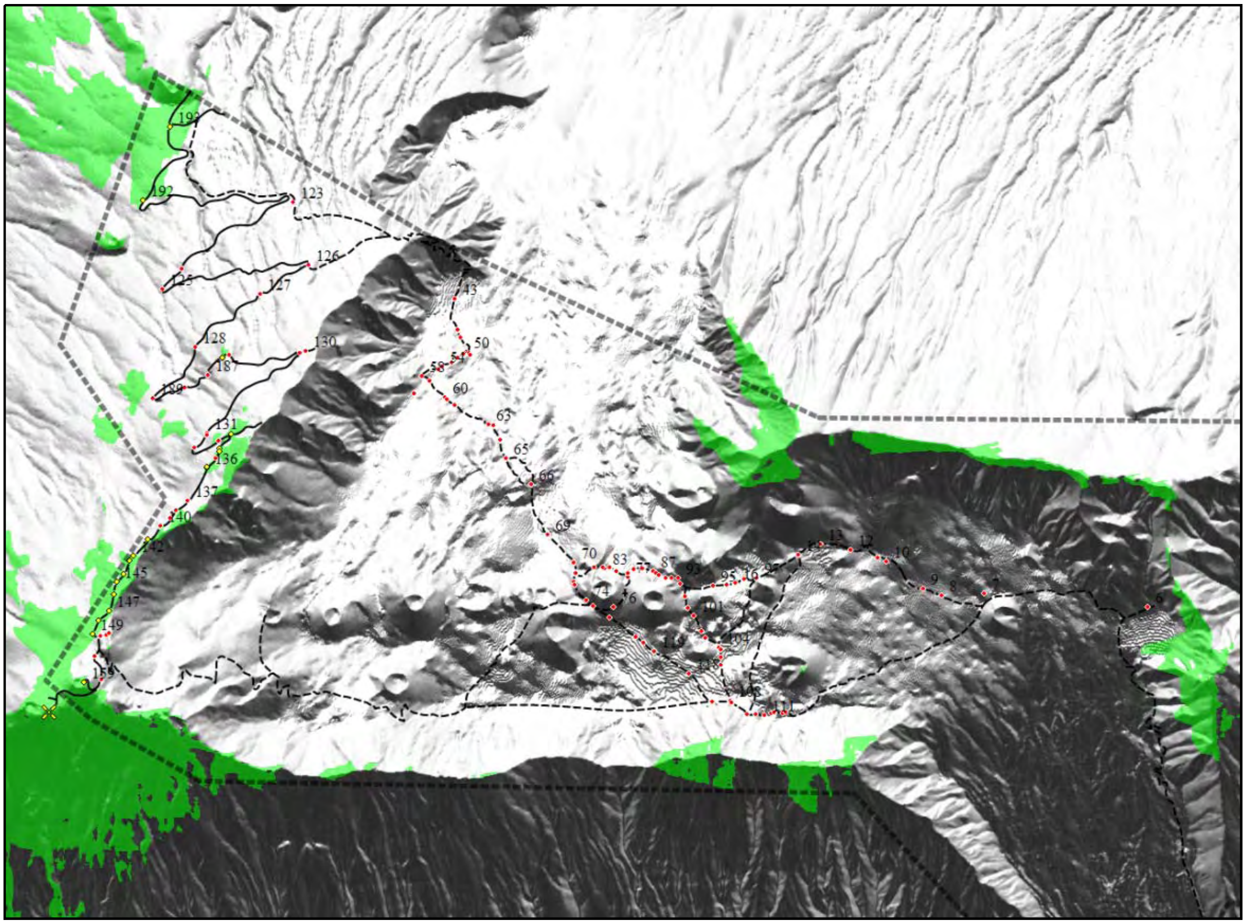


Figure 4-29. Viewshed Map for Primary Mees Site.

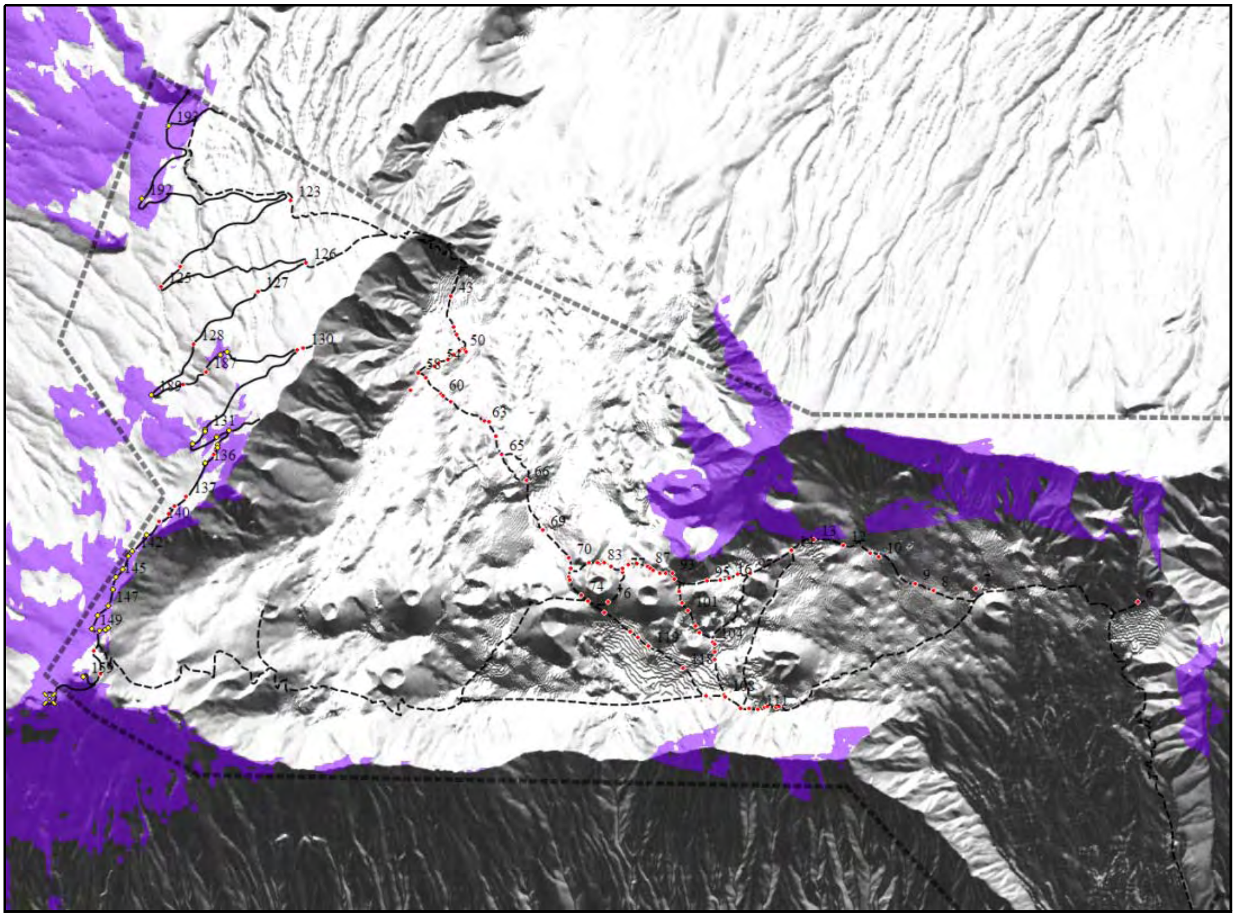


Figure 4-30. Viewshed Map for Alternate Reber Circle Site.

At either the primary or alternate proposed locations, the validated viewshed model predicts that ATST would not be visible from any of the maintained Haleakalā Crater trails. Only ATST at the alternate Reber Circle site would be visible at a place within 75 feet of a maintained trail. However, ATST would be visible at both the primary site from waypoints 16/39 and the alternate Reber Circle site from waypoints 22/39 along Crater Road. GPS, waypoint, and photo data (Figs. 4-19 to 4-22) indicate that visitors on most maintained trails within the crater can see either the Haleakalā Visitor Center or the Puʻu Ulaʻula Overlook buildings when looking up at the rim toward those man-made buildings.

Park Road Corridor

With respect to predicted visibility along the Park road corridor, the viewshed models predict that ATST would be visible along stretches of the road near the HALE entrance and at elevations above 9,000 feet, totaling about 3 miles of Park road. Photos taken during the survey were used to model ATST as it would appear from various locations along the road. Figures 4-31 to 4-34 are renderings that show how ATST would appear from within a vehicle at three of these road locations. Figures 4-31 to 4-33 show ATST at the proposed Mees site. Figure 4-34 shows ATST at the proposed alternate Reber Circle site.

For clarification, rendered Figure 4-31 correlates with road waypoint location 133 on any of the viewshed maps (Figs. 4-27 to 4-30). Note that due to scale of the map, waypoint 133 is one of the four unlabeled points between waypoints 131 and 136. To an observer, the ATST facility would appear to the left of the current facilities at HO, but due to terrain and/or building obscuration, it would not be fully visible from any location along the Park road corridor.

Figure 4-31. Rendering of Proposed ATST at Mees Site, Picture #105, Waypoint 133 – Crater Road.

Figure 4-32. Rendering of Proposed ATST at Mees Site, Picture #129, Waypoint 145 – Crater Road.

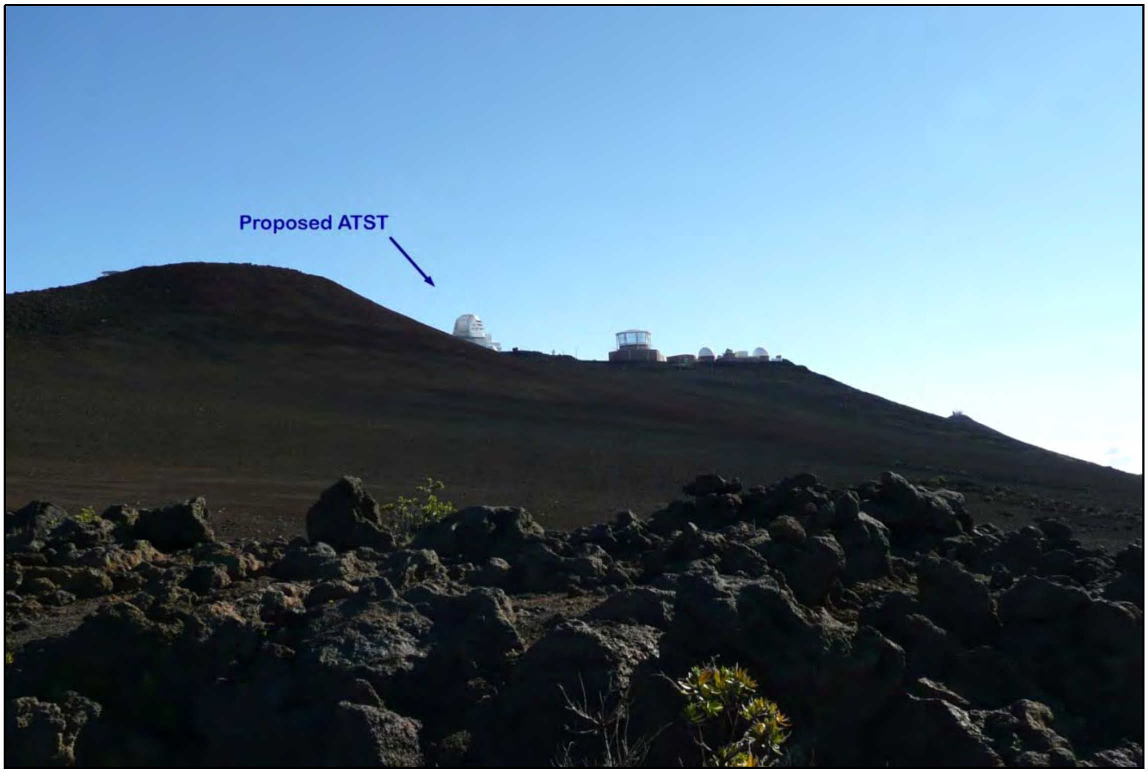


Figure 4-33. Rendering of Proposed ATST at Mees Site, Picture #153, Waypoint 149 – Crater Road.

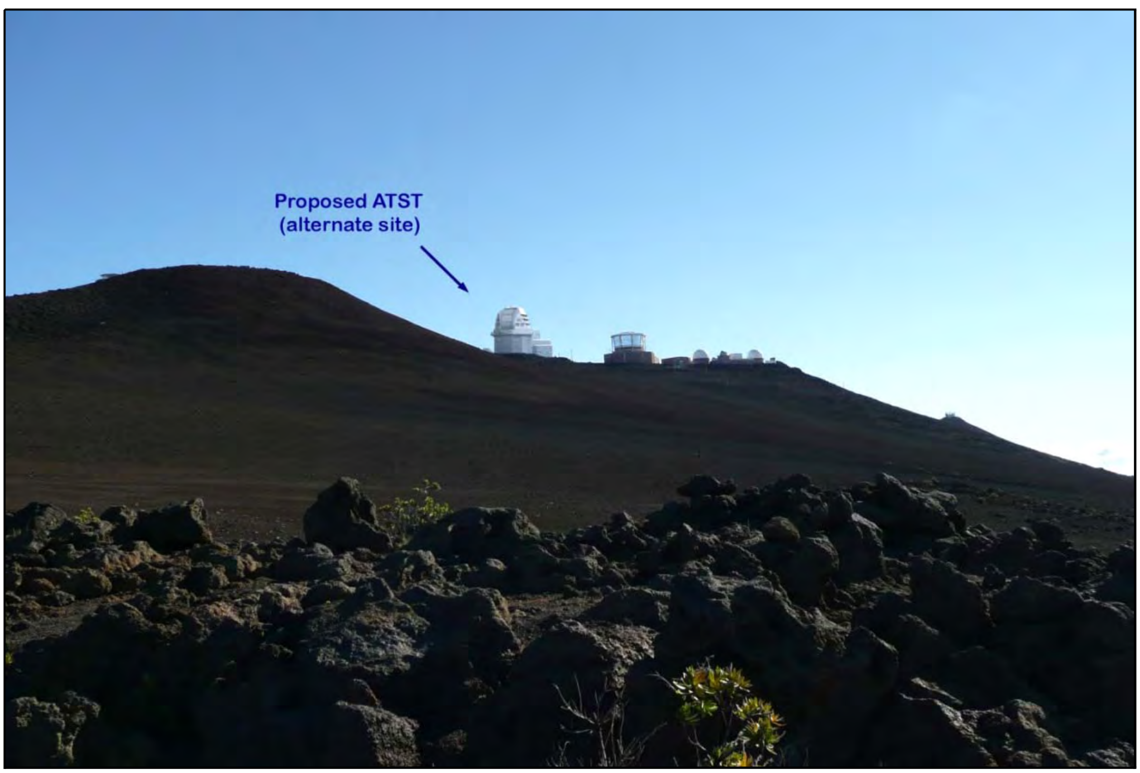


Figure 4-34. Rendering of Proposed ATST at Alternate Reber Circle Site, Picture #153, Waypoint 149 – Crater Road.

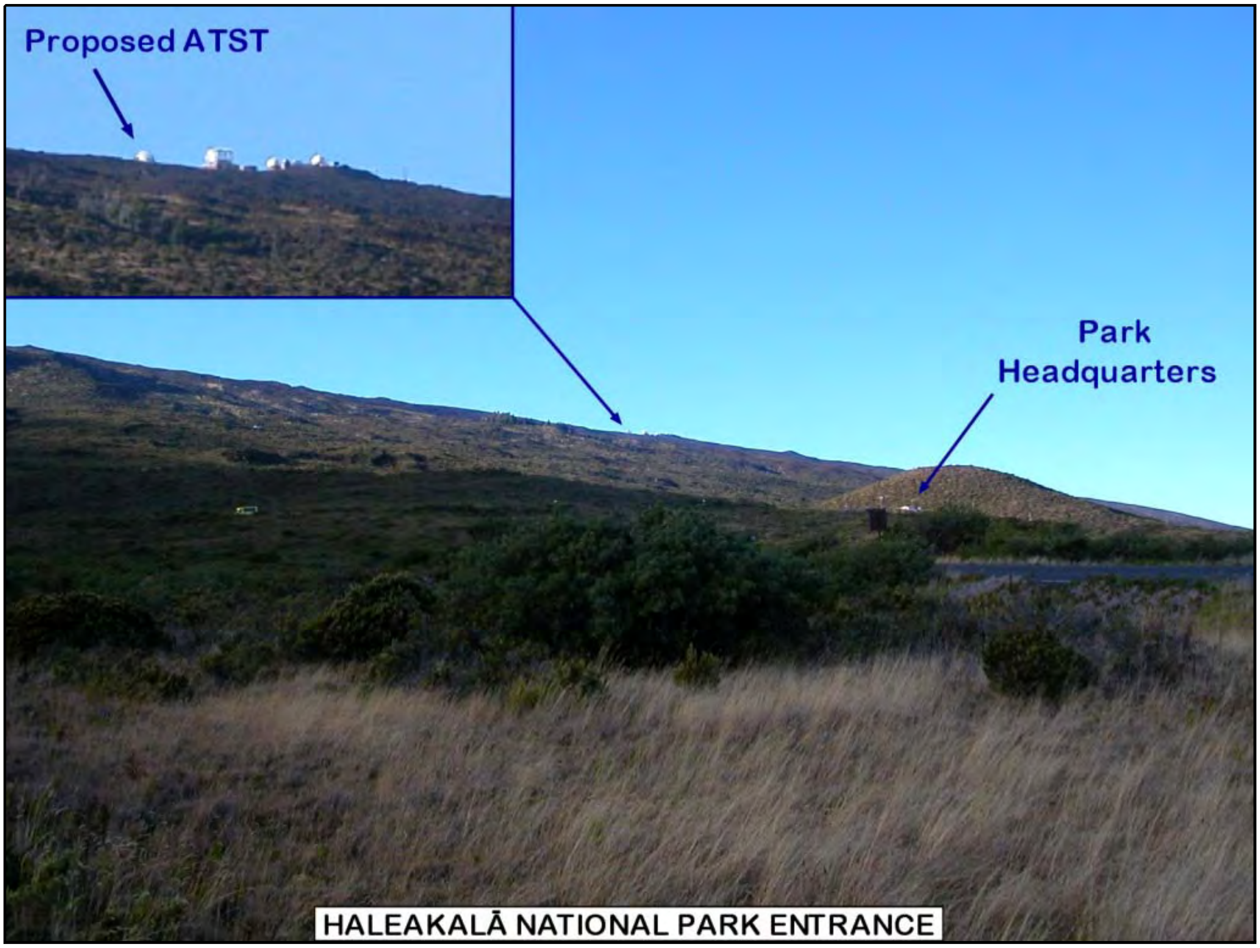


Figure 4-35. Rendering of Proposed ATST from Park Road at Entrance to Hosmer Grove.

Maui-Wide Viewshed

Once the smaller scale crater and Crater Road viewsheds were established, the same process was used to produce viewshed maps for the proposed primary Mees and alternate Reber Circle sites to show predicted visibility for the entire island of Maui (Figs. 4-2 and 4-3) using the same NED 1/3 arcsecond resolution data. This translates to a resolution of approximately 10 meters horizontally and +/-7 meters vertically. The resolution for these maps is approximately three times greater than the viewshed maps shown in the DEIS.

4.5.3 Evaluation of Potential Effects at the Mees Site

<u>DIRECT AND INDIRECT EFFECTS</u>

Construction-Related Visual Effects at the Mees Site

<u>Puʻu Ulaʻula Overlook.</u> Construction would result in a moderate, adverse visual effect to observers at the Puʻu Ulaʻula Overlook, as a result of the use of 3 to 5 cranes to lift building and telescope components and as a result of the evolving building structures during construction.

A 250-foot lattice crane and 3 to 5 much smaller cranes (under 100 feet) would be employed to install telescope and building components (Section 2.4.3-Construction Activities). It is anticipated that cranes would be needed at various times over a period of approximately four years during construction. These types of obstructions would be clearly visible from the Pu‘u Ula‘ula Overlook in HALE during periods when they are raised into operating position. The 250-foot crane would be considerably taller than any other structure at the summit and would be readily visible when extended during daytime working hours. Since the cranes would only be 5 to 10 feet in width and of lattice construction, they would obstruct a small part, but not a substantial portion, of the original view from that location when raised. There would also be some terrain shielding of cranes behind the northeastern rim of the cinder cone that constitutes Pu‘u Kolekole. Qualitatively, the appearance of a large crane within the natural viewshed would be readily detectable and have an adverse effect on those who see the crane as an intrusion on the vista. Although it would be quantitatively small with respect to the entire viewshed, overall, the use of cranes during construction would result in a moderate, adverse, but short-term effect on visual resources at the Pu‘u Ula‘ula Overlook.

Other, shorter cranes and smaller construction equipment would be seen during the construction phase, but it would be difficult to visually resolve them (identify or separate them from one another or from current structures within HO). They would also be partially obscured from the Pu‘u Ula‘ula Overlook by topographic shielding from the northeastern rim of the cinder cone of Pu‘u Kolekole. Therefore smaller construction equipment, including small cranes would constitute a minor, adverse, and short-term effect.

As the proposed ATST would be constructed, the structure would become visible from the Pu‘u Ula‘ula Overlook when the structure reached a height a little over 30-feet, which would be during construction of the lower enclosure. From then until the rotating upper enclosure was constructed, the proposed ATST Project would be clearly visible. Therefore, the effect on visual resources is considered to be moderate, adverse, and long-term.

The Areas of HALE Adjacent to HO, But Not on Pu‘u Ula‘ula, Including Magnetic Peak. Within the part of the ROI for visual resources that includes the areas of HALE adjacent to HO but outside of the Pu‘u Ula‘ula Overlook, the visibility of the proposed ATST Project construction equipment at the Mees site would be quite variable. Intervening natural topographic features such as cinder cones and lava flows rapidly alters the line-of-sight between objects over very short distances. A 250-foot crane would not be visible from the HALE Visitor’s Center during either day or night, due to these intervening landmasses such as Pa Ka‘oao (White Hill).

A 250-foot crane would be visible on cloudless days from the extreme western edge of the parking area for the Visitor’s Center. It would also be visible from the summits of Pa Ka‘oao and Magnetic Peak. From those locations a 250-foot lattice crane would be readily detectable, e.g., resolvable with respect to its identity as a construction crane, and it would be the tallest man-made structure in the summit area. However, the see-through lattice work and relatively narrow width of the crane would not affect much of the original view. Again, qualitatively, the appearance of a large crane within the natural viewshed would be readily detectable and have an adverse effect on those who see the crane as an intrusion on the vista. Although it would be quantitatively small with respect to the entire viewshed, overall, the visual effect would be moderate, adverse, and short-term.

During construction at the Mees site, the proposed ATST Project would not be visible from anywhere in this portion of the ROI until structure height reached about 30 feet. It would then be clearly visible from the summits of Pa Ka‘oao and Magnetic Peak. However, qualitatively, from this location it would be intrusive to those whom observatories are an intrusion, and the effect on those individuals at this distance would be moderate, adverse, and long-term. Elsewhere in this portion of the ROI adjacent to HO but outside of the Pu‘u Ula‘ula Overlook construction would not be visible until structure height reached about 78 feet at which time the lower enclosure and support structure would be clearly visible from the extreme western end of the Haleakalā Visitor Center parking area and a short portion of the summit access road between that parking area and Pa Kaʻoao. The same qualitative effect would be applicable, and overall, the effect on visual resources in this portion of the ROI from the construction of the lower and upper enclosure would be moderate, adverse, and long-term.

The Upper Road Corridor, Including the Haleakalā Visitor Center. Along the approximately two miles of the Park road corridor from the Kalahaku Overlook to the summit terminus of the road, the 250-foot crane would be visible on clear days where the road direction and topographic shielding permit HO to be seen, as exemplified by the visibility of AEOS at HO in Table 4-3, waypoints 142, 143, 148-152 and Figure 4-28. From Kalahaku Overlook to approximately 0.6 miles from HO (at the junction of the Park road and Haleakalā Visitor Center parking area), the crane would be visible, but not resolvable. Therefore, the visual effect on the observer would be small, resulting in a minor, adverse, and short-term effect. Other cranes and equipment would be visible where there is direct line-of-sight to HO along this section of road, as above. From more than 0.6 miles, these objects would be difficult to resolve (identify or separate from one another or from current structures within HO) and qualitatively those who prefer unbroken vistas would see the crane but are not likely to view the relatively small addition of the crane as substantially diminishing the vista from those locations, especially since they would be viewed almost exclusively from vehicles on the road. The overall effect would be minor, adverse, and short-term. From the short distance closer than 0.6 miles to HO in which the proposed ATST Project would be seen along the summit access road (between the Haleakalā Visitor's Center and Pa Kaʻoao, where there is direct line-of-sight to HO the 250-foot crane would be taller than other structures on the summit, be readily visible and resolvable, but quantitatively, because of its narrow width and lattice construction, it would not dominate the vista. However, it would have an adverse effect on those who feel that a tall man crane is out of scale for the natural vista, and to those individuals it would therefore result in a moderate, adverse, and short-term effect on visual resources.

The construction of the proposed ATST Project at the Mees site would not be visible to observers on the upper two miles of the Park road corridor until the lower enclosure structure is completed, at about 78 feet above ground level. Once the lower enclosure of the proposed ATST Project is constructed, observers along the road would be able to see the structure along the Park road corridor from locations between the Kalahaku Overlook to the Haleakalā Visitor Center parking area. Between a distance of 2 miles and approximately 0.6 miles from HO, the proposed ATST Project would be visible, but without the upper enclosure, it would appear unidentifiable as something other than a cylinder seen in profile, e.g., a rectangle, but occupying less than 10 percent of the viewshed. It would also be partially hidden behind Magnetic Peak. During this period, the visual effect would be minor, adverse, and short-term. When the upper, rotating enclosure is completed, observers along the same portion of the road corridor would be able to see the proposed ATST project clearly (Figs. 4-31 and 4-32). Because it would not be fully visible along the upper roadway, it would likely not evoke the same level of adverse feeling from those who would feel it is out of character for the natural surroundings. Overall, the effect on visual resources at these locations would be minor, adverse, and long-term.

Along the Park road corridor, at about 0.6 miles from HO, the proposed ATST structure would become visible when the lower enclosure is completed. The structure would be clearly visible to observers, and would be identifiable as a facility under construction. It would be about 12 percent to the portion of the HALE viewshed that contains HO in this area. This portion of the viewshed amounts to approximately 3 percent of the total 360-degree vista at this distance from HO, which would be a quantitatively minor, adverse, and long-term effect. However, the size and color of the structure would be clearly observable to those who feel that the proposed ATST Project at the Mees site is an inappropriate part of the viewshed. Therefore, the overall effect on visual resources from this perspective would be moderate, adverse, and long-term.

The Crater. The viewshed modeling that was completed for the proposed ATST Project predicted that structures taller than 153 feet would be seen from the crater. Therefore the 250-foot crane, but not other shorter construction equipment, would be visible from trails and campsites within the crater. However, with the terrain shielding of Magnetic Peak shielding about half the lower part of the crane and at the distances involved, only the upper 100 feet of the crane would appear as a barely visible, dark, very thin, linear object standing about 1/30th the height of the crater wall above which it would be viewed. It would be difficult to resolve the structure such that it can be identified as a crane and the view from the crater trails already includes the Haleakalā Visitor Center and the Puʻu Ulaʻula Overlook facilities at the summit. Qualitatively, it would be difficult for viewers to form a judgment about the crane, since it would be so difficult to resolve in the background. Overall, therefore, the effects from the construction equipment would be considered minor, adverse, and short-term.

At no time during construction would the proposed ATST Project structure itself be visible within the crater. At its full 143-foot height above ground level which is below the 153-foot threshold predicted by viewshed modeling to be visible from within the crater. In addition, at the Mees site, the proposed ATST Project would be shielded from view in the crater by Magnetic Peak and other topography in the line-of-sight to the crater trails and campsites. The effect on visual resources from within the crater would, therefore, be negligible, adverse, and long-term.

The Lower Park Road Corridor, Including Hosmer Grove. The cranes, but not the other construction equipment, would be visible along approximately one mile of the Park road corridor from the HALE entry station to just beyond the Park Headquarters Visitor Center, including Hosmer Grove. From the entry station to just beyond the Park Headquarters Visitor Center, the cranes would appear as very thin, relatively short, linear objects against the ridgeline near the summit and would comprise a small fraction of one percent of the ridgeline vista and would not obscure or substantially change it. Therefore, from these locations the effect would be just barely at the level of detection and therefore negligible, adverse, and short-term.

As illustrated in Figure 4-35, the evolving facility structure of the proposed ATST project construction at the Mees site would not be visible from the lower portion of the Park road corridor until structure height reached about 100 feet, at which time the upper enclosure would become visible along the approximately one mile of Park road corridor from the entry station to just beyond the Park Headquarters Visitor Center, including Hosmer Grove. At that distance from the Mees site the structure would be visible but would be very similar in height and reflectivity to the other structures in HO. The effect on visual resources would therefore be minor, adverse, and long-term.

Populated Areas of Maui, Including Windward, Upcountry, Central Valley, and South Maui Locations. Construction of the proposed ATST project at the Mees site would result in relatively negligible, adverse visual effects on observers in population centers on Maui as a result of construction cranes at the site, and also as a result of the increasing height of the proposed ATST Project.

During construction, a 250-foot lattice crane and 3 to 5 smaller cranes of less than 100 feet would be employed to install telescope and building components (Section 2.4.3-Construction Activities). It is anticipated that cranes would be needed at various times over a period of approximately 4 years during construction. These obstructions would be barely visible at long distances from the population centers on Maui, which are located no closer than 5 miles to the Mees site. Cranes would be barely detectable in populated areas as extremely thin objects against the mountain ridgeline and they would only comprise a negligible fraction of the total height of the mountain visible to observers, e.g., they would comprise a fraction of 1 percent of the overall mountain vista at those distances, and as such they would not obscure or substantially change the ridgeline. Therefore, from these distant locations the effect would be negligible, adverse, and short-term, in that this analysis applies to the approximate 4 to 5-year long construction phase.

As the proposed ATST would be constructed, the structure would become visible from portions of Maui. Due to terrain shielding at the Mees site, the current 30-foot tall Mees Observatory is not visible from any populated location on Maui. Viewshed modeling predicts that observers within central, windward, upcountry and south Maui locations areas of Maui would begin to see the proposed ATST Project by the time the approximately 78-foot tall non-rotating elements of the building structure are completed. This part of the proposed ATST Project would include the lower enclosure and some fixed structure above the catwalk (see Vol. II, Appendix J (4). Until such time as the lower enclosure was constructed, the proposed ATST Project would not be visible to observers in populated areas within the ROI, and the effects on the visual resources from the proposed ATST Project structures would be negligible, adverse, and short-term.

Operations-Related Visual Effects at the Mees Site

When completed at the Mees site, the proposed ATST Project would be visible from portions of the Maui landmass, from HO, as well as from certain areas within HALE. However, as described for construction effects it would not be visible from any HALE public trails or campsites within the crater or from approximately two thirds of the HALE road corridor (Fig. 4-29). It also would not be visible from those portions of the Maui landmass shielded by terrain (Fig. 4-2). The following sections discuss effects on the visual resources of areas from which the proposed ATST Project would be observed.

<u>Puʻu Ulaʻula Overlook.</u> From HALE, the current HO complex is plainly visible from the Puʻu Ulaʻula Overlook, and the proposed ATST Project at the Mees site would be a noticeable addition to HO. However, it would not dominate the current vista toward HO (Fig. 4-14) nor would it likely result in a significant reduction of the existing vista for the approximately 1.7 million annual visitors (HALE, 2006). It would appear taller than the AEOS facility, which, at 117 feet, is currently the tallest structure at HO. Because the Puʻu Ulaʻula Overlook is the closest location from which HALE visitors could observe the proposed ATST Project (approximately 0.3 miles), the structure would appear closer and larger than anywhere else in HALE. Qualitatively, the effect on the visual quality of the landscape would be readily detectable by observers and there would be regional consequences for those resources. For example, the natural wilderness vistas visible from the highest point on Haleakalā result in large numbers of visitors traveling there. The proposed ATST Project would be the largest man-made object within the viewshed from that location.

The addition of the proposed ATST Project would add approximately another 20 percent to the total extent of HO in the viewshed from Puʻu Ulaʻula Overlook, for a total of about 14.5 percent of the total viewshed, which would be considered a moderate, adverse, and long-term effect. Taking both quantitative and qualitative factors into consideration, from the Puʻu Ulaʻula Overlook vantage point, the effects would be moderate, adverse, and long-term.

<u>The Areas of HALE Adjacent to HO, But Not on Puʻu Ulaʻula, Including Magnetic Peak.</u> Within the part of the ROI for visual resources that includes the areas of HALE adjacent to HO but outside of the Puʻu Ulaʻula Overlook, the visibility of the proposed ATST Project at the Mees site would be quite variable. Quantitatively, the intervening natural topographic features such as cinder cones and lava flows rapidly alters the line-of-sight between objects over very short distances. For example, the proposed ATST Project at the Mees site would not be visible from the Haleakalā Visitor's Center during either day or night, due to the intervening landmass of Pa Kaʻoao. But it would be visible on cloudless days in the extreme Western edge of the parking area for the Haleakalā Visitor's Center. It would also be visible from the summits of Pa Kaʻoao and Magnetic Peak. From those locations the proposed ATST Project would be readily visible and be the tallest man-made structure. Qualitatively, for some visitors and others who visit the area, the view of the proposed ATST Project from the road would be inconsistent with the natural vista or out of scale with the natural topography. To those individuals, the visual effect would be moderate, adverse, and long-term. The proposed ATST Project would not be visible elsewhere in this portion of the ROI, and the effect on visual resources in this portion of the ROI would be negligible, adverse, and long-term.

The closest views of the proposed ATST Project from the area adjacent to HO, but outside of the Puʻu Ulaʻula Overlook, would be along the access road to the summit from the Visitor's Center. Along the access road above the Visitor's Center, the proposed ATST Project would be visible only a short distance on the way to Pa Kaʻoao before Magnetic Peak shields the entire HO viewshed (Fig. 4-33). In that short portion of the road, the proposed ATST Project would be readily detectable. In addition, the lower half and south side of the proposed ATST Project would be truncated by Magnetic Peak. Qualitatively, because only part of the completed lower and upper enclosure structures would be visible along the access road, the proposed ATST Project would have less effect on a viewer's perception of the visual resources than it would if there were no terrain shielding. Quantitatively, it would add less than 12 percent to the approximately 3 degrees of total viewshed attributed to HO at this location, which would be minor, adverse, and long-term. However, overall it is believed that the effects on visual resources along this short portion of road would be moderate adverse and long-term. For all other areas of HALE adjacent to HO and outside the higher and closer Puʻu Ulaʻula Overlook vantage point, the proposed ATST Project would not be visible, and, therefore, the effects are considered to be negligible, adverse, and long-term.

The Upper Park Road Corridor, Including the Haleakalā Visitor Center. Along the remaining two miles of the Park road corridor in which the proposed ATST Project would be visible — which is the upper portion of the road as it travels to the summit — an observer would see it on clear days at various locations along the Park road corridor depending on:

1. the compass direction of the road at any point, which changes direction toward or at oblique angles to HO,
2. the intervening terrain along the road, which includes steep cuts, projecting outcrops, cinder slopes; and,
3. the relative position of topography closer to the proposed ATST Project than the road, such as Magnetic Peak and Pa Kaʻoao.

The facilities at HO appear larger as a traveler on the road approaches the summit area. This would also be true for the proposed ATST Project, as illustrated by the renderings in Figures 4-31 to 4-33. For about half of the distance from the Kalahaku Overlook to the summit road terminus, the proposed ATST Project would be a very small feature in relation to the visible mountain mass and would have a minor, adverse, and long-term effect on visual resources. Within the last mile of Park road corridor, vehicle passengers would have a progressively closer view of the proposed ATST facility, which would end at about a 0.6 mile distance along the summit access road past the Visitor's Center on the way to Pa Kaʻoao. At that distance, the structure would be readily detectable to an observer. However, considering the clear view of the proposed ATST Project from the access road, intensity of the effect would be moderate, adverse, and long-term.

The Crater. The viewshed computer modeling results predict that at the Mees site location, structures taller than 153 feet would be visible on trails and in campsites within the HALE crater area. At a height of 143 feet, viewshed models for the proposed ATST Project predict that it would not be visible on any visitor trail or within any campsite (Fig. 4-29). Therefore, the effect on visual resources within the crater would be negligible, adverse, and long-term.

Lower Park Road Corridor, Including Hosmer Grove. Quantitative viewshed analyses of locations along the Park road corridor from the entry station to the Visitor's Center Overlook at the crater predict that the proposed ATST Project at the Mees site would be visible along approximately one-third of the Park road corridor, or for a total of approximately three miles. For about the first mile within HALE, from the entry station to the first turn after the Park Headquarters Visitor Center, the proposed ATST Project would be visible. Depending upon an observer's location along this corridor, the viewing angle would alter the appearance of the proposed ATST Project such that it would be seen in different relative positions and at different relative heights within the HO complex. For example, at some locations it would appear to be shorter than AEOS, as illustrated by the rendering in Figure 4-35 (AEOS is the current tallest structure at HO and the proposed ATST would be taller by 26 feet). Qualitatively, however, at no location in this area would the proposed ATST Project dominate the vista (have a commanding or preeminent place or position). Therefore, along this part of the HALE road corridor, there would be a long-term effect on visual resources, because it would not dominate the vista, the effects are anticipated to be minor, adverse, and long-term.

Populated Areas of Maui, Including Windward, Upcountry, Central Valley, and South Maui Locations. From both the computer modeling and the renderings, it is apparent that the proposed ATST Project would be visible from large portions of the Maui landmass that are populated. The structure would be visible from central, windward, Upcountry, and south Maui. From some of these locations, it would be separately identifiable on a cloudless day, when atmospheric transparency permits. However, at a minimum range of five miles to any population center it would not appear to be significantly taller or more reflective than the current facilities that are present in the photographs. Moreover, for most Maui population centers from which the proposed ATST Project would be detectable, changes to the visual quality of the landscape would be so slight that they would not be of any measurable or perceptible consequence. For example, from a distance of 7 miles, in the populated area of Kula, HO comprises about 2 percent of the entire ridgeline viewshed of Haleakalā. The proposed ATST project would add approximately another 0.2 percent to man-made facilities within the viewshed. Quantitatively the operation of the proposed ATST Project would have a negligible, adverse, and long-term effect. Qualitatively, the very small increment would not be easily seen as a new and separate facility from many of those locations, since there would be some terrain and other facilities shielding part of the structure. Since other enclosures are white, it would not stand out as a new type of material and would not seem out of context with the other facilities seen along the ridgeline. Overall, the effect on visual resources within those populated portions of the central, windward, Upcountry, and south Maui parts of the ROI would be negligible, adverse, and long-term.

4.5.4 Evaluation of Potential Effects at the Reber Circle Site

DIRECT AND INDIRECT EFFECTS

Construction-Related Effects at the Reber Circle Site

Pu'u Ula'ula Overlook. From a quantitative perspective, construction would result in a moderate, adverse visual effect to observers at the Pu'u Ula'ula Overlook, as a result of the use of 3 to 5 cranes to lift building and telescope components and as a result of the evolving building structures during construction. A 250-foot lattice crane and 3 to 5 much smaller cranes (under 100 feet) would be employed to install telescope and building components (Section 2.4.3-Construction Activities). It is anticipated that cranes would be needed at various times during construction over a period of approximately four years. These types of obstructions would be clearly visible from the Pu'u Ula'ula Overlook in HALE during periods when they are raised into operating position.

The 250-foot crane would be considerably taller than any other structure at the summit and would be readily visible when extended during daytime working hours. Since the cranes would only be 5 to 10 feet in width and of lattice construction, they would obstruct part, but not a substantial portion, of the original view from that location when raised. However, unlike the Mees site, there would not be any terrain shielding of cranes behind the northeastern rim of the cinder cone that constitutes Puʻu Kolekole, and the cranes would be plainly visible during construction activities. Overall, the use of cranes during construction would result in a moderate, adverse, but short term effects on visual resources at the Puʻu Ulaʻula Overlook. Other, shorter cranes and smaller construction equipment would be seen during the construction phase, but it would be difficult to visually resolve them (identify or separate them from one another or from current structures within HO). Therefore smaller construction equipment, including small cranes would constitute a minor, adverse, and short-term effect.

Qualitatively, as the proposed ATST Project would be constructed, it would be visible from the Puʻu Ulaʻula Overlook. From the time excavation began, prior to construction of the lower enclosure, e.g., the proposed ATST Project would be clearly visible from the onset of activities, those who have negative feelings about tall structures within the viewshed or are disturbed by man-made obstructions to the vista at the Puʻu Ulaʻula Overlook, would have the greatest possible exposure to the construction process. Therefore, overall it is believed that the dominance of the structure and the opinions of some who would view this dominance as a major impediment to their enjoyment of the visual resources would result in a major, adverse, and long-term effect on visual resources.

The Areas of HALE Adjacent to HO, But Not on Puʻu Ulaʻula, Including Magnetic Peak. Within the part of the ROI for visual resources that includes the areas of HALE adjacent to HO but outside of the Puʻu Ulaʻula Overlook, the visibility of the proposed ATST Project construction equipment at the Reber Circle site would be quite variable. Intervening natural topographic features such as cinder cones and lava flows rapidly alters the line-of-sight between objects over very short distances. A 250-foot crane would not be visible from the Park Headquarters Visitor’s Center during either day or night, due to these intervening landmasses such as Pa Kaʻoao (White Hill). A 250-foot crane would be visible on cloudless days from the about the middle of the parking area for the Haleakalā Visitor’s Center. It would also be visible from the summits of Pa Kaʻoao and Magnetic Peak. From those locations, a 250-foot lattice crane would be readily detectable, e.g., resolvable with respect to its identity as a construction crane, and it would be the tallest man-made structure in the summit area. Quantitatively, the see-through lattice work and relatively narrow width of the crane would not affect much of the original view. However, the crane would dominate the topography and overall, the visual effect would be moderate, adverse, and short-term.

Because most of these portions of HALE are lower than HO, the topography would provide some shielding and during construction at the Reber Circle site the proposed ATST Project would not be visible from anywhere in this portion of the ROI until structure height reaches about 30 feet. From excavation onward, it would then be clearly visible from the summits of Pa Kaʻoao and Magnetic Peak, however, it would be within the context of the facilities at HO. From these locations, as at the Puʻu Ulaʻula Overlook, the visual effects would be during the later stages of construction as major, adverse, and long-term.

Elsewhere in this portion of the ROI, adjacent to HO but outside of the Puʻu Ulaʻula Overlook, construction would not be visible until structure height reached about 30 feet at which time the lower enclosure and support structure would be clearly visible from about the middle of the Haleakalā Visitor Center parking area and along a short portion of the summit access road between that parking area and Pa Kaʻoao. The subsequent addition of the upper rotating enclosure would match the appearance of other astronomical facilities at HO. But the proposed ATST Project would stand out without any terrain or other facility shielding the structure. Qualitatively, those who find tall man-made structures to be out of character with the natural topography might have a negative reaction to the large, white structure clearly visible along the upper Park road corridor. Overall, the effect on visual resources in this portion of the ROI from the construction of the lower and upper enclosure would be moderate, adverse, and long-term.

The Upper Park Road Corridor, Including the Haleakalā Visitor Center. Along the approximately two miles of the Park road corridor from the Kalahaku Overlook to the summit terminus of the road, the 250-foot crane would be visible on clear days where the road direction and topographic shielding permit HO to be seen, as exemplified by the visibility of AEOS at HO in Table 4-3, waypoints 142, 143, 148-152 and Figure 4-28. From Kalahaku Overlook to approximately 0.6 miles from HO (at the junction of the Park road and Haleakalā Visitor Center parking area), the crane at Reber Circle would be visible, but not resolvable. Again, visitors would not have a distinct view of the crane and negative feelings and opinions would not likely be evoked. Overall, observers would likely experience only minor, adverse, and short-term effects on visual resources. Other cranes and equipment would be visible where there is direct line-of-sight to HO along this section of road. From more than 0.6 miles, these objects would be difficult to resolve (identify or separate from one another or from current structures within HO) and, therefore, the effect would be minor, adverse, and short-term.

From the short distance closer than 0.6 miles to HO in which the proposed ATST Project would be seen along the summit access road (between the Haleakalā Visitor's Center and Pa Ka'oao), there is direct line-of sight to HO. The 250-foot crane would be taller than other structures on the summit and would be readily visible and resolvable. Quantitatively, because of its narrow width and lattice construction, the crane would not dominate the vista, but it would still be a large structure in relation to the natural topography and landforms. For those who would find it an objectionable intrusion into the natural environment, it would be consequential. Overall, the crane would, therefore, result in a moderate, adverse, and short-term effect on visual resources.

The construction of the proposed ATST Project at the Reber Circle site would become visible to observers on the upper two miles of the Park road corridor when the lower enclosure structure was under construction, at about 30 feet above ground level. Observers along the road would be able to see the structure along the Park road corridor from locations between the Kalahaku Overlook to the Haleakalā Visitor Center parking area. Quantitatively, between a distance of 2 miles and approximately 0.6 miles from HO, the proposed ATST Project would be visible, but without the upper enclosure, it would appear unidentifiable as something other than a cylinder seen in profile, e.g., a rectangle. The small viewing angle it would occupy would result in a minor, adverse, and short-term effect. When the upper, rotating enclosure is completed, observers along the same portion of the road corridor would be able to see the proposed ATST Project clearly (Fig. 4-34). Qualitatively, it would be an incremental addition to HO and at these distances it would not be likely to evoke strong negative feelings about viewshed obstruction. The overall effect on visual resources at these locations would be minor, adverse, and long-term.

Along the Park road corridor, at about 0.6 miles from HO, the proposed ATST structure at Reber Circle would become visible when the lower enclosure is under construction. The structure would be clearly visible to observers and would be identifiable as a facility under construction. This portion of the viewshed amounts to approximately 3 percent of the total 360-degree vista at this distance from HO and quantitatively, it would have only a minor, adverse, long-term effect on the visual resources. However, because of the increased visibility of the proposed ATST Project at Reber Circle relative to the Mees site, those visitors who would see it as an intrusion on the visual resources along the upper road corridor might find the facility more offensive than at the Mees site. Overall, from this perspective the effect would be moderate, adverse, and long-term.

The Crater. The viewshed modeling that was completed for the proposed ATST Project predicted that structures taller than 153 feet would be seen from the crater. Therefore the 250-foot crane, but not other shorter construction equipment, would be visible from roads and campsites within the crater. However, with the terrain-shielding of Magnetic Peak shielding about half the lower part of the crane and at the distances involved, only the upper 100 feet of the crane would appear as a barely visible, dark, very thin, linear object standing about 1/30th the height of the crater wall above which it would be viewed. Qualitatively, it would be difficult to resolve the structure such that it could be identified as a crane and the view from the crater trails already includes the Haleakalā Visitor Center and the Pu‘u Ula‘ula Overlook facilities at the summit. Therefore, the overall effects from the construction equipment would be considered minor, adverse, and short-term.

The proposed ATST Project structure at Reber Circle would become visible along some trail points within the crater when completed. Quantitative modeling indicates that because the ground level is higher at the Reber Circle site, when the addition of the upper enclosure would bring the structure to its full 143-foot height above ground level, the 153-foot visibility threshold within the crater would be slightly exceeded. At some locations on crater trails, the very top of the proposed ATST Project would likely be visible, although the viewshed map is not clear that would be the case (Fig. 4-30). At the Reber Circle site, the proposed ATST Project would be shielded in part by Magnetic Peak and other topography in the line-of-sight to the crater trails and campsites. Where it would be visible, it would be distinguishable as a man-made object, although not resolvable as an observatory. Those in the backcountry areas within the crater are not likely to be able to locate the structure without careful scanning the crater rim and it would not be highly reflective (as is the case with the Haleakalā Visitor Center) and, therefore, easy to see at certain times. The effect on visual resources from within the crater would, therefore, be minor, adverse, and long-term.

Lower Park Road Corridor, Including Hosmer Grove. The cranes, but not the other construction equipment, would be visible from Reber Circle along approximately one mile of the Park road corridor from HALE’s entry station to just beyond the Park Headquarters Visitor Center, including Hosmer Grove. From the entry station to just beyond the Park Headquarters Visitor Center, the cranes would appear as very thin, relatively short, linear objects against the ridgeline near the summit and would comprise a small fraction of one percent of the ridgeline vista, and would not obscure or substantially change it. Therefore, from these locations the effect would be just barely at the level of detection and, therefore, negligible, adverse and short-term.

The evolving facility structure of the proposed ATST Project construction at the Reber Circle site would not be visible from the lower portion of the Park road corridor until structure height reached about the height of the upper enclosure, which would become visible along the approximately one mile of Park road corridor from the entry station to just beyond the Park Headquarters Visitor Center, including Hosmer Grove. Quantitatively, at that distance from the Reber Circle site, the structure would be visible. Qualitatively, it would be difficult for those who feel such structures are inappropriate in the summit area to clearly distinguish the new facility from the other portions of the complex, and so strong negative feelings and opinions would not likely be evoked in these locations. The overall effect on visual resources would therefore be minor, adverse, and long term.

Populated Areas of Maui, Including Windward, Upcountry, Central Valley, and South Maui Locations. Construction of the proposed ATST Project at the Reber Circle site would result in relatively negligible, adverse visual effects on observers in population centers on Maui as a result of construction cranes at the site, and also as a result of the increasing height of the proposed ATST Project.

During construction, a 250-foot lattice crane and 3 to 5 smaller cranes of less than 100 feet would be employed to install telescope and building components at the Reber Circle site (Section 2.4.3-Construction Activities). It is anticipated that cranes would be needed at various times during construction over a period of approximately 4 years. These obstructions would be barely visible at long distances from the population centers on Maui, which are located no closer than 5 miles to the Reber Circle site. Cranes would be barely detectable in populated areas as extremely thin objects against the mountain ridgeline; and, as at the Mees site, they would only comprise a negligible fraction of the total height of the mountain visible to observers, e.g., they would comprise a fraction of 1 percent of the overall mountain vista at those distances; and, as such, they would not obscure or substantially change the ridgeline. Quantitatively, therefore, from these distant locations, the effect would be negligible, adverse, and short-term, in that this analysis applies to the approximate 4- to 5-year long construction phase. The same would be true for the qualitative effects, since it would be very difficult to discriminate the crane from other structures at HO. There would be no way to visually discern what is under way at HO from those locations and the effects would also be negligible, adverse, and short-term from those locations.

As the proposed ATST Project would be constructed, the structure would become visible from portions of Maui. Due to less terrain shielding at the Reber Circle site than at the Mees site, viewshed modeling predicts that observers within the central, windward, Upcountry and west Maui areas would begin to see the proposed ATST Project earlier than when the approximately 78-foot tall, non-rotating elements of the building structure are completed. Until such time as the lower enclosure is constructed, the proposed ATST Project would not be visible to observers in populated areas within the ROI, and the quantitative effects on the visual resources from the proposed ATST Project structures would be negligible, adverse, and short-term. Qualitatively, viewers in populated areas of Maui might become more aware of the structure if it were to be built at Reber Circle, and for those who find such structures on Haleakalā inappropriate, there would be some negative feelings about the changes to the ridgeline near the summit. Since those changes would still be very small when viewed from those distances and not easily distinguishable from the rest of the HO complex, the effect would likely be negligible, adverse, and short-term.

Operations-Related Effects at the Reber Circle Site

When completed at the Reber Circle site, the proposed ATST Project would be visible from portions of the Maui landmass. It is also likely to be visible from some HALE public trails or campsites within the crater. It would not be visible from approximately two thirds of the Park road corridor nor from those portions of the Maui landmass shielded by terrain (Fig. 4-3). The following sections discuss effects on the visual resources of areas from which the proposed ATST Project would be observed.

Pu‘u Ula‘ula Overlook. Because of its central location within HO and the lack of any terrain shielding it would dominate the current vista toward HO (Fig. 4-36). Quantitatively, from that location, the proposed ATST Project would be visible and it would appear taller than the AEOS facility, which, at 117 feet, is currently the tallest structure at HO. Because the Pu‘u Ula‘ula Overlook is the closest location from which HALE visitors could observe the proposed ATST Project (approximately 0.3 miles), the structure would appear closer and larger than anywhere else in HALE. Quantitatively, the effect on the visual quality of the landscape would be readily detectable by observers and there would be substantial consequences for those resources. The proposed ATST Project would be the largest man-made object within the viewshed from that location. Taking both quantitative and qualitative factors into consideration, from the Pu‘u Ula‘ula Overlook vantage point the effects would be major, adverse, and long-term.

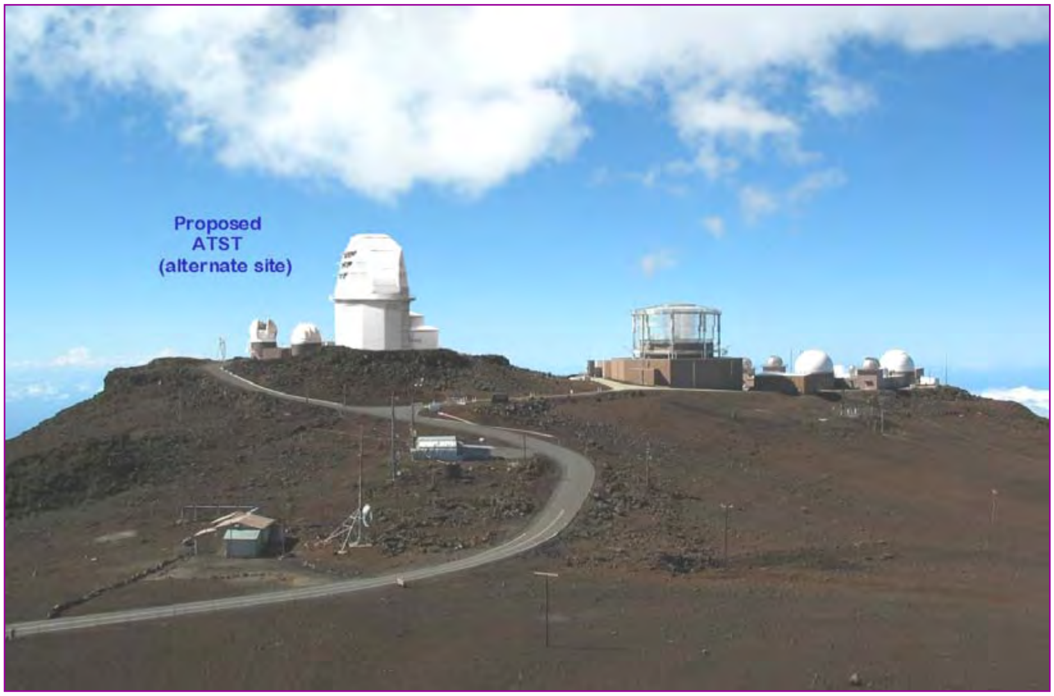


Figure 4-36. Reber Circle Site Rendering, View From Pu‘u Ula‘ula (Red Hill) Overlook.

The Areas of HALE Adjacent to HO, But Not on Pu‘u Ula‘ula, Including Magnetic Peak. Within the part of the ROI for visual resources that includes the areas of HALE adjacent to HO but outside of the Pu‘u Ula‘ula Overlook, the visibility of the proposed ATST Project at the Mees site would be quite variable. Intervening natural topographic features such as cinder cones and lava flows rapidly alters the line-of-sight between objects over very short distances. The proposed ATST Project at the Reber Circle site would not be visible from the Haleakalā Visitor’s Center during either day or night, due to the intervening landmass of Pa Ka‘oao. It would be visible on cloudless days from the middle of the parking area of the Haleakalā Visitor’s Center. It would also be visible from the summits of Pa Ka‘oao and Magnetic Peak. From those locations, the proposed ATST Project would be readily visible and be the tallest man-made structure. Therefore the visual effect would be moderate, adverse, and long-term. The proposed ATST Project would not be visible elsewhere in this portion of the ROI and the effect on visual resources in this portion of the ROI would be negligible, adverse, and long-term.

The closest views of the proposed ATST Project from the area adjacent to HO, but outside of the Pu‘u Ula‘ula Overlook, would be along the access road to the summit from the Haleakalā Visitor’s Center. Along the access road above the Haleakalā Visitor’s Center, the proposed ATST Project would be visible only a short distance on the way to Pa Ka‘oao before Magnetic Peak shields the entire HO viewshed. In that short portion of the road, the proposed ATST Project would be readily detectable. Qualitatively, because the entire structure would be visible along the access road, the proposed ATST Project would likely have more effect on those who have a negative opinion about tall man-made structures within the viewshed than it would if there were no terrain shielding, e.g., as at the Mees site. Overall, the effects on visual resources along this short portion of road would be moderate, adverse, and long-term. For all other areas of HALE adjacent to HO and outside the higher and closer Pu‘u Ula‘ula Overlook vantage point, the proposed ATST Project would not be visible, and, therefore, the effects are considered to be negligible, adverse, and long-term.

The Upper Park Road Corridor, Including the Haleakalā Visitor Center. As with the proposed ATST Project at the Mees site, an observer along the remaining two miles of the Park road corridor in which the proposed ATST Project would be visible — which is the upper portion of the road as it travels to the summit — would see it at the Reber Circle site on clear days at various locations along the Park road corridor depending on:

1. the compass direction of the road at any point, which changes direction toward or at oblique angles to HO;
2. the intervening terrain along the road, which includes steep cuts, projecting outcrops, cinder slopes; and,
3. the relative position of topography closer to the proposed ATST Project than the road, such as Magnetic Peak and Pa Kaʻoao.

The facilities at HO appear larger as a traveler on the road approaches the summit area. For about half of the distance from the Kalahaku Overlook to the summit road terminus, the proposed ATST Project would be a very small feature in relation to the visible mountain mass and from a quantitative perspective alone it would have a minor, adverse, and long-term effect on visual resources. Qualitatively, it would not likely evoke strong feelings as a separate entity, since it would be small in relation to the mountain mass and it would be entirely within the HO complex. Within the last mile of Park road corridor, vehicle passengers would have a progressively closer view of the proposed ATST facility, which would end at about a 0.6 mile distance along the summit access road past the Haleakalā Visitor's Center on the way to Pa Kaʻoao. At that distance, the structure would not occupy more than 20 percent of the vista, but it would be readily detectable to an observer and because of its position within HO and the lack of any terrain shielding, it would dominate the view (have a commanding preeminent place or position). From a qualitative perspective of the clear view of the proposed ATST Project from the access road and from this viewing perspective might evoke strong opinions and feelings among those who believe large man-made structures are inappropriate for that location. Overall, it is likely that the intensity of the effect would be major, adverse, and long-term.

The Crater. The proposed ATST Project structure at Reber Circle would likely be visible along some trail points within the crater. At some locations on crater trails, the very top of the proposed ATST project would likely be visible, although the viewshed map is not clear that would be the case (Fig. 430). At the Reber Circle site, the proposed ATST Project would be shielded in part by Magnetic Peak and other topography in the line-of-sight to the crater trails and campsites. Where it would be visible, it would be distinguishable as a man-made object, although not resolvable as an observatory. The effect on visual resources from within the crater would, therefore, be minor, adverse, and long-term.

Lower Park Road Corridor, Including Hosmer Grove. Quantitative viewshed analyses of locations along the Park road corridor from the entry station to the Haleakalā Visitor's Center Overlook at the crater predict that the proposed ATST Project at the Reber Circle site would be visible along approximately one-third of the Park road corridor, or for a total of approximately three miles. For about the first mile within HALE, from the entry station to the first turn after the Park Headquarters Visitor Center, the proposed ATST Project would be visible. Depending upon an observer's location along this corridor, the viewing angle would alter the appearance of the proposed ATST Project such that it would be seen in different positions and at different heights. Therefore, along this part of the Park road corridor, because it would not dominate the vista, the effects are anticipated to be minor, adverse, and long-term.

Populated Areas of Maui, Including Windward, Upcountry, Central Valley, and South Maui Locations. From both the computer modeling and the renderings, it is apparent that the proposed ATST Project at Reber Circle would be visible from large portions of the Maui landmass that are populated. The structure would be visible from central, windward, Upcountry, and south Maui. From some of these locations, it would be separately identifiable on a cloudless day, when atmospheric transparency permits. However, at a minimum range of five miles to any population center it would not appear to be significantly taller or more reflective than the current facilities that are present in the photographs. Moreover, for most Maui population centers from which the proposed ATST Project would be detectable, changes to the visual quality of the landscape would be so slight that they would not be of any measurable or perceptible consequence. For example, from a distance of seven miles, in the populated area of Kula, HO comprises about two percent of the entire ridgeline viewshed of Haleakalā. Quantitatively, the proposed ATST Project at Reber Circle would add approximately another 0.2 percent to man-made facilities within the viewshed (Figs. 4-37 to 4-39). As suggested by the renderings, the operation of the proposed ATST Project would not be likely to have much effect on viewers from these locations since the distances are too great to separate ATST from the rest of the HO complex. Overall, operation at the Reber Circle site would have a negligible, adverse, and long-term effect on the visual resources within those populated portions of the central, windward, Upcountry, and south Maui parts of the ROI on cloudless days.

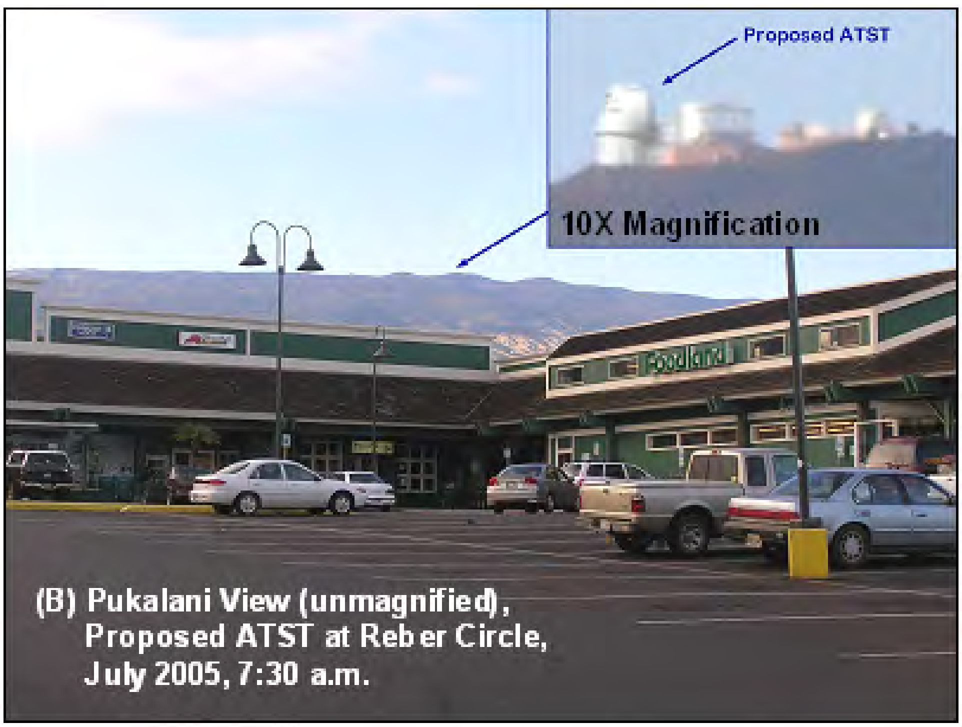


Figure 4-37. Reber Circle Site Rendering From Pukalani Terrace Shopping Center, July 2005.

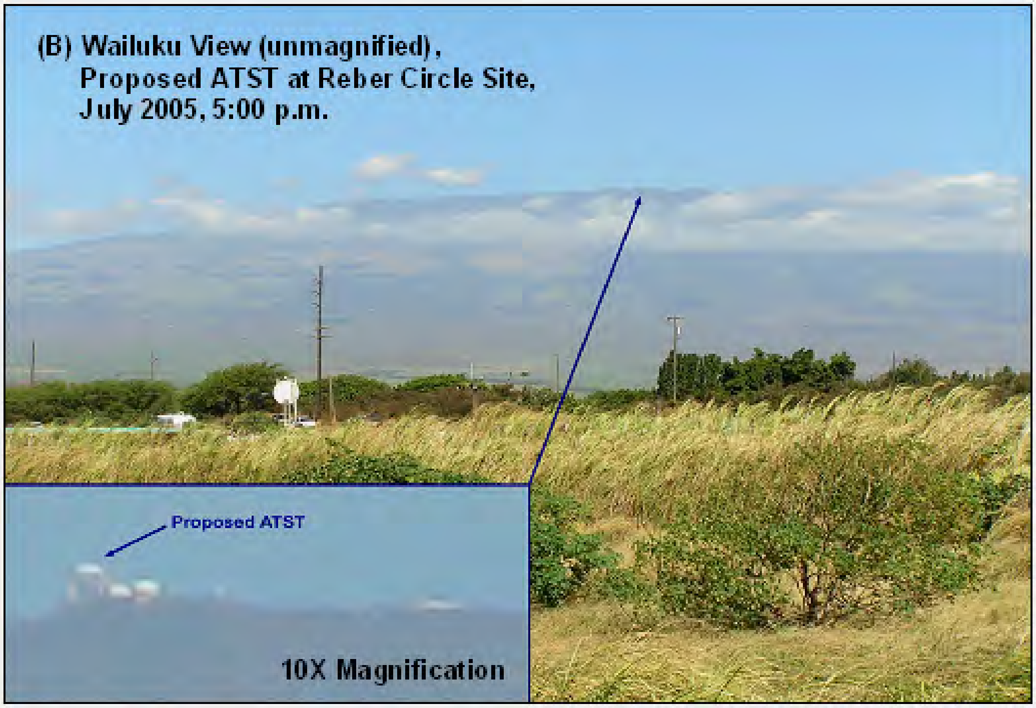


Figure 4-38. Reber Circle Site Rendering From High Street and Kuikahi Drive, Wailuku, July 2005.

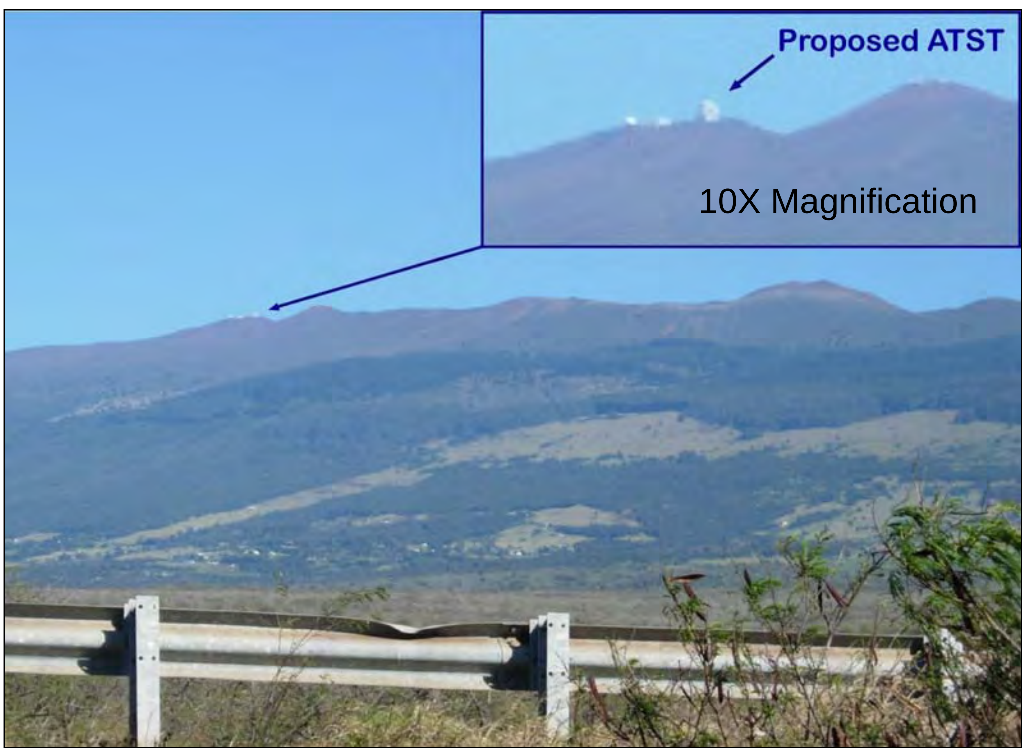


Figure 4-39. Reber Circle Site Rendering From Keonekai, Kihei, March 2006.

4.5.5 No-Action Alternative

There would be negligible, adverse, and long-term effects effect to visual resources and view plane under the No-Action Alternative, as the proposed ATST Project would not be constructed.

4.5.6 Summary of Effects on Visual Resources and View Plane

From HALE, the current HO complex is plainly visible from the Puʻu Ulaʻula Overlook and the addition of the proposed ATST Project at the Mees site would be noticeable but would not dominate the vista. It would have a moderate, adverse, and long-term effect. At the Reber Circle site, the proposed ATST Project would appear somewhat closer and larger from the Puʻu Ulaʻula Overlook (Fig. 4-36), and because of its position and lack of shielding topography, it would dominate or significantly reduce the vista. This adverse and long-term effect is considered to be major.

The quantitative methods used to evaluate effects on the viewshed indicate that the proposed ATST Project would be visible from various locations outside of HO. Within those areas of HALE adjacent to HO, but not at the Puʻu Ulaʻula Overlook, it would be seen where topography does not intervene. In those areas the effects would range from moderate to major, adverse, and long term, depending on whether the proposed ATST Project would be located at the Mees or Reber Circle site, and how close the observer would be to the structures.

For the lower Park road corridor, the proposed ATST Project at either the Mees or Reber Circle site would be visible along approximately one mile from the entry station to just above the Park Headquarters Visitor Center. At the Mees site, partial terrain and HO facility shielding and a lower ground elevation would result in a less distinct view, with minor, adverse, and long-term effects on the viewshed. Qualitatively, although the proposed ATST Project would be seen more clearly at the Reber Circle site, it would still be considered to have a minor, adverse, and long-term effect on visual resources from those locations.

Along the uppermost two miles of the HALE roadway, the proposed ATST Project at either site would be visible from locations that face HO and are not blocked by terrain. At the Mees site, the view to the proposed ATST Project would be partly obscured by Magnetic Peak, but at the Reber Circle site, no such shielding would be present. However, until an observer was within about 0.6 miles of the proposed ATST Project, the effects on visual resources would be considered minor, adverse, and long-term for either site. Within 0.6 miles, the visual effects would be more obvious for both sites, but because the Reber Circle site has no terrain shielding, it would result in a major, adverse, and long-term effect on visual resources, whereas the proposed ATST Project at the Mees site would result in moderate, adverse, and long-term effects.

Within the crater, the proposed ATST Project would be invisible from the Mees site, and, therefore, would have negligible effects on the visual resources of that portion of HALE. The Reber Circle site is topographically higher and viewshed analyses indicate that it is likely that at least the upper parts of the proposed ATST Project would be visible from some trails within the crater. Although the structure of the proposed ATST Project would be indistinct, the visibility of another man-made object within the wilderness areas of the crater would result in a minor, adverse, and long-term effect.

4.6 VISITOR USE AND EXPERIENCE

The ROI for consideration of effects on visitor use and experience encompasses certain portions of the landmass of Maui, HO, and other areas within HALE (including the Park road corridor) from which structures at HO are visible.

4.6.1 Methodology for Effects Assessment

The methods used to determine the extent to which the proposed ATST Project would affect visitors' services and experiences are as follows:

1. Review and evaluate existing and past actions to identify the proposed ATST Project's potential effect on visitor use and experience.
2. Review and evaluate each alternative to identify its potential to adversely affect the visitor use and experience within the ROI, including the effects of the proposed ATST Project on the existing visual resources and soundscapes.
3. Assess the compliance of each alternative with applicable Federal, State, or County regulations.

Effects on visitor use and experience could be considered adverse if they result in a decline in the quality or quantity of existing recreational facilities, or if they exceed adopted Federal, State, or County recreation planning standards.

Effects are analyzed by direct and indirect effects to visitor use and experience from the proposed ATST Project, alternatives, and the No-Action Alternative. Direct effects (those caused by an action and occurring at the same time and place) are those that for example would result from air quality and/or noise quality changes that result from a project's actions that affect the visitors' overall quality of experience while visiting the Park. Direct effects could also reduce the number of visitors' service facilities, or change the amount of available land so that the quality of a visitor's experience would be reduced. Indirect effects (those caused by an action but occurring later or farther away, but at a reasonably known time or place) could occur for example, from an increase in the local human population that would result in overcrowding of facilities, or from a reduction in the local human population such that the Park reduced amenities or services available to visitors.

The thresholds of change for the intensity of effects on visitors' services are defined as follows:

Effect Intensity	Intensity Description
Negligible	Visitors would not likely be aware of the effects associated with changes proposed for visitor use and enjoyment of Park resources.
Minor	Visitors would likely be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources; however the changes in visitor use and experience would be slight and likely short term. Other areas in the Park would remain available for similar visitor use and experience without derogation of Park resources and values. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate	Visitors would be aware of the effects associated with changes proposed for visitor use and enjoyment of Park resources. Changes in visitor use and experience would be readily apparent and likely long-term. Other areas in the Park would remain available for similar visitor use and experience without derogation of Park resources and values, but visitor satisfaction might be measurably affected (visitors could be either satisfied or dissatisfied). Some visitors who desire to continue their use and enjoyment of the activity/ visitor use and experience would be required to pursue their choice in other available local or regional areas. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.

Effect Intensity	Intensity Description
Major	Visitors would be highly aware of the effects associated with changes proposed for visitor use and enjoyment of Park resources. Changes in visitor use and experience would be readily apparent and long-term. The change in visitor use and experience proposed in the alternative would preclude future generations of some visitors from enjoying Park resources and values. Some visitors who desire to continue their use and enjoyment of the activity/ visitor use and experience would be required to pursue their choice in other available local or regional areas. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.
Duration: **Short-term –** occurs only during the construction period. **Long-term –** occurs even after the construction period.	

4.6.2 Evaluation of Potential Effects at the Mees Site

DIRECT AND INDIRECT EFFECTS

Visual Resources

Depending on the elevation and shielding topography of the Sliding Sands hiking trail at various points along the designated route, hikers into the crater may be able to view the 250-foot crane that would be used during construction and hear some of the construction traffic and noise. These effects would last throughout the construction period during daytime construction hours, but they could be mitigated somewhat through BMP's imposed during construction, such as scheduling deliveries and construction-related traffic during periods of less visitor activity and by lowering construction cranes at night so as to not create a mishap hazard or obstruct any views.

Section 4.5-Visual Resources and View Plane describes the effects on the view that would result in a moderate, adverse, and short-term effect on visual resources. Since these effects would be small and only last during construction, the effects would be minor, adverse, and short term. In consideration of the clear view of the completed ATST Project from the access road and its small contribution to the HO viewscape, the intensity of the effect would be moderate, adverse, and long-term as described in Section 4.5. This would result in a similar moderate, adverse, and long-term effect on visitor use and experience.

Soundscape

As with visual changes, noise changes due to construction activities would have a major, adverse, and short-term direct affect on the visitor use and experience at HALE. Many visitors report that the most important reasons for backpacking and overnight camping trips in the Park are to experience the sounds of nature, experience a sense of connection with nature, and experience a sense of remoteness, as well as to remove themselves from human development and man-made noises (Lawson, et al, 2008). Because the proposed ATST Project area is located within two-thirds mile of high-use trailheads (Sliding Sands), in addition to various trails throughout the summit and mountain areas such as those in and around Pa Kaʻoao (White Hill) and Magnetic Peak, visitors would experience construction-related noise during construction hours that would adversely affect the quality of their experience while hiking and backpacking in the Park. Construction activities associated with the proposed ATST Project such as caisson driving would create more man-made noise in relation to other construction activities, e.g., actual renovations and building of the new facilities. As noted in Section 4.10-Noise, noise attenuation from the construction site would decrease at approximately 6 to 7 dBA by every doubling of distance. For the loudest construction activities, at about 120 dBA approximately 72-75 dBA of noise would be heard near the crater and the Puʻu Ulaʻula Overlook. This is considered to be in the same range as a "Jeep" type or loud passenger vehicle ascending the road (KCE, unpublished).

From this analysis, it can be concluded that construction noise would have a major, adverse, and short-term effect on visitor use and experience. Mitigation measures for construction noise would be included in the SUP for the proposed ATST Project to reduce the effects of construction noise. One mitigation measure would limit on-site outside construction noise that exceeds 83 dBA at a 5-foot distance to between 30 minutes after sunrise and 30 minutes prior to sunset. The nearest HALE visitor would be at a distance of about 0.3 miles at the Puʻu Ulaʻula Overlook. At that distance, 83 dBA noise levels would be geometrically attenuated to about 35 dBA, which is considered ambient background noise for rustling leaves, tall grass in a light to moderate wind (Resource Systems Group, Inc., 2006, p. 12). These measures would reduce the effects of construction noise on visitor use and experience to intensity levels of negligible, adverse, and long-term for those periods when noise is limited to less than 83 dBA at the construction site due to USFWS mitigation measures for endangered species (April 20th and July 15th). At other times of the year, when noise levels would exceed 35 dBA for visitors at Pu`u Ula`ula Overlook and the entry to Sliding Sands trailhead (but not 75 dBA), the effects would be mitigated to moderate adverse and long term. Effects from noise are discussed further in Section 4.10-Noise.

In a 2007 survey of visitors exiting from HALE, 75 percent of respondents reported they would be very likely to return to Haleakalā to tour the ATST. HALE did not commission this study nor have a role in its design. HALE notes flaws in this survey, citing the presence of a likely bias, technical errors in the instrument, and errors in the related reporting. HALE also indicated that the conclusions are based on an insufficiently designed and administered survey. NSF contends that the survey does show that, when comparing the respondents' initial intention of returning to the Park with their intention of returning to the Park after evaluating the addition of the ATST, it was found that there would be a small but positive change in visitor behavior. Seventy-three percent of respondents said they were likely to return to HALE and they were also likely to return to the tour ATST; 16 percent were likely to return to HALE, but were not likely to tour the ATST; 3 percent were not likely to return to HALE, but were likely to return to tour the ATST; and 8 percent were not likely to return to HALE, and were not likely to return to tour ATST. This study and the results of the respondents polled suggest that a tour of ATST would be an attractive component of a visit to HALE. This indicates that, in this respect, there would be a minor but beneficial effect on the visitor use and experience. In addition, the building of the proposed ATST Project would have a minor beneficial, long-term effect as a result of offering new science and technology education to interested visitors.

Traffic

ATST-related traffic levels during construction are expected to increase by 15 trips per day. As concluded in the FHWA road study, this is only a small increase of vehicular traffic entering and leaving HALE compared to the approximately 1.7 million annual visitors at HALE (Vol. II, Appendix P-FHWA HALE Road Report, 2009 and HALE, 2006). This small increase would have a negligible effect on travel time and visitor use and experience. The traffic increase would also increase the noise level by approximately up to 3 dBA during construction. This increase would be barely perceptible to users and would have a minor, short-term effect on the visitor use and experience. During operations the increased traffic would be even less and the noise increase would not be noticeable (less than 1 dBA) and would have a negligible, long-term effect on the visitor use and experience.

4.6.3 Evaluation of Potential Effects at the Reber Circle Site

DIRECT AND INDIRECT EFFECTS

The effects on visitor use and experience from construction and operation of the proposed ATST Project at the Reber Circle site would be greater than those identified for the Mees site since the Reber Circle site is higher and more visible from the Pu'u 'Ula'ula Overlook and from the summit of Pa Kaʻoao and Magnetic Peak. This visual intrusion would result in a major, adverse, and long-term effect on visitor use and experience from Puʻu ʻUlaʻula and the upper Park road and minor, adverse, and long-term from some locations in the crater.

The effects to visitor use and experience due to traffic and noise along the Park road corridor would be similar to those described for the Mees site. If the proposed ATST Project were to be constructed at the Reber Circle site, it would be moderately more visible along the Park road corridor due, as mentioned above, to the higher elevation within HO and the reduced terrain and facility blocking as described in Section 4.5-Visual Resources and View Plane. This visual intrusion and would result in a major, adverse, and long-term effect on visitor use and experience.

4.6.4 No-Action Alternative

DIRECT AND INDIRECT EFFECTS

There would be no direct effect to visitors' services under the No-Action Alternative, as all visitors' services would remain the same as the existing conditions outlined in Section 3.0-Description of Affected Environment. Likewise, there would be no effect on the visitor use and experience if the proposed ATST Project were not built.

4.6.5 Summary of Effects on Visitor Use and Experience

In conclusion, there would be major, adverse, and short-term effects on visitor use and experience from changes in the quality of recreational activities such as sightseeing, hiking, backpacking, photography, and camping from constructed-related noise increases, changes in view from construction activity at the proposed ATST Project site and along the Park road corridor, and from air quality associated with increased construction vehicle traffic and use. These effects would occur over the short-term, would be mitigated to the greatest possible extent, and the effects on visitor use and experience would diminish in the long-term. However, changes in view would continue to result in moderate, adverse, and long-term effects on the visitor use and experience from locations where the proposed ATST Project would be prominently seen, as described in Section 4.5-Visual Resources and View Plane.

4.7 WATER RESOURCES

Haleakalā Observatories is within the Waiakoa and the Manawainui Gulch watersheds. The groundwater boundaries are the Kamaole and Makawao Aquifer Systems of the Central Aquifer Sector and the Lualailua and Nakula Aquifer Systems of the Kahikinui Aquifer Sector (U.S. AFRL, 2005). The ROI for water resources includes HO, the affected areas within HALE and the Park road corridor. The entire ROI is within the Waiakoa and the Manawainui Gulch watersheds and the Central Aquifer and Kahikinui Aquifer Sectors. The ROI for water resources includes HO, the affected areas within HALE and the Park road corridor. A sector is a large region with hydro-geological similarities that primarily reflects broad hydro-geologic features, and secondarily, geography. A system is an area within a sector showing hydro-geological continuity.

4.7.1 Methodology of Effect Assessment

The methods used to determine whether the proposed ATST Project would have a major effect on water resources are as follows:

1. Review and evaluate existing and past action's effects on surface water, drainage, and ground water to identify the action's effects on surface water, drainage, and ground water to identify the action's potential effect on water resources.

2. Review each alternative from the perspective of effects on:

   a) surface water from calculations of potential flow from impervious surfaces of the proposed facility,
   b) drainage from the addition of surface water anticipated from the proposed ATST Project,
   c) ground water from known water infiltration patterns; and,
   d) identifying the potential of each alternative to adversely affect the ecosystem and its component parts within and adjacent to HO, including detrimental effect on existing water quality or on water resources.

3. Assess the compliance of each alternative with applicable Federal, State, or County regulations with respect to stormwater and groundwater.

The following effect thresholds were established in order to describe the relative changes in water quality (overall, localized, short- and long-term, cumulatively, adverse and beneficial) under the management activities.

Effect Intensity	Intensity Description
Negligible	Effects (chemical, physical, or biological effects) that would not be detectable, would be well below water quality standards or criteria, and would be within historical or desired water quality conditions.
Minor	Effects (chemical, physical, or biological effects) would be detectable but would be well below water quality standards or criteria and within historical or desired water quality conditions.
Moderate	Effects (chemical, physical, or biological effects) would be detectable but would be at or below water quality standards or criteria; however, historical baseline or desired water quality conditions would be temporally altered.
Major	Effects (chemical, physical, or biological effects) would be detectable and would be frequently altered from the historical baseline or desired water quality conditions; and/or chemical, physical, or biological water quality standards or criteria would temporarily be slightly and singularly exceeded.
Duration:	**Short-term –** Recovery would take less than one year. **Long-term –** Recovery would take longer than one year.

4.7.2 Evaluation of Potential Effects at the Mees Site

DIRECT AND INDIRECT EFFECTS

Surface Water Features and Drainage

Based on the hydrologic modeling prepared to control runoff of the IfA facilities on Haleakalā, under existing drainage conditions, the infiltration basin appears to adequately contain the stormwater runoff for all but the most extreme storm events (50 years and above).

The current area of the MSO facility parking lot is 4,855 sq ft, as outlined in the Vol. II, Appendix L-Stormwater Master Plan for HO. The proposed parking/service area to serve both Mees and ATST would be 6,850 square feet for a total of 1,995 additional square feet, or a 41 percent increase in “impervious” area. However, the total impervious surfaces at HO are 144,178 square feet, counting all existing roads and pavements, and the additional area estimated for the U.S. Air Force Mirror Coating Facility (MCF). Therefore, an additional 1,995-square foot parking/service area to serve the MSO facility and the proposed ATST Project would represent a 1.4 percent increase in impervious area.

Some of the runoff from the MSO facility parking area currently flows down the abandoned road and off the west side of the mountain (Vol. II, Appendix L-Stormwater Master Plan for HO). Prior to construction of the proposed ATST Project, IfA would redirect water flow such that it would drain into the infiltration basin, rather than contribute to any potential erosion of the slope below the MSO facility. That would mean the full 6,850 square feet of the new parking/service area would drain into the basin, an increase of 4.8 percent in the total impervious surface area draining to the infiltration basin.

Under these proposed conditions, the infiltration basin is estimated to overtop at storm events larger than the five-year recurrence interval. However, containment of larger storm events is considered to be for flood control only (Vol. II, Appendix L-Stormwater Master Plan for HO) and therefore, the present containment for stormwater would be adequate to capture additional runoff as a result of increased impervious areas at the Mees site. Additionally, the proposed ATST Project facility would capture stormwater and surface water for reuse reducing the potential adverse effects on the infiltration basin. Furthermore, adherence to the guidelines in the SWMP for HO would reduce the potential for adverse effects on surface water features and drainage due to the increased impervious areas at the Mees site. As such, runoff is not expected to increase as a result of the proposed ATST Project, therefore negligible, adverse, and short- or long-term effects on surface water and drainage would be expected. Since no changes to the Park road corridor are proposed there would be no changes in stormwater runoff and no effects along the Park road corridor.

Groundwater

The proposed ATST Project would have minor beneficial and negligible, adverse effects on groundwater sources or supplies. Under the proposed ATST Project, the existing cesspool at the MSO facility would be removed and an advanced aerobic individual wastewater system (IWS) would be installed to treat sanitary wastewater. The specifications of the treatment plant and its related piping/discharge system would be in compliance with the applicable regulations of the State of Hawaiʻi Department of Health. Effluent from the IWS would be discharged to the subsurface similar to that of a septic tank leach field. The innovative design of the IWS would provide wastewater treatment and discharge high quality effluent resulting in minor beneficial, long-term effects on groundwater as compared to the existing cesspool system. The IWS is further discussed in Section 4.9.2-Evaluation of Potential Effects at the Mees Site of the Infrastructure and Utilities section. Groundwater could potentially be affected by wastewater discharges during handling and operations or in the event of system failure. However, the likelihood of a discharge is minimal and the effects would be negligible, adverse, and short-term as compared to minor, adverse, and long-term effects from cesspool wastewater on groundwater resources. Additionally, site personnel would be adequately trained on handling wastewater and operating the IWS to prevent discharges to groundwater. Since no changes to the Park road corridor are proposed there would be no effects to groundwater along the Park road.

4.7.3 Evaluation of Potential Effects at the Reber Circle Site

<u>DIRECT AND INDIRECT EFFECTS</u>

Surface Water Features and Drainage

Under the proposed ATST Project to construct the facility at the Reber Circle site, similar environmental effects as those of the Mees site are anticipated on surface water. The proposed service area for ATST at the Reber Circle site would be 10,480 square feet, which would be a 7.3 percent increase in the total impervious surface. As described for the Mees site, the existing infiltration basin is estimated to overtop during storm events larger than the five-year recurrence interval, resulting in minor, adverse, and short-term effects on the infiltration basin. However, containment of larger storm events is considered to be for flood control only, therefore the present containment for stormwater would be adequate to capture additional runoff as a result of increased impervious areas at the Reber Circle site. Additionally, adherence to the guidelines in the SWMP for HO (Vol. II, Appendix L) would reduce the potential for adverse effects on surface water features and drainage due to increased runoff from the Reber Circle site. Since no changes to the Park road are proposed there would be no changes in stormwater runoff and no effects along the Park road corridor.

Groundwater

Under the proposed ATST Project to construct the facility at the Reber Circle site would include the installation of a new wastewater treatment plant to capture and process domestic wastewater. The characteristics of the new wastewater treatment system would be similar to the one described for the Mees site. Installation of the plant would equally follow the legal procedures and requirements. Effluent from the system would be of high quality and would be discharged to the subsurface similar to that of a septic tank leach field. During handling and operations or in the event of system failure, groundwater could potentially be affected by wastewater discharges. However, the likelihood of a discharge is minimal and the effects of a single event would be negligible, adverse, and short-term. Additionally, site personnel would be adequately trained on handling wastewater and operating the system to prevent discharges to groundwater.

If the ATST is constructed at the Reber Circle site, the existing cesspool at MSO would continue to be used for wastewater treatment. Untreated wastewater and septic waste is discharged directly into the ground in cesspool systems, potentially contaminating subsurface water quality and resulting in minor, adverse, and long-term effects on groundwater. The effects to groundwater sources from construction of the ATST at the Reber Circle site would be minor, adverse, and both short- and long-term since wastewater from both the new treatment system at Reber Circle and the existing cesspool at the MSO facility would result.

4.7.4 No-Action Alternative

DIRECT AND INDIRECT EFFECTS

Surface Water Features and Drainage

Although the conditions would remain unchanged under the No-Action Alternative, based on the conditions described in the Stormwater Erosion Report (UH IfA, 2005a), the SWMP for HO (Vol. II, Appendix L) would still need to be implemented. Based on the results of the erosion study, culverts were cleaned out of soils that were previously interrupting the flow to the infiltration basin. This routine cleaning is being maintained in order to avoid diversion of water through prior erosional zones.

Groundwater

The No-Action Alternative could have minor, adverse, and long-term effects on groundwater from potential discharges of domestic wastewater. The existing cesspool at MSO would continue to be used for wastewater treatment. Untreated wastewater and septic waste is discharged directly into the ground in cesspool systems, potentially contaminating subsurface water quality and resulting in minor, adverse, and long-term effects on groundwater.

4.7.5 Summary of Effects on Water Resources

The proposed ATST Project would have negligible, adverse environmental effects on the surface water and negligible, adverse, and minor, beneficial, and long-term effects on groundwater in the ROI. Based on the hydrologic modeling prepared to control runoff of the IfA facilities at HO, existing surface water features appear adequate to contain stormwater runoff at the site with the addition of the proposed ATST Project at the Mees or Reber Circle sites.

Minor beneficial, long-term effects and both negligible and minor, adverse, short-term effects on groundwater quality would result from the implementation of the proposed ATST Project at the Mees site and negligible, adverse effects on groundwater quality would result from implementing the proposed ATST Project at the Reber Circle site. At both sites, wastewater treatment systems would be constructed and treatment to domestic wastewater would occur prior to infiltration into subsurface water. Additionally, if the proposed ATST Project is implemented at the Mees site, the existing cesspool would be removed and site remediation would occur to ensure no contamination of groundwater from untreated wastewater. Negligible, adverse, and short-term effects could result at both sites if discharges of untreated wastewater occurred while handling, during operations, or in the event of system failure.

Under the No-Action Alternative, the current surface water features and drainage would remain unchanged and the cesspool used at the existing MSO facility would continue to be used. Any discharges of untreated wastewater could cause minor, adverse, and long-term effects on groundwater quality.

4.8 HAZARDOUS MATERIALS AND SOLID WASTE

The ROI for hazardous materials (HAZMAT) and solid waste includes HO, the Park road corridor, and the portion of State highway leading up to the Park road corridor.

4.8.1 Methodology of Effect Assessment

Effects related to solid and hazardous wastes were evaluated by comparing proposed volumes and types of proposed waste generation with current generation at the HO complex and the capacity of landfills treating the complex. Major effects would be realized if the proposed ATST Project were to contribute an amount of waste that would substantially shorten the projected lifespan of the serving landfill. Effects related to hazardous wastes would be considered major if a new hazardous material were introduced to the HO complex that would put the health of workers or the environment at risk through its use, handling, transport, or disposal.

Effects related to on-site contamination were evaluated based on the location of existing contamination, compared to the areas proposed for earth-moving activities. Major, adverse effects would be realized if earth-moving activities could expose workers to HAZMAT in a contaminated site.

Therefore, the methods used to determine whether the proposed ATST Project would have a major effect on the use of HAZMAT and solid waste are as follows:

1. Review and evaluate existing and past actions with respect to production and management of solid and hazardous waste to identify the action’s potential effect on the use and disposal of HAZMAT and solid waste.
2. Review and evaluate each alternative to identify the risks to health and safety from proposed practices and procedures for producing and managing solid and hazardous waste, using Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), and EPA standards to assess effects to the ecosystem and its component parts within and adjacent to HO, along the Park road corridor, and the State highway leading up to the Park, including damage from HAZMAT or waste.
3. Assess the compliance of each alternative with applicable Federal, State, or County regulations and in particular, CERCLA, RCRA, and EPA relating to storage, transport, handling and disposal of wastes.

The thresholds of change for the intensity of HAZMAT and solid waste effects are defined as follows:

Effect Intensity	Intensity Description
Negligible	The use HAZMAT and disposal of hazardous or solid waste would not affect health and safety or waste streams, or the effects would be at the lowest levels of detection and would not have an appreciable effect on health and safety or waste management.
Minor	The effect would be detectable but would not have an appreciable effect on health and safety or waste streams. If mitigation were needed, it would be relatively simple and would likely be successful.
Moderate	The effects would be readily apparent and result in substantial, noticeable effects to health and safety on a local scale. Mitigation measures would probably be necessary and would likely be successful.
Major	The effects would be readily apparent and result in substantial, noticeable effects to health and safety or waste streams on a regional scale. Extensive mitigation measures would be needed, and success would not be guaranteed.
Duration: **Short-term –** Effects last one year or less. **Long-term –** Effects last longer than one year.	

4.8.2 Evaluation of Potential Effects at the Mees Site

DIRECT AND INDIRECT EFFECTS

Construction-Related Effects at the Mees Site

Solid Waste

In accordance with the LRDP requirements, construction contractors would remove construction trash frequently, particularly food sources that could increase the population of mice and rats that prey on native species. Most construction waste would be removed in roll-off trash receptacles that would be covered before transport.

During demolition and construction activities at the Mees site, solid waste requiring disposal would be generated. Construction waste and debris would be secured, particularly during non-working hours, to minimize windblown materials and would be transported to the Maui Demolition and Construction Landfill in Ma’alaea. The amount of demolition and construction debris generated under the proposed ATST Project at the Mees site is expected to be minimal with no appreciable effect on waste streams; therefore, negligible, adverse, and short-term effects on the solid waste management would be expected from construction-related activities and would not interfere with HO or Park operations.

Hazardous Materials, Waste, and Site Contamination

Site development activities, such as welding and metalworking, could generate minor quantities of hazardous waste and air pollutants. Other HAZMAT or substances that may be used in the construction phase would include fuels, oils, and lubricants in the machinery operations and paints on building structures. Petroleum products are CERCLA-defined HAZMAT and would be monitored, handled, and reported through the RCRA, if necessary. No other HAZMAT or substances would be used in construction. Under the LRDP-imposed construction constraints, no oil or chemical treating may be used at the site for dust control.

The construction contractor would comply with the requirements from the LRDP related to hazardous waste during construction:

1. No hazardous waste is to be released at the site. Surplus or used paint, oil, solvents, and cleaning chemicals must be removed from the area and disposed of by a U.S. Environmental Protection Agency (EPA)-approved transport storage disposal facility.
2. Accidental spills of any hazardous material during the execution of a contractor's project at the site must be reported immediately to the on-site IfA supervisor. Spill containment would be supervised by IfA personnel at the site. Spill remediation methods must be approved by the UH's Environmental Health and Safety Office prior to clean up, and all costs incurred for cleanup would be assigned to the contractor. In the event of a reportable release, the construction contractor would be liable for any Federal or State imposed noncompliance penalties (UH IfA, 2005b).
3. Washing and curing water used for aggregate processing, concrete curing, and cleanup cannot be released into the soil at the site. A recovery process is required by the contractor to recapture wastewaters (UH IfA, 2005b).

Hazardous materials may be used during the construction of the proposed ATST Project at the Mees site, however the use would be temporary and the above-mentioned practices would be implemented to protect the health and safety of the workers. Negligible, adverse, and short-term effects on health and safety relating to the use of HAZMAT would result during project construction at the Mees site and there would be no interference with HO or Park operations.

Operations-Related Effects at the Mees Site

Solid Waste

After completion of the proposed construction, the facility would be operational. Thus, solid waste generated on-site would be carried out of the building by facility workers and kept in covered refuse containers. Non-hazardous trash and recyclable material would be disposed of off-site at Maui's licensed landfill.

There would be no change in the long-term solid waste disposal practices from the Mees site, although solid waste generation could triple. At present, approximately four to five bags are being disposed of weekly from the Mees facility and other facilities under HO jurisdiction (i.e., the Atmospheric Airglow facility, the Zodiacal Observatory, and the FTF). The operations of the proposed ATST at the Mees site would have no appreciable effect on waste streams; therefore negligible, adverse, and long-term effects on solid waste management would result.

Hazardous Materials, Waste, and Site Contamination

Once the proposed ATST Project is operational, hazardous wastes and petroleum product wastes would be segregated at a generation point and handled separately as directed by the ATST Hazardous Materials Management Plan (Vol. II, Appendix D-HazMat Management Program). While the operation of the proposed ATST Project would result in an increase in HAZMAT and waste; no appreciable effect on health and safety and waste management is expected. There would be negligible, adverse, and long-term effects resulting from handling or use of HAZMAT.

Table 4-5 is a list of hazardous substances that may be present or used under the proposed ATST Project, whether located at either the Mees site or Reber Circle site.

Table 4-5. Proposed ATST Project Hazardous Substance Uses.

Hazardous Substance		Purpose/Use	Amount Stored/Used	Storage Method	Schedule of Replacement
1	Hydrochloric acid	Mirror stripping and cleaning	None stored on-site	Stored in secured manufacturer's containers off-site.	Mirror recoating every two years; materials brought on-site.
2	Cupric sulfate				
3	Potassium hydroxide				
4	Nitric acid				
5	Calcium carbonate				
6	Ethyl alcohol				
7	Aluminum	Mirror recoating	Small quantity	Stored in a secure on-site location.	Additional material brought on-site approximately every two years when recoating is required.
8	Silver				
9	Silver nitride				
10	Nickel chromium				
11	Propylene glycol heat-transfer fluid	Used in the cooling fluid for the enclosure and other systems.	10 gallons of concentrate; 1200 gallons of 30% solution	Stored in utility building and used in a closed-loop system.	Replenished as required, never normally replaced.
12	Refrigerant (R134a, R404a, R410a, or possibly R22)	Used in the cooling system.	Enough to allow for a fully charged coolant system.	None stored outside the fully charged system.	Outside contractors brought in to charge the system when needed.
13	Synthetic hydrocarbon-based hydraulic oil	Used as hydraulic fluid for telescope bearings.	1,400 gallons	In storage tank in base level of the S&O Building.	Replenished as required, never normally replaced.
14	Compressed (liquid and gaseous) helium and nitrogen	Super-cooling instrumentation	Less than 100 gallons	In manufacturer's cylinders and within piping and compressor	Replenished as required, never normally replaced.
15	Liquid nitrogen	Cooling instruments and for mirror vacuum tank	1,000 gallons	In manufacturer supplied exterior tank and in piping and dewars	Supply replenished as needed. 1000-gallon tank refilled approximately twice per year.
16	Diesel fuel	Fuel for generator at Mees Site	200 gallons	Stored in approved aboveground fuel tank.	Supply replenished as needed. 200-gallon tank refilled about twice a year.

Items 1 through 6 of Table 4-5 would be used for mirror stripping and cleaning. They would be stored in the manufacturer's containers and kept in a secure area off-site. These chemicals would be brought to the proposed ATST Project facility when the primary mirror is to be stripped and recoated, approximately every two years. The stripping and cleaning process results in a series of effluents with varying disposal requirements. All effluents would be captured in a sink and trench system built into the floor of the coating area. From there, the liquid would flow through a double-containment pipe system to a set of underground polypropylene tanks. The water and light detergent (Orvis soap or equal) collected in the tanks from the initial pre-wash would be tested to ensure compliance with non-hazardous standards and then would be pumped to the seepage pit(s) of the domestic water treatment system. The effluent from the remainder of the stripping and cleaning process would be tested on-site to determine its pH and other hazardous criteria, would be pumped into appropriate transportation containers, and would be disposed of off-site by a licensed HAZMAT disposal contractor. The total effluent quantity generated each time the primary mirror is stripped and cleaned is expected to be less than 1,000 gallons (generated at coating/cleaning events - every two years). The licensed contractor also would dispose of the solid waste material from the process, approximately three five-gallon buckets of chemical soaked laboratory tissue paper sheets. The disposal of all materials would comply with all applicable requirements of the USEPA and the State of Hawai‘i Hazardous Waste Branch.

Items 7 through 10 would be used for mirror recoating approximately every two years. The small quantities of these very pure solid materials would be stored in a secure location. They present no hazards in handling and require no special containers. The coating process itself would take place within a sealed chamber and would result in no hazardous waste or discharge to the environment.

Item 11. Approximately 10 gallons of an additive concentrate for producing the cooling fluid for the enclosure and other systems would be kept in the Utility Building. The specific liquid concentrate would be propylene glycol — such as DowFrost, an ionic brine — such as Dynalene HC-20, or other non-hazardous heat-transfer additive. This concentrate would be connected to the hydronic piping through an automatic feed device. Most of the cooling fluid (approximately 1,200 gallons of water mixed with heat-transfer fluid in the proper proportion) would flow through the piping and platecoil units on the enclosure. Any heat-transfer fluid utilized would be a non-toxic, but because it would a foreign material in a sensitive environment, measures would be implemented to prevent its accidental release. The enclosure cooling system would be equipped with leak detection and automatic shutoff devices. The concrete apron around the base of the dome would also serve as a secondary containment basin for the enclosure cooling fluid in the event of a leak. The cooling fluid would be contained within a closed loop system and is not drained or discharged to the environment.

Item 12. The air-cooled scroll compressor chiller would contain about 200 pounds of refrigerant. The refrigerant has not yet been selected; it may be R22, but is more likely to be R134a, R404a, or R410a. No supply of additional refrigerant (beyond the charge of the system) would be maintained on-site. System recharge, when necessary, would be done by licensed outside contractors and would comply with all USEPA- and State-mandated regulations for containing and handling the specific refrigerant used. The chiller would also use about 10 gallons of a refined mineral refrigeration oil, such as SUNISO 4GS.

Item 13. The storage tank for hydrostatic oil would be located in the base level of the S&O Building. The tank would be specifically designed for this application and would comply with all applicable USEPA and State requirements. The interior location of the tank would minimize the potential for any leakage to the environment. An inspection and maintenance regime for the bearings, piping, and all system components would be implemented during the entire operational life of the proposed ATST Project.

Items 14 and 15. The quantities and methods for on-site storage of nitrogen and helium would be as described in Table 4-5. These natural atmospheric elements present no potential for environmental damage if accidentally released. They would be used for super-cooling instruments, detectors, and other components.

Item 16. There is an above-ground storage tank in the exterior area immediately west of the MSO facility that is used for storing diesel fuel. This same tank would be used to supply commercial Grade-1 diesel fuel to the proposed backup generator for the proposed ATST Project facility at the Mees site. This tank is a fully approved recent installation, and no upgrades are anticipated to be necessary. During ATST operation, all applicable inspection, maintenance, and safety regulations related to the fuel tank and generator would be enforced.

In the event of a non-minor spill of a hazardous material, ATST staff would contact the Fire Department (911), other local authorities, and the AURA Risk Management Specialist for advisement. In the event of a minor spill, ATST staff would handle the spill per the ATST Hazardous Materials Management Plan and contact the AURA Risk Management Specialist to determine whether there would be any Federal or State reporting requirements. Accidental spills of any hazardous material during operations at the site would also be reported immediately to the on-site IfA supervisor and the Park would be notified, as appropriate.

There would be no change in the long-term hazardous waste disposal activities from the Mees site. There would be little potential for major releases of hazardous substances to the environment, therefore there would be negligible, adverse, and long-term effects associated with hazardous waste releases.

There have been no known spills of HAZMAT at the MSO facility. Construction crews would be required to follow all Occupational Safety and Health Administration (OSHA) worker safety requirements. Negligible, adverse, and long-term effects on worker health and safety from exposure to HAZMAT contained in on-site soils would be expected.

4.8.3 Evaluation of Potential Effects at the Reber Circle Site

DIRECT AND INDIRECT EFFECTS

Solid Waste

Solid waste disposal and its effects would be identical to those described for the Mees site. There would be negligible, adverse, and short-term effects on solid waste management from construction-related activities and negligible, adverse, and long-term effects on solid waste management from the operations of the ATST at the Reber Circle site and therefore would be no effect on Park operations.

Hazardous Materials, Waste, and Site Contamination

Hazardous materials storage and handling at the Reber Circle site would be identical to that for the Mees site, with the exception of diesel fuel. For the Reber Circle site, a new aboveground fuel tank would be installed, which would comply with all USEPA and State requirements. During ATST operation all applicable inspection, maintenance, and safety regulations related to the fuel tank and generator would be enforced.

In the event of a major or minor spill of a hazardous material, the identical procedures would be implemented as those described for the Mees site.

Operating the diesel fuel tank at the Reber Circle site would have a negligible, adverse, and long-term effect resulting from the increased potential for contamination of on-site soils when handling and storing diesel fuel.

Hazardous waste disposal and its effects would be identical to those described for the Mees site.

There have been no known spills of HAZMAT at the Reber Circle site. Construction workers would follow all OSHA worker safety requirements. Negligible, adverse, and long-term effects on worker health and safety would result from exposure to HAZMAT contained in on-site soils. There would be negligible adverse, and both short- and long-term effects on the Park road corridor resulting from the use or handling of HAZMAT and the Park resources would not be altered.

4.8.4 No-Action Alternative

Solid Waste

There would be no change from the current management of solid waste. Facilities would continue to be responsible for their waste. Negligible, adverse effects on solid waste management would be experienced.

Hazardous Materials and Site Contamination

Under the No-Action Alternative, the proposed ATST Project would not be constructed thereby omitting any short-term use of materials. Existing facilities would continue to use materials for mirror coating and cleaning, lubrications, refrigerants, etc. Therefore, the potential for a release would still exist. Negligible, adverse effects are expected as a result of the No-Action Alternative.

4.8.5 Summary of Effects from Hazardous Materials and Solid Waste

The proposed ATST Project would utilize HAZMAT and produce hazardous and solid waste. Implementing and adhering to the management plans that have been prepared for the proposed ATST Project, constructing containment features that have been designed for HAZMAT and waste storage, and conducting required on-site training for personnel would occur, therefore negligible, adverse, and long-term effects from these waste streams would be expected.

4.9 INFRASTRUCTURE AND UTILITIES

The ROI for infrastructure is HO, the adjacent FAA facilities, and the Park road corridor. The ROI for utilities is focused on HO, which is separately served by Maui Electric Co., Inc. (MECO) and Hawaiian Telcom and the Park road leading up to HO.

4.9.1 Methodology of Effect Assessment

The methods used to determine whether the proposed ATST Project would have a major effect on infrastructure and utilities are as follows:

1. Review and evaluate the infrastructure of existing and past actions with respect to their effects on wastewater, stormwater, drainage, electrical systems, communications, and roadways and traffic to identify the action's potential effect on infrastructure and utilities.
2. Review and evaluate each alternative to identify its potential to adversely affect the infrastructure or utilities within and outside of HO, including pollution, erosion, damage to the existing infrastructure, capacity overload, or long-term degradation. The methods used include:
   a) evaluation of wastewater management through an Individual Wastewater System,
   b) extrapolation of stormwater data for HO to include potential contribution from the proposed ATST Project,
   c) calculation of addition of runoff to existing drainage capacity,
   d) consultations with MECO on electrical requirements,
   e) consultations with Hawaiian Telcom and FAA to address effects on communications; and,
   f) consultations and study results from FHWA survey of Park road corridor.
3. Assess the compliance of each alternative with applicable Federal, State, or County regulations in particular, permitting for transportation of wide and heavy loads and pollutant discharge.

The thresholds of change for the intensity of effects on infrastructure and utilities are defined as follows:

Effect Intensity	Intensity Description
Negligible	The proposed ATST Project would result in a change to existing infrastructure and utilities, but the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The proposed ATST Project would result in a change to existing infrastructure and utilities, but the change would be small and localized and of little consequence.
Moderate	The proposed ATST Project could result in a change to existing infrastructure and utilities; the change would be measurable and of consequence.
Major	The proposed ATST Project that would result in a noticeable change to existing infrastructure and utilities; the change would be measurable and result in a severely adverse or beneficial effect.
Duration: **Short-term –** Effects last one year or less. **Long-term –** Effects last longer than one year.	

2009 FHWA HALE Road Report

To obtain objective professional guidance on effects assessment (as outlined in the tasks above) with regard to the road through the Park, HALE initially requested and the NSF subsequently supported a field investigation and preparation of a formal report by the FHWA. Their initial investigation, completed in May 2007, was inconclusive as to the extent of effect to the Park road from traffic related to the proposed ATST Project and recommended follow-up testing and further study. That additional work was later completed and the results of all the investigative efforts by the FHWA are described in their final report issued in March 2009 (Vol. II, Appendix P–FHWA HALE Road Report). This report addresses the current condition of the Park road, as well as the drainage structures along its route, consisting of one bridge and multiple culverts. The FHWA report also includes recommended mitigation measures to reduce the potential for any effects to the historic road, bridge and culverts that might occur as a result of traffic related to the construction and operation of the proposed ATST Project.

The report goes on to describe the methods and results of the road condition investigation, which involved extensive visual inspection and physical testing. Visual inspection by the FHWA resulted in characterization of the road in four different sections based on current condition. These sections are identified by milepost and labeled numerically from the base of the road at the Park entrance up to the summit where it enters HO. Sections 1, 3, and 4 (totaling of 7.9 miles) are generally described as being in good condition with little to no signs of pavement distress. Section 2, a 3.6-mile stretch of the road that receives much more rainfall, is described as being in much worse condition, having significant cracking and distress from the presence of water and inadequate drainage. Physical testing as part of the FHWA investigation included borings to determine pavement thickness and underlying soil conditions, as well as Falling-weight Deflectometer analysis to determine structural characteristics of the pavement. The physical testing campaign corroborated the conclusions of the visual inspection and provided detailed empirical data to serve as the basis for recommended repairs and mitigations. Section 2 was characterized as having less thickness, weaker bearing strength of pavement and substrate, and significantly lower structural capacity than the other parts of the roadway. Section 2 was found to be at the end of its service life, while the other parts of the road were reported to have at least 8 years of service life remaining.

The FHWA HALE Road Report also provides an inventory and conditional assessment of the drainage structures along the Park road corridor. Field inspection for structural condition and dimensional adequacy were conducted on 77 metal pipe culverts, 11 concrete box culverts, and the bridge. Some minimal damage was noted at several of the pipe culverts and two were noted to potentially have insufficient cover between the top of the pipe and the road surface. Some of the box culverts were noted to have loose stones and eroded mortar in their masonry headwalls, but otherwise were found to be undamaged and in serviceable condition. No special conditional issues or damages were noted regarding the bridge, as the FHWA relies primarily on the regular program of bridge inspections, most recently in 2005 for this structure, to determine its condition and load rating.

Existing traffic on the Park road, primarily passenger cars and tourist buses, is quantified in Table 9 of the FHWA HALE Road Report based on statistics provided by HALE. The level and type of potential increased traffic for construction of the proposed ATST Project is based on the schedule and projections provided by the ATST engineering team (Section 2.4.3-Construction Activities and FHWA HALE Road Report, Table 11). The FHWA requested from the ATST Project team an estimate of the approximate extent and duration of the required use of the road for construction and operation of proposed ATST Project. For both the existing traffic and potential ATST construction traffic, the FHWA report converts the number and type of vehicle trips into equivalent single axle loads (ESALS) (FHWA HALE Road Report, Tables 10 and 12). The number of current annual ESALS on the Park road is 11,021 and the total from projected construction traffic of the proposed ATST Project is 1,397 over the 7-year construction, integration, and commissioning period. This amounts to approximately 2 percent more ESALS over that 7-year period, which the FHWA characterizes as a relatively small increase.

In summary, the FHWA HALE Road Report (p. 32) states: "When compared to normal daily traffic using Haleakala Highway (passenger and bus traffic), the low stress/volume of traffic, 1,397 ESALs, related to the ATST project is expected to have little effect on the roadway sections from MP 10.3 to 11.2 and 14.8 to 21.2 assuming the traffic axle loadings are legal and the volume of traffic as estimated by the ATST staff is correct. From MP 11.2 to 14.8, the deterioration of this section would continue at relatively rapid pace with or without ATST traffic."

4.9.2 Evaluation of Potential Effects at the Mees Site

DIRECT AND INDIRECT EFFECTS

Wastewater

The existing cesspool at the MSO facility would be removed and an advanced aerobic IWS would be installed to treat sanitary wastewater. In order to receive a permit, the IWS must meet Hawaiʻi Department of Health requirements. Effluent from the IWS would be discharged to the subsurface as in a septic tank leach field, except that the effluent from the proposed system would be of much higher quality. The effluent would percolate downward through permeable deposits and fractured basalts until it encounters obstacles to its flow, such as dikes that have intruded the joints and fractures. The exact path of the percolating water cannot be predicted. The proposed IWS would not increase the amount of effluent, but it would increase the effluent quality relative to current conditions. Construction of the IWS resulting in a change in effluent quality would have a minor beneficial, long-term effect on groundwater.

Stormwater and Drainage System

A majority of the HO site is served by a stormwater collection system of paved channels designed to convey runoff from impervious areas to a central infiltration basin. The proposed ATST Project facility design would include stormwater drainage capacity and configuration that would tie it into the drainage system for HO. A National Pollutant Discharge Elimination System (NPDES) permit would be obtained from the State of Hawaiʻi Department of Health for stormwater runoff during construction and a second permit would be obtained for permanent operations.

The proposed ATST Project would have negligible, adverse, and long-term environmental effects on surface water. The proposed ATST Project would implement the guidance of the SWMP for HO (Vol. II,

Appendix L) prepared according to the recommendations stated in the Stormwater Erosion Report (UH IfA, 2005a). This report states that runoff from the impervious surfaces associated with the HO and adjacent roads may not increase the total volume of stormwater flow entering the natural drainages but may only affect the way it is transported there (UH IfA, 2005a). The proposed ATST Project facility would capture stormwater and surface water for reuse through gutters, rainwater leaders and catchment drains piped to an underground storage tank and ultimately pumped to the existing cistern. As such, changes to runoff are not expected to increase as a result of the proposed ATST Project and no measurable or perceptible consequences on the existing stormwater management system or drainage patterns would result. Capturing surface water and stormwater and implementing the guidance of the SWMP for HO would reduce the potential for increased runoff entering the stormwater management system. Therefore, negligible, adverse, and long-term effects on surface water and drainage patterns would be expected.

Electrical Systems

The estimated total electric service for the proposed ATST Project is 960 kilovolt-ampere (kVA). The entirety of that load would not be concurrent. Applying a diversity factor of 70 percent the maximum anticipated new electrical demand would be approximately 670 kVA. The reserve capacity in the existing MECO substation at HO is estimated by MECO engineers to be adequate for the existing connected loads and all currently identified future loads, including the proposed ATST Project (Kauhi).

The other anticipated future electrical loads that would be served by that substation are the AEOS mirror coating facility (680 kVA, non-concurrent), the Pan-STARRS facility (400 kVA), and the NASA Transportable Laser Ranging System (120 kVA).

Although the existing HO substation has adequate capacity, the equipment is considered obsolete. MECO is planning to upgrade it to a new 2500 kVA substation with improved efficiency and safer reserve capacity (Kauhi, 2005). Representatives from the proposed ATST Project and the other HO power customers have been in contact with MECO engineers to ensure that the full potential, future electrical power demand for the proposed ATST Project is considered in the design of that upgrade. With this upgrade, there should be sufficient capacity to handle activities at the Mees site.

A Request for Electric Service has been officially submitted to MECO on behalf of the proposed ATST Project to allow incorporation of the anticipated ATST electrical power requirements into their planning and capital budgeting process. A MECO-funded study (AMEL, 2005) has also been completed that identified ways to reduce the peak electrical load of the proposed ATST Project through specification of more efficient equipment and shifting cooling loads to off-peak times. These identified strategies have been incorporated into the planning for the proposed ATST Project. All connections would be through below ground electrical lines. The MECO upgrade would change the existing electrical system by improving efficiency and providing a safer reserve capacity, resulting in moderate, beneficial, long-term effects on the electrical system at HO.

Communications Systems

The proposed ATST Project would require data connectivity of approximately 1 Gigabit per second to the base facility; however, the location of the Maui base facility and ATST data repository has not been determined. Connectivity from the site to the base headquarters would use existing dark optical fiber from the proposed ATST Project. Arrangements would be made with the commercial provider to lease the necessary capacity. The hardware to implement the connection and the service agreement with the commercial provider would be supplemental to the existing communications connections in the ROI. These required changes to the existing communication system would have no perceptible consequence; therefore, negligible, adverse, and long-term effects on the communication systems would be expected. Communication connections to serve the proposed ATST Project would be through existing reserve lines or new lines that would follow the path of existing lines. Any required new lines would be placed during site excavation.

The FAA RCAG system on Pu‘u Kolekole maintains two sets of frequencies for contact with interisland air traffic down to 8,000 feet. As a result of the potential addition of the proposed ATST Project at the Mees site, physical obstruction to the geometric line-of-sight for signals from RCAG could occur. These frequencies could experience attenuation, which would be defined as signal loss in a narrow swath of 5 degrees originating at the RCAG antennas and intersecting the width of the proposed ATST Project structure about 800 feet away. In accordance with 14 CFR Part 77.35, FAA specialists working with NSF will address any potential issue involving a degradation of signal as a result of the proposed ATST Project. If there is such a degradation of signal, a resolution of the issue will be developed and accompanied by the appropriate level of NEPA compliance. In addition, NSF will work with the FAA to obtain adequate funding for implementation of the resolution. This would reduce the effects to negligible, adverse, and long-term.

<u>Construction-Related Effects on Roadways and Traffic</u>

As previously identified, the ROI for roadways and traffic includes both the roads within the HO property and the Park road corridor leading to HO. The different areas of roadway are subject to different levels of traffic, are managed by different agencies, and require varying levels of maintenance. They are treated separately in this analysis to allow for appropriate assessment of the effect of the construction of the proposed ATST Project.

Roadways at HO. During the construction phase of the proposed ATST Project, the roads at HO would continue to be used for ongoing observatory operations. Any necessary barricading would be temporary and would be prearranged with other road users. Some roads within the HO complex may be temporarily widened to allow through-traffic during construction.

The access road that leads from north of the MSO facility down to the main staging area would be reopened for use during construction. This would require removing rock and soil that have been placed at the entrance to the road as a surface water diverter. The rock and soil diverter would be reconstructed after the proposed ATST Project construction is complete. All of these activities would be done in accordance with and to a level not to interrupt the effective use of the HO stormwater management, discussed in Section 3.7.1-Surface Water.

The roads within HO are maintained by IfA, with contributions from all users of roads and easements. Vehicular traffic is normally slow-speed and low in volume and would not be substantially affected by the cyclic integration of construction vehicles and equipment related to the proposed ATST Project. Currently, most roadways within HO require very little maintenance and have considerable longevity. These observatory roads were not designed, however, to support unusually heavy loads, such as large trucks and construction vehicles. Construction of the proposed ATST Project would inevitably result in moderate, adverse, and short-term effects to the condition of the roads within HO. To mitigate this effect, contractors would be made aware of the potential for road damage and would be required to take measures to minimize the damage. Any damage to HO roadways that does result from ATST construction traffic would be repaired so as to, at a minimum, restore those roadways back its condition before construction of the proposed ATST Project. These mitigations, to be negotiated between the affected parties, would reduce the overall effect on HO roadways and traffic down to minor, adverse, and short-term effects.

Roadways Leading to HO. The roadways leading to the construction site for the proposed ATST Project include a series of State-maintained highways up until the Park entrance and the Park road itself, which is managed and maintained by HALE. Traffic along these routes would primarily be affected by heavy equipment, delivery of concrete and materials, and miscellaneous service trips as characterized in Section 2.4.3-Construction Activities. The specific effect to the Park road is described in the FHWA Road Report summarized above (Vol. II, Appendix P). The following discussion deals first with effects that are common to all these highways – both State- and Park-managed – and then addresses the issues that are particular to each

Large trucks, delivery vehicles, van shuttles and passenger vehicles would all travel the State and Park highways leading to HO during construction of the proposed ATST Project. Construction vehicles would include heavy vehicles, such as dump trucks, flatbeds, water trucks and vehicles to transport large construction equipment such as bulldozers, backhoes, trenchers, a truck-mounted auger, and a large crane. The most intensive period of construction-related traffic would be during the first year of the project when heavy earth-moving equipment and most of the concrete for foundations and the telescope pier would be transported to the project site. The heavy equipment would remain at the site for as long as practicable to minimize conveyance over the roads. During the entirety of the construction period all large-vehicle traffic would be coordinated around heavier traffic periods and neighboring activities to minimize adverse effects. Furthermore, to minimize highway traffic and the need for on-site vehicle parking, construction workers would be required to carpool.

Even with these mitigations, traffic on the State and Park roadways leading to the site would be affected by the construction traffic for the proposed ATST Project. The effects from construction-related traffic would be most evident on the mountain highways – State Route 378 and the Park road, which together form the only access route leading to the summit and into HO. The majority of this route is a two-lane highway with steep inclines and numerous switchback curves. This is a speed-limiting factor for large trucks causing inevitable queuing of vehicles behind the trucks. Considering the characteristics of the road, coupled with the normal tourist traffic, moderate, adverse, and short-term effects to traffic on the State highways and the roadway through the Park are expected during periods of heavy equipment use and material deliveries to the proposed ATST Project site.

State Road Effect. Since the issuance of the DEIS, concerns were raised about potential effects to State Road 378. In response to the DEIS, the State of Hawaiʻi Department of Transportation (DOT), the agency having jurisdiction over this portion of the road, identified no special concerns regarding road conditions or traffic related to the proposed ATST Project. They did, however point out that "…any heavy or wide truck transportation of project equipment on our State highways would require that your project staff and/or construction contractor contact our Highways Maui District Office for the appropriate truck permit and traffic route coordination." The ATST Project engineering team has researched the applicable statutes regarding standard authorized dimensions and weights of loads on State Highways, as well as the permitting requirements for loads that exceed these limits (HRS 291-34 to 36). The Project would fully comply with these requirements. It is anticipated that there would not be more than minor, adverse, and short-term effects associated with construction-related traffic on this roadway, as the vehicle load widths and weight would not exceed thresholds permitted by the Hawaiʻi DOT.

On Route 378, the State-maintained portion of the Haleakalā access road, the most recent traffic count conducted on September 19 and 20, 2007 by the DOT reported total, two-way, 24-hour traffic of 1,439 vehicles (September 19, 2007) and 1,562 vehicles (September 20, 2007). On State Route 377, which leads to Route 378, the total, two-way, 24-hour traffic was reported to be 3,323 vehicles (September 19, 2007) and 3,265 vehicles (September 20, 2007) (DOT, 2007). The traffic required for construction of the proposed ATST Project, as described in Section 2.4.3-Construction Activities, would be an average of about 10 vehicle round-trips per day, with a maximum of 20 round-trips depending on the activities in progress. Based on the DOT statistics and proposed ATST Project predictions the maximum traffic increase would be about 1.2 percent (40/3265 x 100) on Route 377 and 2.8 percent (40/1439 x 100) on Route 378.

It is anticipated that there would be minor effects associated with construction-related traffic on the State roadways. As described above, the vehicle load widths and weight would not exceed thresholds permitted by the DO, and the increase in traffic volume for the proposed ATST Project would not be a significant increase over existing traffic levels.

Park Road Effect. Large trucks carrying heavy and wide loads and other construction-related traffic as defined in Section 2.4.3-Construction Activities would utilize the Park road corridor leading up to HO during construction of the proposed ATST Project.

The requirement for passage of wide truck loads required for construction of the proposed ATST Project past the restricted roadway at the entrance station to HALE would require a widened, drivable shoulder. This work, as described in Section 2.4.3 (Construction Activities, HALE Entrance Station Clearance), would be undertaken by the ATST Project and coordinated with HALE staff. Following the construction phase, when this wide-load access is no longer required, the condition of the roadway and the shoulder would be rehabilitated and restored to the previously existing condition. The effect of this requirement of the proposed ATST Project would be minor and temporary.

The FHWA report (Vol. II, Appendix P-FHWA HALE Road Report) makes a comparison of the current existing traffic on the Park road, to the proposed ATST construction traffic, as quantified in Table 2-4. The comparison is made in terms of equivalent single-axle loads (ESALS). One ESAL is the equivalent of 2,549 single passenger cars. The total number of ESALS attributable to the proposed ATST Project over the 7-year construction, integration, and commissioning period is calculated to be 1,397 (Vol. II, Appendix P-FHWA HALE Road Report, Table 12). The volume of average daily traffic on the Park road over the last five years is 443 passenger cars and 30 buses, which calculates to a total of 11,021 ESALS per year (Vol. II, Appendix P, Table 10). The FHWA report states: "Note that a comparison of visitor traffic ESAL loading, Table 10, and ATST project construction traffic over the 5-year period, (Vol. II, Appendix P, Table 12), would result in an increase of about 2 percent additional ESAL loading on this route, 1,397/(11,021 X 7) = 1.8 percent. It should also be pointed out that the increased ATST construction ESALs of 1,397 are equivalent to approximately 47 days or 1 1/2 months of normal tour bus traffic on this route. This amount of traffic is considered relatively small."

The FHWA HALE Road Report notes the generally sound condition of the bridge, based on inspection reports; however, they recommend specific measures and precautions to protect its structural integrity: "Although constructed in 1934 the bridge has a favorable load rating as was noted in the 2005 inspection report. Nevertheless, it would be prudent to require written notification within 30 days of each anticipated occurrence of vehicle loadings above legal limits crossing the structure. Diagrams showing vehicle configuration (axle spacing and width), weight per axle, and overall vehicle widths and lengths should be presented to the NPS for verification by the Federal Lands Highway Bridge Office for conformance with current load rated capacity. With the anticipated heavy and wide loads that will be necessary for the construction, the probability of accidental damage to the bridge will also proportionally increase. It is recommended that prior to the construction notice to proceed that the bridge be photographed, inspected and documented as to existing condition. Periodic monitoring during the construction project may be employed if actual construction traffic deviates from [that estimated by ATST engineers]...to verify that the bridge is not being impacted due to construction activities resulting from the project."

In addition, all construction-related traffic within the Park road corridor would be coordinated with HALE and conducted in compliance with an SUP issued by HALE, so as to avoid or minimize: damage to the road pavement, potential damage to historic structures along the park road corridor, traffic congestion, and other potential adverse effects on Park resources and the visitor use and experience. Even with these provisions, based on the conclusions of the FHWA Road Report, the use of the Park road by these vehicles would have a minor, adverse, and long-term effect on the longevity of the pavement. The contribution of the proposed ATST Project to a future road repair project to compensate for this effect would be subject to the provisions of the SUP.

The increase in total traffic volume on the Park road required for construction of the proposed ATST Project would be the same as described above for the Route 378. The counts of total, two-way, 24-hour traffic 1,439 vehicles (September 19, 2007) and 1,562 vehicles (September 20, 2007), can conservatively be assumed to also represent the total traffic that continues into the Park, as this roadway does not have any other major destinations. The same calculated maximum total traffic increase of approximately 2.8 percent would apply to the Park road. Apart from the road wear effect described above due to the large construction vehicles, this amount of traffic effect is considered to be minor.

Operations-Related Effects on Roadways and Traffic

The operational phase of the proposed ATST Project would, if approved, begin in late 2015. An estimated on-site staff of six would operate the facility, with others staffing remote locations on Maui or off-island. Four to seven round trips per day are estimated during the preliminary operational phase, which accounts for three shifts for observing, maintenance, and engineering staff. The estimated round trips per day includes three carpooling van trips to accommodate the three shifts and one to four additional cars. After the initial operational phase, the round trips per day are expected to decrease to about one to five.

Roadways at HO. Once construction is complete, there should be no further need for barricading of roadways for normal operational access to the proposed ATST Project. All truck and passenger vehicle parking is expected to be accommodated within the ATST service yard. During operation of the proposed ATST Project the effect to roadways within HO is anticipated to be negligible.

Roadways Leading to HO – State Road Effect. The State roadways in the Upcountry area, including State Routes 377 and 378, would continue to be utilized for access to the proposed ATST Project during its full operational lifetime. On State Route 377 the most recent traffic count conducted by the DOT reported total, two-way, 24-hour traffic of 3,323 vehicles (September 19, 2007) and 3,265 vehicles (September 20, 2007). On Route 378 the total, two-way, 24-hour traffic was reported to be 1,439 vehicles (September 19, 2007) and 1,562 vehicles (September 20, 2007) (DOT, 2007). The traffic required for operation of the Proposed ATST Project, as described in section 2.4.4-Telescope Operation Activities, would be an average of about 7 vehicle round-trips per day, with a maximum 10. Based on these statistics and predictions the maximum traffic increase would be about 0.6 percent (20/3265 x 100) on Route 377 and 1.4 percent (20/1439 x 100) on Route 378. Given that the additional ATST-related traffic would be minimal in comparison to normal traffic, there would be negligible, adverse, and long-term effects on these State roadways from operation of the proposed ATST Project.

Park Road Effect. The Park road corridor would continue to be utilized for access to the proposed ATST Project during its full operational lifetime. Any necessary mitigation measures related to this use, such as continued carpooling by ATST staff, advance notification and approval of occasional large or heavy loads, compliance with established procedures for transportation of HAZMAT, etc. would be arranged with HALE pursuant to the SUP. Given these measures, and the fact that additional ATST-related traffic would be minimal in comparison with normal park traffic as documented in the FHWA Road Report and as calculated above (maximum of 1.4 percent increase on State Route 378 and continuing into the Park), there would be negligible, adverse, and long-term effects on the Park road from operation of the proposed ATST Project.

4.9.3 Evaluation of Potential Effects at the Reber Circle Site

DIRECT AND INDIRECT EFFECTS

Wastewater

The same environmental conditions as those for the Mees site are anticipated for wastewater if the proposed ATST Project were implemented at the Reber Circle site, given that the same IWS would be installed.

Stormwater and Drainage System

The same environmental conditions as those for the Mees site are anticipated for surface water if the proposed ATST Project were implemented at the Reber Circle site. Capturing stormwater on-site and following the SWMP for HO (Vol. II, Appendix L) would reduce the potential for increased runoff entering the stormwater management system. Therefore, negligible, adverse, and short-term effects of the Reber Circle site on surface water and drainage patterns would result.

Electrical Systems

There would be no difference in the electrical system plans for the Reber Circle site as compared to the Mees site. With the projected upgrade of the MECO substation adjacent to HO, there should be sufficient capacity to handle activities for the Reber Circle site.

Communications Systems

There would be no difference in the requirements for communication systems for the Reber Circle site as compared to the Mees site. There would be major, adverse, and long-term effects on the FAA communication systems for the Reber Circle site. FAA specialists working with NSF will address any potential issue involving a degradation of signal as a result of the proposed ATST Project. If there is such a degradation of signal, a resolution of the issue will be developed and accompanied by the appropriate level of NEPA compliance. In addition, NSF will work with the FAA to obtain adequate funding for implementation of the resolution. This would reduce the effects to negligible, adverse, and long-term.

Roadways and Traffic

Effects to roadways and traffic during both construction and operational phases at the Reber Circle site would be identical to those identified for the Mees site. ATST-related commutes and deliveries would be coordinated around high volume traffic periods and activities on the mountain to the level possible. Carpooling would be enforced for construction workers and operational staff to reduce traffic and parking issues. Material and equipment staging would be coordinated based on immediacy of need. All moderate, minor, and negligible, adverse effects to roadways within HO and roadways leading to HO would be the same as those identified for the Mees site.

4.9.4 No-Action Alternative

Wastewater

There would be negligible effects to wastewater generation under the No-Action Alternative, as the proposed ATST Project would not be constructed on HO property.

Stormwater and Drainage System

Although the conditions would remain unchanged under the No-Action Alternative, based on the conditions described in the Stormwater Erosion Report (UH IfA, 2005a), the SWMP for HO (Vol. II, Appendix L) was developed both in response to ongoing baseline operations and in anticipation of planned and projected activities per the LRDP. This plan is still being implemented. Based on the results of the erosion study, culverts were cleaned out of soils that were previously interrupting the flow to the infiltration basin. This is being maintained in order to prevent unwanted erosional pathways.

Electrical Systems
There would be no change to the existing electrical system under the No-Action Alternative. The MECO upgrade would likely be eliminated.

Communications Systems
There would be no change to the existing electrical system under the No-Action Alternative.

Roadways and Traffic
Negligible effects on roadways and traffic would be experienced as a result of the No-Action Alternative. Under this alternative, no facility would be constructed, no additional staffing would be needed, and the current work force and service-related traffic at HO would access the site at the current levels.

4.9.5 Summary of Effects on Infrastructure and Utilities

The removal of the existing cesspool and implementation of an IWS under the proposed ATST Project, if implemented at the Mees site would result in a minor beneficial, long-term effect on the wastewater system. The implementation of an IWS at the Reber Circle site would have negligible, adverse, and long-term effects on the wastewater system.

The proposed ATST Project would result in negligible, adverse, and long-term environmental effect on the surface water at the site. The runoff from impervious surfaces associated with the proposed ATST Project would not increase substantially due to designed capture of stormwater, although transport to the natural drainage locations may be slightly altered.

The anticipated electrical load that would be required by the proposed ATST Project would have a negligible, adverse, and long-term effect on the MECO service to HO. Additional loads from all anticipated needs would be served by an upgrade that has been specified by MECO and power demands could be met with improved efficiency and a safer reserve capacity, and would thus result in a moderate, beneficial, and long-term effect on the electrical system.

Fiber optic lines are available at HO that would be adequate for data connectivity and negligible, adverse, and long-term effects are anticipated from the additional requirements of the proposed ATST Project.

Moderate, adverse, and short-term effects to roadways and traffic would occur during construction of the proposed ATST Project. Traffic along State highways and Haleakalā Crater Road would be affected by heavy equipment, delivery of concrete and materials, service trips, and daily commuting of construction workers. These effects would be mitigated by various measures, including carpooling and scheduling of deliveries to minimize conflicts with other traffic, tours, or other activities. Additional specific mitigation measures, such as the ones described above and recommended by the FHWA HALE Road Report (Vol. II, Appendix P), are expected to be included in the HALE-issued SUP, and as such become mandatory requirements for the construction and operation phases of the proposed ATST Project.

4.10 NOISE

The ROI for noise effects is HO and Park road corridor.

4.10. 1 Methodology of Effect Assessment

The methods used to determine whether the proposed ATST Project would have a major effect on noise are as follows:

1. Review and evaluate existing and past actions with respect to noise that has resulted in effects that could assist in identifying the proposed ATST Project's potential for adverse effects due to noise.
2. Review and evaluate each alternative from the perspective of expected noise using industry standard methods to identify potential sound levels and the potential to adversely affect the ecosystem and its component parts within and adjacent to HO, including disturbance to endangered species, recreational activities, and Native Hawaiian cultural practitioners. The sources for noise thresholds are from State standards and the Center for Research and Training (CPWR).
3. Assess the compliance of each alternative with applicable Federal, State, or County regulations for noise.

The thresholds of change for the intensity of effects on noise are defined as follows:

Effect Intensity	Intensity Description
Negligible	The proposed ATST Project would result in a change to noise conditions, but the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The proposed ATST Project would result in a change to noise conditions, more than 5 dBA, but less than 10 dBA, which is the threshold for human ear to recognize a difference, but the change would be small and localized and of little consequence.
Moderate	The proposed ATST Project could result in a change to noise conditions; the change would be measurable and of consequence. This would equate to about 20 dBA or twice the detectable level
Major	A proposed ATST Project would result in a noticeable change to noise conditions; the change would be measurable and result in a severely adverse effect. This would be greater than 20 dBA, which would require doubling the distance three times to reduce the level back to ambient for a 7 dBA attenuation factor

4.10.2 Evaluation of Potential Effects at the Mees Site

<u>DIRECT AND INDIRECT EFFECTS</u>

Construction-Related Effects at the Mees Site

Most noise generated during construction comes from machinery and equipment, particularly powered mechanical equipment. Construction at the Mees site would involve the use of standard heavy excavation machinery, including bulldozers, earth movers, backhoes, and trenchers, as well as portable petroleum-powered generators. Holes for caissons would be drilled using a truck-mounted auger or similar drilling equipment, while hydraulic hammers or manually operated jackhammers would be used for breaking up large rocks. In addition, a 165-ton lattice-boom crane would be used for moving large equipment and placement of building and telescope components. These types of construction machinery and equipment typically generate reference noise levels in the following acoustical ranges, as conservatively measured at ten feet from the source of emission (CPWR, 2005):

- Bulldozers: 93 to 96 dBA
- Earth movers: 87 to 94 dBA
- Backhoes: 84 to 93 dBA
- Cranes: 90 to 96 dBA
- Jackhammers: 102 to 111 dBA
- Rock hammers/drills: 103 to 113 dBA

Non-impulse noise emissions generated during construction would be audible throughout the HO area and would likely exceed the Statewide non-impulse noise standard established for Class A zoning districts (i.e., L_{10} less than or equal to 55 dBA). Although sound levels from a point source of noise (e.g., equipment and machinery) are expected to decrease by about 6 to 7 dBA for every doubling of distance from the source, all neighboring research facilities at HO are within a 200- to 700-foot radius from the proposed construction site. Therefore, noise attenuation from geometric spreading over these short distances would likely not reduce levels at exterior receptor locations below state standards. However, at receptor locations outside of HO, including those public areas closest to the site, attenuation over distance would reduce generated non-impulse noise emissions resulting from construction to levels near or below state standards, even using conservative noise decay calculations (Table 4-6 and Fig. 4-40). Considering the level of noise, the distance to sensitive receptors, and the attenuation of noise to below state standards construction, the proposed ATST Project would have major, adverse, and short-term noise effects. These changes in noise levels due to construction could have an effect on visitors using nearby recreational facilities and overlook such as Pu'u 'Ula'ula Overlook and the Sliding Sands Trail. Detailed discussion regarding noise effects from construction on visitors is located in the Visitors Use and Experience section of this document. Likewise, noise impacts affect persons conducting traditional cultural practices at HO and adjoining areas. These impacts are discussed in Section 4.2.2- Evaluation of Potential Effects at the Mees Site.

Hydraulic hammers and jackhammers used during construction to break up rock would generate impulse noise and are also expected to elevate ambient impulse noise levels at the summit above existing levels. It is probable that some non-continuous impulsive noise levels would exceed the state standard for Class A zoning districts (i.e., L_{10} less than or equal to 65 dBA) at many of the neighboring HO facilities, even with attenuation and atmospheric absorption over distance. Ground-borne vibrations would likewise be detectable at exterior areas near the job site during hammering and drilling.

There are areas within HALE adjacent to HO close enough to visitors such that they would be able to detect noise from construction of the proposed ATST Project at the Mees site. These are the Pu'u Ula'ula Overlook and the Sliding Sands trail, which are about 0.3 miles from the proposed ATST Project. The loudest sounds of construction, at about 113 dBA for impact noise, would be attenuated to about 65 dBA at those distances (Table 4.6 and Figure 4-40). This would be approximately the same level as would be produced by moving passenger vehicles. It would add to the detectable ambient sound levels at those visitor locations sound levels at above 20 dBA above the 47 dBA background at those locations, and therefore the noise effects from the loudest impact construction sounds could be considered major adverse long-term. Two mitigation measures would be employed that would reduce these effects on HALE visitors. First, outside on-site construction noise that exceeds 83 dBA at a distance of 5 feet would be limited to between 30 minutes after sunrise and 30 minutes prior to sunset. Secondly, construction noise exceeding 83 dBA would be prohibited between April 20th and July 15th in compliance with USFWS mitigation measures for petrel incubation. During these pre-sunrise and pre-sunset periods and during April 20th and July 15th, the contribution to ambient sounds at the above visitor locations would be geometrically attenuated to about 35 dBA, or the equivalent of leaves rustling or wind blowing through grass (Resource Systems Group, Inc.

2006, p. 12). These lower than ambient sound levels would have a negligible, adverse and long-term effect during those periods.

Baseline conditions of vehicular traffic along the Park road corridor generate a noise level of approximately 47 dBA. According to the project description and mitigation measures outlined in Section 4.18 of this document, for traffic to coordinate construction-related projects and traffic with affected parties impacts from construction vehicle noise would likely raise the baseline levels to an imperceptible level. In order for a clearly perceptible change in noise to occur, there must be an increase in decibel level of 5 to 6 dBA from the baseline conditions. In general, two noise sources producing equal dB ratings at a given location would produce a composite noise level 3 dB greater than either sound alone. Even with a considerable number of construction vehicles added to the vehicular traffic per day and per hour along the Park road corridor, the maximum decibel associated with traffic would be 50 dBA. The proposed ATST Project calls for approximately 2 construction vehicle trips per month, which would not result in a change in dBA level of even this level. The perceived change in loudness from this change (up to 3 dBA) would be a maximum of 23 percent increase in loudness. Because construction traffic is planned to be at minimum levels, it is not expected that this percent of increase in loudness would be reached. In general, most people cannot distinguish noise level changes that vary by less than 10 percent in relative loudness. With mitigation measures in place for traffic and construction related noise, there would be a minor, adverse, and short-term effect on baseline noise levels from construction traffic along the Park road corridor.

Human receptors at distances along the Park road corridor beyond 2,500 feet would experience noise levels in the range of between 45 and 65 dBa, which are considered within the range of other sources of noise along the Park road, such as traffic. Therefore, at these distances, it is considered that the effects of construction noise would be minor, adverse, and long-term.

Operations-Related Effects at the Mees Site

Standard operational processes for the proposed ATST Project would not emit significant nuisance noises or vibrations to the surrounding research environment. Mirror stripping and cleaning and restorative recoating of the reflective surface, which would occur approximately once every two years, would not generate appreciable noise levels outside the enclosed buildings. Exhaust fans and equipment used for cooling the telescope and enclosure would have sufficient sound attenuation to reduce their noise levels to well below the established outdoor levels for Class A zoning districts. The aperture and ventilation gates would be periodically opened and closed primarily during daylight and occasionally at night for maintenance. Rotational tracking of both the dome and entrance aperture tube atop the enclosure would produce a low frequency spectrum of mechanical noise, audible throughout the HO area. However, the noises would be intermittent and are considered unlikely to elicit adverse responses from neighboring research facilities because operations of these types of observatories are considered normal and standard practice. In addition, the dome would be positioned before nightfall each day, so typically there would be no nighttime rotational noise and the speed of rotation required around sunrise would be reduced.

Furthermore, the change to ambient noise conditions at HO resulting from vehicle traffic would be negligible because the relative increase in daytime commuters accessing the proposed ATST Project facility would not noticeably add to the current level and pattern of vehicle use associated with existing HO operations.

Table 4-6. Noise Attenuation Over Distance, Construction-Related Sources.

	6 dBA Noise Level Decrease Over Distance[1]		7 dBA Noise Level Decrease Over Distance[1]	
Distance of Receptor from Noise Source (Feet)	**Non-impulse Noise Level[2] (dBA)**	**Impulse Noise Level[3] (dBA)**	**Non-impulse Noise Level[2] (dBA)**	**Impulse Noise Level[3] (dBA)**
10	96	113	96	113
20	90	107	89	106
40	84	101	82	99
80	78	95	75	92
160	72	89	68	85
320	66	83	61	78
640	60	77	54[4]	71
1,280	54[4]	71	47	64[5]
2,560 (0.48 miles)	48	65[5]	40	57
5,120 (0.97 miles)	42	59	33	50

Notes:

1. When distance is the only factor considered, sound levels from an isolated noise source generally decrease by approximately 6 dBA (independent of any atmospheric absorption) to roughly 7 dBA (accounting for some atmospheric absorption) for every doubling of distance from the noise source.
2. Non-impulse noise level applicable to bulldozers; reference level of 96 dBA represents high end of range 10 feet from source (CPWR, 2005).
3. Impulse noise level applicable to rock hammers or drills; reference level of 113 dBA represents high end of range 10 feet from source (CPWR, 2005).
4. Represents minimum approximated distance from noise source where measurable level falls below the Hawaiʻi non-impulse noise standard established for Class A zoning districts (i.e., L10 less than or equal to 55 dBA).
5. Represents minimum approximated distance from noise source where measurable level becomes equal to or falls below the Hawaiʻi impulse noise standard established for Class A zoning districts (i.e., L10 less than or equal to 65 dBA).

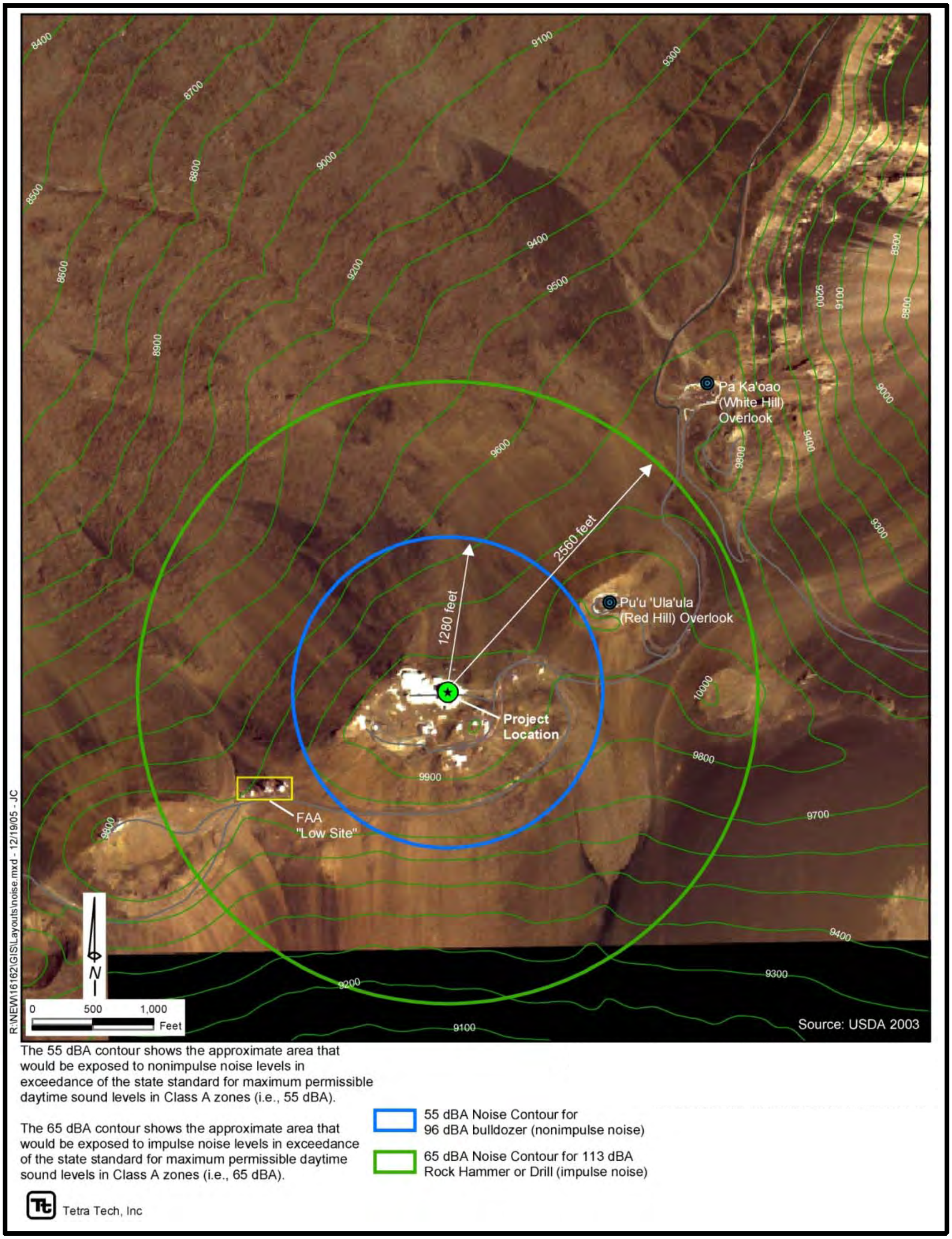


Figure 4-40. Impulse and Non-impulse Construction Noise Contours.

4.10.3 Evaluation of Potential Effects at the Reber Circle Site

DIRECT AND INDIRECT EFFECTS

Construction-Related Effects at the Reber Circle Site

Effects on ambient noise conditions at HO from construction at the Reber Circle site would be qualitatively similar to those described for the Mees site. However, because roughly twice the volume of site material would require excavation and stockpiling under the Reber Circle site (approximately 7,150 cubic yards versus 4,650 cubic yards under the Mees site), the duration of excavation stages of the proposed ATST Project and the frequency of haul trips required by heavy trucks between the job site and the soil stockpiles would be considerably greater. In addition, site development under the Reber Circle site would entail removing the remains of the concrete Reber Circle ring and the "rock building," using more frequent and intensive hammering and drilling than would be required at the Mees site. This would generate a higher daytime level of impulse noise emissions and concurrent, ground-borne vibrations at the summit during the interval required for removal of the concrete remains and "rock building" than is expected at the Mees site.

Therefore, construction at the Reber Circle site would result in a greater noise effect above area background levels initially relative to the Mees site. While the expected total interval of construction would be similar between the two alternatives, the higher magnitude of adverse effects from noise under the Reber Circle site would require a more enhanced noise reduction program by the contractor and wider implementation of source control mitigation measures to limit adverse effects on neighboring research facilities. Even so, adverse effects from noise under each of the two alternatives would be temporary and intermittent and would permanently elevate ambient noise levels at the summit. Moreover, the short-term nature of the construction phase of the proposed ATST Project would likely not adversely affect adjacent HO research personnel who work indoors and who would experience highly attenuated and low detectable adverse effects from project-produced ambient noise and ground-borne vibrations. The construction-related noise effects at the Reber Circle site would be slightly higher than that of the Mees site, and adverse effects would be major and long-term but would be reduced during nighttime periods between April 20th and July 15th by the aforementioned mitigation measures and BMPs.

Operations-Related Effects at the Reber Circle Site

Ambient noise quality and its effects from operations at the Reber Circle site would be essentially identical to those described for the Mees site. The primary difference between the sites would be the addition of a new backup generator, which for the Reber Circle site would be supplemental and would not constitute a replacement of the current generator at the existing MSO facility. Since this stationary unit would operate indoors only approximately 30 minutes per month for testing and during emergencies, the incremental effect in generator-emitted noise at HO would be negligible. Operations for the Reber Circle site would present minor, adverse effects on the summit and negligible, adverse effects on neighboring research facilities.

4.10.4 No-Action Alternative

DIRECT AND INDIRECT EFFECTS

There would be no change to existing conditions under the No-Action Alternative. There would be no construction introducing machinery-related noise intrusion to the area and no operational noise aside from existing sources. There would be negligible effects to noise conditions under the No-Action Alternative.

4.10.5 Summary of Effects on Noise

Effects of noise from the construction of the proposed ATST Project are anticipated to be minor and adverse. Adverse effects would be primarily from point source emitters such as machinery and equipment. These noise emissions would increase the existing ambient noise levels at the summit but would be temporary and intermittent. Trucks and mobile construction machinery would also raise ambient noise above background levels during the construction period. Due to the physical landscape and natural noise attenuation, it is concluded that those within the 65 dBA impulse noise contour of Figure 4-40 would be aware of audible construction activities. These sounds could affect Native Hawaiian cultural practitioners and those engaged in recreational activities within the 65 dBA impulse contour. Additional analyses of noise effects on traditional cultural practitioners is located in Section 4.2.2-Evaluation of Potential Effects at the Mees Site and noise effects on visitors is located in Section 4.6-Visitor Use and Experience.

Because non-authorized personnel are not allowed at HO, vehicular traffic levels would remain the same; therefore noise levels from these vehicles would not change from baseline levels. Personnel traveling to and from HO would use those roads and parking lots, thus vehicle-related noise would not be expanded to areas not already experiencing traffic sounds; negligible noise effects would occur within the ROI.

4.11 AIR QUALITY

The ROI for air quality effects is HO and the Park road corridor.

4.11.1 Methodology of Effect Assessment

The methods used to determine whether the proposed ATST Project would have a major effect on air quality are as follows:

1. Review and evaluate existing and past actions with respect to their effects on air quality from dust generation and emissions, in order to identify the action’s potential effect on air quality.
2. Review and evaluate each alternative with respect to human health and hazardous air pollutant industrial hygiene criteria, to identify its potential to adversely affect the air quality within and adjacent to HO and along the Park road corridor.
3. Assess the compliance of each alternative with applicable Federal, State, or County regulations promulgated by or remanded to the Hawai‘i Department of Health, and contained in the HAR.

The thresholds of change for the intensity of effects on air quality are defined as follows:

Effect Intensity	Intensity Description
Negligible	The proposed ATST Project would result in a change to air quality, but the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The proposed ATST Project would result in a change to air quality, but the change would be small and localized and of little consequence.
Moderate	The proposed ATST Project could result in a change to air quality; the change would be measurable and of consequence.
Major	The proposed ATST Project would result in a noticeable change to air quality; the change would be measurable and result in a severely adverse or major beneficial effect.
Duration:	**Short-term –** Effects last one year or less. **Long-term –** Effects last longer than one year.

4.11.2 Evaluation of Potential Effects at the Mees Site

DIRECT AND INDIRECT EFFECTS

Construction-Related Effects at the Mees Site

Site development and construction at the proposed Mees site, including excavating and grading approximately 4,650 cubic yards of native material, would generate some hazardous and nuisance air emissions. However, actual adverse effects on air quality at HO, based on proposed operations and regional meteorological conditions, are expected to be temporary, intermittent, and at levels substantially below both human health and hazardous air pollutant industrial hygiene criteria.

Use of construction vehicles and heavy equipment would result in low-level, intermittent exhaust emissions. These emissions would result from on-site work involving excavators, bulldozers, backhoes, graders, compactors, and cranes, as well as from petroleum-powered generators used to power various construction-related types of equipment. Other site development activities, such as welding and metalworking, would likewise generate minor quantities of hazardous air pollutants. Minor amounts of mobile source emissions would also result from occupational vehicle traffic accessing the project site. However, the actual increase in daytime traffic during construction periods, as compared to baseline HO operations, would not result in appreciable effects on air quality. Furthermore, vehicle emissions associated with the proposed ATST Project would be reduced by establishing worker carpools and shuttles to and from the job site, while construction equipment/machinery emissions would be mitigated by using proper emission-control technologies and standard exhaust filtration devices.

As noted above, site development at the proposed Mees site, including excavating and grading approximately 4,650 cubic yards of material, would likely generate detectable amounts of fugitive dust. Earthmoving and grading would generate the greatest amount of fugitive dust during construction. No explosive blasting would be used and only small quantities of concrete would be mixed on-site. In addition, the summit's persistent northeasterly trade winds would accelerate dispersion of emissions away from research facilities in the western portion of the HO complex.

To minimize fugitive dust emissions, contractors would be required to comply with applicable State regulations under HAR 11-60.1-33, which require the implementation of "reasonable precautions" for controlling fugitive dust (DOH, 2005). Operational practices by the Contractor would limit controllable emissions from site activities that could adversely affect the local air quality. These practices would be established through an ongoing program by Contractors to control fugitive dust by strictly adhering to the procedures imposed by the LRDP on construction projects at HO (UH IfA, 2005).

The following procedures and practices have been employed successfully for past projects and would be incorporated into the proposed ATST Project as mitigation measures to minimize fugitive dust, including those practices mandated by the LRDP:

1. Establish a written dust control plan that must be observed by all contractor personnel during the project. This plan would be implemented continuously, including during off-hours, weekends, and holidays.
2. Expose the smallest open excavation and stockpile areas possible at any time and halt dust-generating activities during high winds and storms. Expedited completion of the building's foundation would be encouraged.
3. Sprinkle or use similar water-application methods, especially to unpaved vehicle paths/roads, to keep disturbed finer material from becoming airborne.

4. Use catchments or filtering systems/devices when sanding, using power tools, or scraping structural surfaces to be painted.

5. Where practical, erect a designated on-site facility with wash racks to clean equipment and machinery before they are removed from construction zones.

Because contractors must truck in water to HO from sources below the summit, on-site application during construction would be localized and minimal. Therefore, the small volume of water applied to exposed ground surface would be allowed to infiltrate or evaporate and would likewise be carefully monitored to avoid off-site runoff. In addition, to reduce the generation of fugitive dust when hauling and stockpiling soil and fill material, contractors would cover all moving, open-bodied trucks and stockpiled materials. Traffic control measures, including vehicle speed controls, would also be imposed. Staging areas for stockpiled soil would be positioned away from active traffic routes and windblown exposure regions of the summit to minimize the potential for surface disturbances.

Since construction at the proposed Mees site would be taking place adjacent to dust-sensitive optical systems at other HO facilities, implementing the above-noted dust control measures would be a high priority. However, there is the potential for observation activities to be temporarily disrupted at nearby observatory facilities. This potential effect results from the proximity of the neighboring facilities and depends largely on the extent to which observations are made during the daytime and the degree to which their observation methods are influenced by suspended particulate matter. The minimum amount of suspended particulate matter from the proposed ATST Project is not expected to affect most observation methods at the summit.

Lastly, construction of the proposed ATST Project adjacent to the Mees site would not involve large-scale release of volatile HAZMAT into the environment. Under LRDP-imposed construction constraints, no oil or chemical treating may be used at the site for dust control. Implementation of the control measures and mitigation measure described above would minimize emissions from construction activities. Construction of the ATST would affect the air quality; however the changes would be small and localized resulting in minor, adverse, and short-term effects on air quality in HO and along the Park road corridor.

Operations-Related Effects at the Mees Site

There would be no additional effect on air quality from operations of the proposed ATST Project facility at the Mees site. Operations would not produce any major air emissions, and as a result, the facility would meet applicable Federal and State air quality standards. Consequently, as mandated in the LRDP for facilities with stationary sources exceeding threshold quantities of a regulated substance, an air quality risk management plan would not be required for the proposed ATST Project.

Approximately once every two years, the mirrors of the telescope would be stripped and cleaned and a restorative recoating would be applied to the reflective surface. As recorded for similar observatories at HO, non-reportable quantities of hazardous emissions could be released during mirror stripping and cleaning, based on the chemicals used (Section 3.8.2-Hazardous Materials). However, the levels of emissions are expected to be exempt from permitting under applicable State air pollution regulations codified in HAR 11-60.1-62(d). Moreover, there are no reported emissions of hazardous air pollutants associated with the recoating process, as it would be performed within a sealed chamber. Although commercial-size cylinders of compressed liquids and gases, particularly helium and nitrogen, would be used to reduce thermal buildup in optical equipment and instrumentation during proposed routine ATST operations, these natural atmospheric constituents present no potential for adverse environmental effects if accidentally released. Lastly, the approximately 200 pounds of refrigerants used for the compressor chiller would be zero ozone depleting hydro fluorocarbons, or blends thereof, such as R134a, R404a, and/or R410a.

In addition, there would be no significant change to current air quality conditions at HO and along the Park road corridor from vehicle traffic because the relative increase in daytime commuters accessing the facility would not appreciably add to the current level of vehicle use associated with existing HO operations and visitor traffic (Section 3.9.4-Roadways and Traffic). Meteorological conditions at the summit would also prevent noticeable effects from any small increase in the proposed ATST Project-related vehicle traffic. Although a backup generator powered by commercial-grade diesel fuel would be stationed on-site for use in the event of electrical outages, this equipment would be contained inside the Utility Building, would replace a smaller generator, and would be exempt from permitting, per State regulations under HAR 11-60.1-62(d)(7). Lastly, the approximately 1,400 gallons of synthesized hydrocarbon-based hydraulic oil expected to be used in the hydrostatic bearing system would result in insignificant air emissions since this oil is categorized as a non-volatile liquid at ambient conditions.

By employing the above practices to prevent or limit controllable emissions, there would be no appreciable effects on air quality. Therefore, there would be negligible, adverse, and short- or long-term effects on air quality from operations at the Mees site.

4.11.3 Evaluation of Potential Effects at the Reber Circle Site

DIRECT AND INDIRECT EFFECTS

Construction-Related Effects at the Reber Circle Site
Air quality and its effects from construction at the Reber Circle site are essentially identical to those described for the Mees site. Although roughly twice the volume of site material at the Reber Circle site would be excavated and stockpiled (approximately 7,150 cubic yards versus 4,650 cubic yards for the Mees site), the contractor would comply with State regulations under HAR 11-60.1-33. The contractor would implement strict dust control measures and Best Management Practices (BMPs) as mandated by the LRDP, which would likely result in negligible, adverse, and short-term effects on air quality at HO and no material adverse effects on neighboring research facilities.

Operations-Related Effects at the Reber Circle Site
Air quality and its effects from operations at the Reber Circle site are essentially identical to those described for the Mees site. However, for the Reber Circle site, a new commercial grade diesel fuel generator stationed within the Utility Building would not replace the current generator at the MSO facility, resulting in a net gain of one additional generator at HO. Although a new aboveground fuel storage tank would be installed at the Reber Circle site to power the backup generator, this tank would contain diesel fuel, a non-volatile product at ambient conditions and would be exempt from air permitting per State regulations under HAR 11-60.1-62(d)(2). Once in operation, activities for the proposed ATST Project would have negligible and adverse effects on air quality at HO and along the Park road corridor.

4.11.4 No-Action Alternative

DIRECT AND INDIRECT EFFECTS

Under the No-Action Alternative, there would be no site work or construction associated with this proposed Project, however other construction and development activities would continue as approved, resulting in similar effects as discussed for the proposed ATST Project. These activities would be held to the constraints and protocol outlined in the LRDP. Likewise, because ATST would not be built, there would be no additional mirror coating activities containing that emission source. Adverse effects to air quality for this alternative would remain, however they would be negligible.

4.11.5 Summary of Effects on Air Quality

Use of construction vehicles and heavy equipment would result in low-level, intermittent exhaust emissions. These emissions would generate minor amounts of hazardous air pollutants and mobile source emissions. However, these would not result in appreciable air quality effects at HO and along the Park road corridor, even compared to the low levels of emissions from baseline HO operations. In addition, there would be only minor, adverse, and short-term air quality effects from fugitive dust, which would be subject to rigorous mitigation measures, as described in the LRDP, that have already proven effective at HO.

4.12 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The ROI for determining the affected environment for socioeconomics and environmental justice is the island of Maui. This section describes the contribution of the proposed ATST Project to the economy and the sociological environment of the ROI, as well as any effects on minority or low-income communities or the health and safety of children within this region. The proposed ATST Project would be implemented on Maui, one of the four islands that make up Maui County. The socioeconomic indicators used for this study include the following:

1. Population and Housing,
2. Employment, Economy, and Income; and,
3. Education and Public Outreach.

Additionally, a discussion of environmental justice issues is presented in accordance with EO 12898, and a discussion relating to the protection of children from environmental health risks is presented in accordance with EO 13045.

For the purpose of this evaluation, the ROI is the geographic area selected as a basis on which social, economic, and environmental justice effects of project alternatives are analyzed. Each alternative was reviewed and evaluated to identify effects (beneficial or adverse) on conditions within the ROI. For example, the project alternatives may result in changes to the population, employment, and income. These effects may result in direct or indirect effects beyond the immediate project vicinity through housing for the facility personnel and their dependents, schooling for facility families, or in reverse by employing local residents on the island of Maui or in the State. Based on these criteria, the ROI for this evaluation is defined as the island of Maui.

4.12.1 Methodology of Effect Assessment

The methods used to determine whether the proposed ATST Project would have an effect on socioeconomics and environmental justice are as follows:

1. Review and evaluate existing and past actions with respect to their effects on socioeconomics and environmental justice to assist in identifying the proposed ATST Project's potential effect on socioeconomics and environmental justice.
2. Review and evaluate available data on socioeconomic indicators from state sources and the U.S Census for Maui and data from past and present actions that have lead to change in any social, economic, physical, environmental, or health conditions so as to disproportionately affect any particular low-income or minority group or disproportionately endanger children in areas on or near the project site or HO.

3. Assess the compliance of each alternative with applicable Federal, State, or County regulations.

In addition to Section 2.0-Proposed ATST Project and Alternatives, the following assumptions were used for the socioeconomic analysis of project effects:

1. The proposed ATST Project, whether at the Mees site or Reber Circle site, would need approximately 20 people for the first year of commissioning. This number is estimated to grow between 50 and 55 by the final year of commissioning.
2. Approximately 35 of the newly hired personnel would work on Maui and approximately half of them would be relocated from off-island locations to live on Maui while the proposed facility becomes operational.
3. The remaining 20 or so personnel would work for ATST remotely from either the IfA offices on Maui, on the UH Manoa Campus on Oʻahu, or from a mainland location.

Socioeconomics

The baseline year for socioeconomic data is 2000, the most recent year for which data for most of the socioeconomic indicators are available. When available, more recent data are used to best characterize the current socioeconomic conditions.

The island of Maui makes up 90 percent of Maui County, which encompasses three inhabited islands (Maui, Lanaʻi, and Molokaʻi) and one uninhabited island (Kahoʻolawe). Therefore, most economic activities can be tracked at the county level because of the way data are collected and compiled. Similarly, environmental justice issues identify low-income or minority communities at a county level for demographic tracking. Where possible, this section describes the socioeconomic characteristics and environmental justice issues at the island level to more accurately depict the most affected areas adjacent to the proposed ATST Project. Economic and demographic data of the State of Hawaiʻi was used for comparison.

As discussed in Section 1.0-Introduction, this EIS follows both Federal and State environmental review protocol. Public review periods were provided at the onset of the environmental evaluation process for scoping and in review of the EIS Preparation Notice (EISPN), as provided through OEQC. Specific comments were received during these periods requesting the following specific emphasis on socioeconomic and environmental justice issues be added to the EIS:

1. On-site staff and support facilities that would be generated by the proposed ATST Project;
2. Total number of jobs generated by the proposed ATST Project and the resultant amount of money infused into the local economy; and,
3. The resulting non-economic advantages that the proposed ATST Project would bring to Maui and Hawaiʻi.

These issues are evaluated below.

In order to determine the level of effect that may result on any resource as a result of the proposed ATST Project or a project alternative, the effect is compared against specific significance criteria identified at the onset of the evaluation. For the evaluation of socioeconomic conditions, significance is determined if the action would result in any of the following:

1. Substantial population growth or population concentrations.
2. Permanent population that exceeds official regional or local population projections.
3. Displacement of a substantial proportion of residents in a community.
4. A demand for additional housing that could not be sustained within the project area.
5. Substantially adversely affect expenditures or income associated with the planned project within the study area.
6. Cause a substantial decrease in local or area employment.
7. Displace or substantially disrupt businesses.

Environmental Justice and Protection of Children from Environmental Health or Safety Risks
Criteria considered in determining whether an alternative would have an effect on environmental justice included the extent or degree to which its implementation would change any social, economic, physical, environmental, or health conditions so as to disproportionately affect any particular low-income or minority group or disproportionately endanger children in areas on or near the project site or HO.

The thresholds of change for the intensity of an effect for socioeconomic resources, environmental justice and protection of children are defined as follows:

Effect Intensity	Intensity Description
Negligible	The proposed ATST Project would result in a change to socioeconomic resources, environmental justice and protection of children, but the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The proposed ATST Project would result in a change to socioeconomic resources, environmental justice and protection of children, but the change would be small and localized and of little consequence.
Moderate	The proposed ATST Project could result in a change to socioeconomic resources, environmental justice and protection of children; the change would be measurable and of consequence.
Major	The proposed ATST Project would result in a noticeable change to socioeconomic resources, environmental justice and protection of children; the change would be measurable and result in a severely adverse or major beneficial effect.
Duration: **Short-term –** occurs only during the proposed ATST Project. **Long-term –** occurs after the proposed ATST Project.	

4.12.2 Evaluation of Potential Effects at the Mees Site

DIRECT AND INDIRECT EFFECTS

Population and Housing
No major, adverse effects on population and housing are anticipated. Although approximately 25 to 30 people (half of the estimated personnel) proposed to work at ATST on Maui would be hired and brought in from off-island, this is not likely to significantly increase the demand for housing. The 2006 U.S. Census shows a vacancy rate of 23.6 percent for Maui County housing, with 15,015 vacant housing units (U.S. Census Bureau, 2006a). This small and localized demand is expected to be minor and of little consequence, compared to the annual increase in residents to the island of Maui, which has averaged approximately 2,600 per year since 1990 (County of Maui, 2006). At a 1.68 percent projected annual

population growth rate, the proposed ATST project's minor effect on population and housing would be short-term as the estimated number of people that would relocate to Maui is estimated to remain for only two to three years before being replaced by local employees. As many positions as possible would be filled from the growing number of available qualified Maui-based individuals. The permanent population would not exceed population projections, there would be no displacement of residents in their communities, and demand for housing can be accommodated with existing vacant housing units. Therefore, there would be a minor long-term effect on population and housing.

Employment, Economics, and Income

The proposed ATST Project at the Mees site would have minor beneficial, short-term effects on local economy and employment because it would temporarily increase employment and associated regional spending during the construction phase. The proposed ATST Project also would have a minor beneficial, long-term effect on employment, with an estimated 50 to 55 new hires by the final year of commissioning. Of the approximately 55 personnel, 35 people would be working on Maui and therefore would slightly increase the local spending. Half of this number would be hired locally at the onset of the operational phase. After two or three years, the other half of staffing, originally hired or relocated from off-island sources, would be replaced by local hires, resulting in a long-term beneficial effect on local employment. Effects would result in an increase in employment and spending that would be small and localized and of little consequence.

By contributing a service to the Maui-based industry without drawing on socioeconomic resources (i.e. schools or the housing demand), the 20 employees that would be working from either Oʻahu or the mainland would have a negligible beneficial, short-term effect on the economy of the ROI. The change in demand for socioeconomic resources would be so small that it would not be of any measurable or perceptible consequence. Development of the proposed ATST Project is anticipated to be approximately seven years, with a preliminary associated cost of $149,434,940 (in the 2004 dollar value).

Education and Outreach

The Mees site would have minor beneficial, long-term effects on the schools within the ROI. The estimated number of personnel and dependents relocating to is expected to be relatively small and temporary.

Local universities and schools would benefit from the generated data and research conducted at the HO. Additionally, local students at the Maui Community College (MCC) would benefit from the projects that they would be offered at the HO facilities and interactions with the scientific and technical staff.

Environmental Justice

The proposed ATST Project would have no adverse environmental justice effects. Change would be so small that it would not be of any measurable or perceptible consequence. The Mees site is in a Conservation District where no urban or rural population or housing is allowed. The potentially affected area is not a predominantly minority or low-income community, so none of the effects of construction and operation of the proposed ATST Project would disproportionately affect minority or low-income groups.

Protection of Children from Environmental Health or Safety Risks

The proposed ATST Project would not have disproportionate health and safety effects on children. Effects would be negligible and changes would be so small that it would not be of any measurable or perceptible consequence. The proposed ATST Project would be near HALE, where children may be present. However, fencing and other precautions would prevent children from gaining access to the site during construction. Although the HO site is not fenced, it is off-limits to the public. Children that would be allowed into HO would be accompanied by adults and supervised as part of a visiting group to HO facilities.

4.12.3 Evaluation of Potential Effects at the Reber Circle Site

DIRECT AND INDIRECT EFFECTS

Population and Housing

Potential effects on population and housing resulting from the Reber Circle site would be identical to those discussed under the Mees site, minor, adverse, and short-term effects. No adverse effects on the population and housing are anticipated. Effects are expected to be small and localized and would be minor and of little consequence.

Employment, Economics, and Income

Effects on employment, economics, and income under the Reber Circle site would be identical to that of the Mees site. The development duration of the proposed ATST Project and the estimated cost are the same as those for the Mees site. Minor beneficial, short-term effects would be realized during the construction phase, as shown on local vendor and materials hiring and spending. Minor beneficial, long-term effects to employment would result from operational staffing of the proposed ATST Project facility.

Education and Outreach

There would be no difference in effects between the Mees site and the Reber Circle site. No adverse effects are expected on the schools and community within the ROI.

Environmental Justice

The effect evaluation for environmental justice for the Reber Circle site is identical to that of the Mees site evaluation. No adverse effects on low-income or minority communities are anticipated.

Protection of Children from Environmental Health or Safety Risks

The effect evaluation for the protection of children for the Reber Circle site is identical to that of the Mees site evaluation. No adverse effects on children are anticipated.

4.12.4 No-Action Alternative

Population and Housing

Under the No-Action Alternative no new personnel would be relocated to Maui. There would be no new demand on the housing market and no increase in population beyond the natural annual influx. No adverse effects on the local population and housing would occur under the No-Action Alternative because existing conditions and operations would not change. Effects would be negligible.

Employment, Economics, and Income

Negligible adverse effects on the local economy and employment would occur under the No-Action Alternative because existing conditions and operations would not change. Similarly, none of the beneficial, short-term or long-term beneficial effects identified under each of the other proposed ATST Project alternatives would be realized under the No-Action Alternative.

Education and Outreach

The No-Action Alternative would have no adverse effect on the schools and community within the ROI because the existing conditions at the proposed site location would remain unchanged. Similarly, none of the beneficial short- or long-term effects identified under each of the other proposed ATST Project alternatives would be realized under the No-Action Alternative.

Environmental Justice
The No-Action Alternative would have no adverse effect on low-income or minority communities in the vicinity of the ROI because the existing conditions at the proposed site would remain unchanged.

Protection of Children from Environmental Health or Safety Risks
There would be no change in precautionary protocol around HO under the No-Action Alternative that may endanger the health or safety of children. No adverse effects would occur.

4.12.5 Summary of Effects on Socioeconomics and Environmental Justice

The proposed ATST Project, whether located at the Mees site or the Reber Circle site, would need approximately 20 people for the first year of commissioning. This number is estimated to increase up to a number between 50 and 55 by the final year of commissioning. Approximately two-thirds of the newly hired personnel would work on site on Maui with the remaining personnel working for the proposed ATST Project remotely from either Maui or the UH Manoa campus on Oʻahu. No adverse effects on population and housing are anticipated from this addition to the work force, e.g., they would not likely be a major increase in the demand for housing. There would be a minor, adverse, and short-term effect on housing The proposed ATST Project would have both short- and long-term beneficial effects on the local economy and employment.

The proposed ATST Project would not result in adverse effects on the schools within the ROI. Local universities and schools would experience a minor benefit from the research conducted at HO and from internships, post-doctoral fellowships and other student programs.

The proposed ATST Project would have no adverse effects on environmental justice to children because it would be constructed in a Conservation District where no urban or rural population is allowed.

4.13 PUBLIC SERVICES AND FACILITIES

The ROI for public services and facilities includes HO and the Park road corridor. Due to its remote location near the summit of Haleakalā, HO is 22 miles from the nearest public services and facilities. The nearest school is in Kula, approximately 27 miles from HO, as is the nearest healthcare facility. With a travel time of nearly an hour to the closest police or fire stations, the facilities at HO are unable to utilize timely services from Maui public departments. Therefore HO is considered to be independent of most public services and facilities.

4.13.1 Methodology of Effect Assessment

The methods used to determine whether the proposed ATST Project would have a major effect on public services and facilities are as follows:

1. Review and evaluate existing and past actions with respect to their effects on police protection, fire protection, schools, recreational facilities, healthcare services and the FAA facility to identify the proposed ATST Project's potential effect on public services and facilities.
2. Review and evaluate the anticipated effects on public services based on publicly available information about those services on Maui in view of the number of personnel at the proposed ATST Project and the distances to those public services, to identify each alternative's potential to involve substantial secondary effects, such as effects on public facilities at locations within and outside HO.

3. Assess the compliance of each alternative with applicable Federal, State, or County regulations concerning police and fire protection, and the Code of Federal Regulations governing FAA operations.

The thresholds of change for the intensity of an effect for public services and facilities are defined as follows:

Effect Intensity	Intensity Description
Negligible	The proposed ATST Project would result in a change to public services and facilities, but the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The proposed ATST Project would result in a change to public services and facilities, but the change would be small and localized and of little consequence.
Moderate	The proposed ATST Project could result in a change to public services and facilities, the change would be measurable and of consequence.
Major	The proposed ATST Project that would result in a noticeable change to public services and facilities; the change would be measurable and result in a severely adverse or major beneficial effect.
Duration:	**Short-term –** occurs only during the proposed ATST Project. **Long-term –** occurs after the proposed ATST Project.

4.13.2 Evaluation of Potential Effects at the Mees Site

DIRECT AND INDIRECT EFFECTS

Police Protection

The nearest police substation is located in Kula, which is the community closest to the summit of Haleakalā but still approximately 22 miles away. Therefore, HALE rangers are the designated policing authority within HALE and the Maui Police Department (MPD) has no jurisdiction over Park activities. Park rangers would be required to continue to respond to emergency needs on the Park road corridor and, as has been the case on occasion, assist HO personnel with emergency needs. It is not anticipated the proposed ATST Project would affect MPD operations. Police communication facilities in the summit area would not be affected by the construction or operations of the proposed ATST Project at either the Mees or Reber Circle sites. The few extra vehicles on the road during construction and operation of the proposed ATST Project in comparison with the approximately 1,600 vehicles that ascend the summit each day would not appreciably increase demands on Park rangers or MPD services. Park rangers or MPD would experience negligible, adverse, and long-term effects as a result of immeasurable and imperceptible changes brought on by the proposed ATST Project.

Fire Protection

The closest fire station is located in Kula approximately 28 miles away from the summit of Haleakalā. Another fire station serving the Upcountry community is located in Makawao, approximately 29 miles from the summit. These two fire stations, although the closest to HO and the Park road corridor, would be beyond fire fighting capabilities for both. In the event of a wildlife fire, National Park Wildlife Firefighters comprised of a militia of approximately 10 to 12 certified, wildland firefighters residing on Maui would undertake this responsibility (see Section 3.13.2-Fire Protection). Therefore there are negligible, adverse, and long-term effects anticipated from the proposed ATST Project on these services at either the either the Mees or Reber Circle site locations. The ATST facility would be equipped with standard fire prevention and fire fighting capabilities required for the nature of its activities and type of facility. The few extra vehicles on the road during construction and operation of the proposed ATST Project in comparison with the approximately 1,600 vehicles that ascend the summit each day would pose negligible, adverse, and long-term demands on fire protection services. Changes would be so small that it would not be of any measurable or perceptible consequence.

Schools

The closest schools to the proposed ATST Project are located in the Kula community (Haleakalā Waldorf School, King Kekaulike High School, Kula Elementary, the Carden Academy**,** and the Kamehameha Schools) and are approximately 25 to 27 miles from the summit of Haleakalā and the Park road corridor. Negligible, adverse, and long-term effects are anticipated from construction or operation of the proposed ATST Project. Changes would be so small that it would not be of any measurable or perceptible consequence.

Recreational Facilities

As described in Section 3.13.4-Recreational Facilities, the Haleakalā Visitor Center of HALE is located approximately two-thirds of a mile east of HO and is one of the main points of attraction for visitors to the mountain. Besides boasting a magnificent view of the crater, the Haleakalā Visitor Center also details the geology, archeology, and ecology of the area as well as the wilderness protection programs in exhibits posted throughout the area. The proposed ATST Project would not be visible from the overlook itself, but would be visible from the parking area. The proposed ATST Project would appear amongst the other HO observatories visible from that location and at various locations along the Park road and given the large visitor population and heavy traffic the adverse effect of an additional observatory would be minor and long-term for those who see it. Orientation panels and descriptive displays are located at Leleiwi and Kalahaku overlooks and the proposed ATST Project would not be visible from either of those vistas.

Puʻu Ulaʻula Overlook, located about 0.3 mile east of HO along the Park road between the Haleakalā Visitor Center and the summit, is a major visitor attraction. From this vantage point, the proposed ATST Project would be visible from the overlook when looking to the southwest. The proposed ATST Project would appear taller than the AEOS facility at either of the sites in HO, and the telescope carousel and enclosure would be white in color. The degree to which the visual effect of the facility would be adverse would again be subjective, based on one's beliefs and feelings about a place for astronomical facilities within a conservation setting.

The nearby Skyline Trail begins at the 9,750-foot elevation at the lowest point of the paved access road near the Saddle Area and continues for about 6.5 miles, ending at the Polipoli Spring State Recreation Area. Trails through the area are open to the public for hiking and related recreational activities, except during times of extreme fire danger. The upper carousel of the proposed ATST Project would be visible along some portions of the upper third of this trail, but not from the lower two thirds.

As discussed in Section 4.6-Visitor Use and Experience, the proposed ATST Project would have moderate, adverse, and long-term effects on recreational facilities due to a change in visual resources. The change would be noticeable at various locations in HALE as described in Section 4.5. No access to any HALE or State Conservation Land facilities, including the Park road corridor, would be blocked or impeded, and no trails would be eliminated or re-routed.

Healthcare Services

The closest healthcare facility is the Kula Hospital and Clinic which, along with its limited acute-care services, began to provide urgent care and limited rural emergency care on a 24-hour, 7-day a week basis on October 31, 2005. Negligible, adverse, and long-term effects on this facility or the much more distant Maui Memorial Hospital are anticipated. There are also emergency medical service stations located in

Kula and Makawao, which dispatch emergency medical care. The proposed ATST Project would not affect Healthcare services. Changes would be of immeasurable or imperceptible consequence and, therefore effects on Park resources is not expected.

Federal Aviation Administration
In response to a request for concurrence to NSF's determination of negligible, adverse effect, the FAA issued a Notice of Presumed Hazard in October 2007, suggesting that the proposed ATST Project would result in radio frequency shadowing at the FAA RCAG facility located about 800 feet to the West of the proposed ATST Project. In accordance with 14 CFR Part 77.35, FAA specialists working with NSF will address any potential issue involving a degradation of signal as a result of the proposed ATST Project. If there is such a degradation of signal, a resolution of the issue will be developed and accompanied by the appropriate level of NEPA compliance. In addition, NSF will work with the FAA to obtain adequate funding for implementation of the resolution. This would reduce the effects to negligible, adverse, and long-term.

4.13.3 Evaluation of Potential Effects at the Reber Circle Site

DIRECT AND INDIRECT EFFECTS

Effects for the Reber Circle site would be identical to those discussed for the Mees site. There would be negligible, adverse, and long-term effects on most public services and facilities, such as police and fire protection, schools, and healthcare services. The proposed ATST Project would result in immeasurable and imperceptible changes.

For recreational facilities, minor, adverse, and long-term effects can be expected. The proposed ATST Project would be the tallest structure in HO if placed at the Reber Circle site and would be visible from the Puʻu Ulaʻula Overlook when looking to the southwest. Although there is an effect, it is not considered major as this viewshed has included the HO complex and facilities prior to the proposed introduction of ATST. ATST would be additive, however would not obstruct an otherwise pristine view; thus, the effect would be minor, adverse, and long-term and, therefore effects on Park resources is not expected.

4.13.4 No-Action Alternative

If the proposed ATST Project were not constructed, there would be negligible, adverse, and long-term effects on public services and facilities. There would be no measurable or perceptible consequence as a result of the No-Action Alternative. The Puʻu Ulaʻula Overlook would not have an additional facility within its viewshed and the Skyline Trail would not have a view of the upper portions of the facility from locations along the upper third of the trail.

4.13.5 Summary of Effects on Public Services and Facilities

With its remote location near the summit of Haleakalā, HO is 22 miles from the nearest public services and facilities. With a travel time of nearly an hour to the closest police or fire stations, the facilities at HO are unable to utilize timely services from these Maui public departments. The nearest schools are in Kula, approximately 25 to 27 miles from HO, as is the nearest healthcare facility. The proposed ATST Project would have negligible, adverse, and long-term effects on these services. Changes would be so small that it would not be of any measurable or perceptible consequence. However, there are recreational facilities within a short distance from both the Mees and Reber Circle sites, and construction and operation of the proposed ATST Project would have some visual effect on those facilities, but no effect on trail access, or access to recreational facilities hosted by HALE or on State Conservation lands. Minor, adverse, and long-term effects can be expected for recreational facilities. Changes would be small and localized and of little consequence.

4.14 NATURAL HAZARDS

The ROI for natural hazards includes HO and the Park road corridor.

4.14.1 Methodology of Effect Assessment

The methods used to determine whether the proposed ATST Project would have a major effect on natural hazards are as follows:

1. Review and evaluate existing and past actions with respect to earthquakes, hurricanes and other storms, hypoxia, and extreme temperatures to identify the potential effect of natural hazards on the proposed ATST Project or the proposed ATST Project on environmentally-sensitive areas.
2. Review and evaluate each alternative with respect to available earthquake, storm, and temperature data from HO, and reports of hypoxia to identify its potential to adversely affect the nature of natural hazards within and adjacent to HO and the Park road corridor, and for natural hazards to affect the proposed ATST Project, including damage, destruction, and loss of life.
3. Assess the compliance of each alternative with applicable Federal, State, or County regulations for seismic design factors and the International Building Code for design and construction.

The thresholds of change for the intensity of effects on natural hazards are defined as follows:

Effect Intensity	Intensity Description
Negligible	The proposed ATST Project would be affected by natural hazards or the proposed ATST Project would affect the nature of natural hazards, but the effect would be so small that it would not be of any measurable or perceptible consequence.
Minor	The proposed ATST Project would be affected by natural hazards or the proposed ATST Project would affect the nature of natural hazards, but the change would be small and localized and of little consequence.
Moderate	The proposed ATST Project would be affected by natural hazards or the proposed ATST Project would affect the nature of natural hazards, the effects would be measurable and of consequence.
Major	The proposed ATST Project would be noticeably affected by natural hazards or the proposed ATST Project would noticeably affect the nature of the natural hazards; the effects would be measurable and result in a severely adverse or major beneficial effect.
Duration:	**Short-term –** Effects last one year or less. **Long-term –** Effects last longer than one year.

4.14.2 Evaluation of Potential Effects at the Mees Site

DIRECT AND INDIRECT EFFECTS

The potential natural hazards at HO are high winds, extreme rain, ice, and snow due to storms or hurricanes; earthquakes due to Hawaii's position within a seismically active zone; and, hypoxia due to the high altitude of the site. Incidence of naturally occurring events including severe weather conditions has the potential to affect the HO site and health and safety of personnel at any time. When conditions become critical and serious to warrant protection of human life, HALE takes precautionary measures to prevent or minimize the effects of natural hazards by closing HALE during severe weather events.

The potential effects from seismic activity vary depending on the magnitude of an earthquake. A Preliminary Seismic Design Analysis was prepared by the ATST Project team to determine the seismic design factors to be used in the General Specification (SPEC-0070) for the ATST Project. The 2006 edition of the International Building Code was designated as the primary reference for the preliminary seismic hazard analysis and would be the contractually enforced, life-safety code that architecture and engineering firms would be required to comply with for the entire ATST facility design (NSO, 2007). Designing and constructing the ATST in accordance with the General Specifications based on seismic design analysis conducted by NSO is expected to be adequate protection from potential seismic events.

Altitude-related conditions, including hypoxia is a potential affect experienced by some personnel working at the summit. Working at high altitudes requires proper planning, specialized training and adequate equipment. As required of all personnel working at HO, employees of the proposed ATST Project, both during construction and operation, would be required to attend training prior to beginning work at the site.

The construction and operation of the proposed ATST Project would have a negligible, adverse effect on the safety of the public and adverse effects on the environment would be negligible such as to cause damage, destruction, or loss of life.

4.14.3 Evaluation of Potential Effects at the Reber Circle Site

DIRECT AND INDIRECT EFFECTS

The effects from natural hazards at the Reber Circle site would be identical to those identified for the Mees site. There would be negligible, adverse effects experienced at either project location.

4.14.4 No-Action Alternative

There would be no change from existing conditions under the No-Action Alternative and no mitigations would be necessary.

4.14.5 Summary of Effects From Natural Hazards

Any of the natural hazards that have been identified as a risk to HO may affect the proposed ATST Project and its personnel at any time. Architects and engineers would be required to use seismic design factors and comply with the 2006 International Building Code for design and construction of the proposed ATST Project. All HO contractors and operations staff would be trained on the natural hazards unique to the site in order to minimize potential injuries. Therefore, the construction and operation of the proposed ATST Project would have negligible, adverse effects on the safety of the public and adverse effects on the environment would be negligible such as to cause damage, destruction, or loss of life.

4.15 SUMMARY OF POTENTIAL EFFECTS OF THE PROPOSED ATST PROJECT

The evaluation of whether effects are collectively significant begins with the characterization of the effects from the proposed ATST Project itself. Sections 4.1 to 4.14 describe these effects. These include both adverse and beneficial effects on resources within the ROI for the proposed ATST Project, whether implemented at the Mees site or the Reber Circle site. The proposed ATST Project would result in a variety of effects, some mitigable and some not.

4.16 OTHER REQUIRED ANALYSES

In addition to the analyses discussed in Sections 3.0-Description of Affected Environment and 4.0-Summary of Environmental Consequences, Cumulative Effects, and Mitigation, NEPA requires additional evaluation of the proposed ATST Project's effects with regard to the following:

1. The relationship between local short-term uses of the environment and long-term productivity; and,

2. Any irreversible or irretrievable commitment of resources.

4.16.1 Relationship Between Local Short-Term Uses of the Environment and Long-Term Productivity

Short-term uses of the environment for implementation of the proposed ATST Project at either the Mees site or the Reber Circle site would be limited. The long-term productivity of either of the proposed ATST Project alternatives is based on NSF's mission, specifically its objective to promote science and technology – here, to progress solar observation. Any measurement of long-term productivity in this context must include the overriding importance of advancing knowledge of the Sun, both as an astronomical object and as the dominant external influence on Earth, by providing forefront observational opportunities to the research community. While NSF would take whatever actions are reasonable and practicable to preserve and protect the natural environment under its stewardship, by advancing the knowledge of solar function and meeting the objectives discussed in Section 1.0-Introduction, NSF has the ability to make significant advances in what we know about solar history, developments, and functions. The Project alternatives are designed to meet these goals.

4.16.2 Irreversible and Irretrievable Commitments of Resources

NEPA requires an analysis of the extent to which the proposed project's primary and secondary effects would commit non-renewable resources to uses that would be irreversible or irretrievable to future generations. A commitment would be irreversible when primary or secondary effects limit the future options for a resource. An irretrievable commitment refers to these or consumption of resources neither renewable nor recoverable for future use. Construction of the proposed ATST Project would consume energy and building materials.

Petroleum, oils, and fuels would be used by construction vehicles and equipment and by staff vehicles during operation. Furthermore, equipment used in the facility would require lubricants, oils, and solvents. Construction material such as steel, cement and aggregate would be expended. There would be increases in water, power, and other resources necessary to maintain and operate new facilities and machinery. Finally, there would be a slight increase in local resources required to support the additional staff and their families. These physical resources are generally in sufficient supply and their commitment to the proposed ATST Project would not have an adverse effect on their availability. In some cases, certain material resources such as concrete, steel, or water could be reclaimed, recycled, and reused.

In terms of human resources, trade and non-skilled laborers would be used during the development, construction, and operations of the proposed ATST Project. Labor is generally not considered to be a resource in short supply and the proposed ATST Project would not have an adverse effect on the continued availability of these resources.

4.17 CUMULATIVE EFFECTS TO THE AFFECTED ENVIRONMENT

The impacts of the proposed ATST Project were examined together with the impacts from past, present, and reasonably foreseeable activities within the ROI for each resource. An introduction to the regulatory guidance used to identify temporal and geographic boundaries for cumulative effects is presented; those boundaries are listed, as are the agencies contacted to identify future activities within the ROI for each resource. To assist in determining the scope of cumulative effects, a brief summary of past, present, and reasonably foreseeable future actions within the relevant ROI is presented in Sections 4.17.1 to 4.17.3. Detailed discussion of the cumulative effects resulting from the proposed ATST Project is presented in Sections 4.17.4 to 4.17.17.

The CEQ NEPA-implementing regulations define cumulative effects as the incremental environmental effects of the proposed ATST Project when added to other "past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions." Cumulative effects can result from individually minor, but collectively significant, actions taking place over time. Although all cumulative impacts were analyzed in this SDEIS, during the scoping process for this EIS, NSF consulted with interested agencies and the public, who identified the following cumulative effect concerns associated with the proposed ATST Project: the ‘ua‘u and its habitat on Haleakalā, the central role of Haleakalā in the cultural and spiritual life of Native Hawaiians, the visual effect of the proposed ATST Project on the viewshed from Haleakalā National Park (HALE) and from lower elevations on Maui, the use of electrical power; and, increased traffic to and from the summit.

Guidance for implementing NEPA recommends that Federal agencies identify the temporal and geographic boundaries of the potential cumulative effects of the proposed ATST Project (CEQ, 1997). For the purposes of this evaluation, the temporal boundary of analysis extends from 1964, when the Mees Solar Observatory (MSO) facility was constructed at HO, until such time when it is anticipated that a lease agreement between the University of Hawai‘i (UH) and the National Solar Observatory (NSO) would end, if the proposed ATST Project is constructed and becomes operational. The geographic boundaries of analysis vary depending on the relevant ROI for each resource. For most resources, the analysis area is the same as introduced in the resource-specific affected environment sections, primarily characterized by the boundaries of the Haleakalā High Altitude Observatory (HO) complex and the Park road corridor. Reasonable geographic boundaries for each Region of Influence (ROI) are specified for each of the potentially affected resources of the proposed ATST Project, as follows:

1. Land Use: HO and the Park road corridor.
2. Cultural, Historic and Archeological Resources: HO, summit area within HALE, and the Park road corridor.
3. Biological Resources: HO and the Park road corridor.
4. Topography, Geology, and Soils: HO and the Park road corridor.
5. Visual Resources and View Plane: Portions of the Maui landmass, HO, the Park road corridor, and other areas within HALE from which structures within HO are visible.
6. Visitor Use and Experience: The Park road corridor and areas within HALE from which structures within HO are visible and from which noise generated by activities related to the proposed ATST Project could be heard.
7. Water: HO and the Park road corridor, which are both within the Waiakoa and Manawainui Gulch watersheds and Kahikinui Aquifer system.

8. Hazardous Materials and Solid Waste: HO, the Park road corridor, and a portion of the State highway leading up to the Park road corridor.
9. Infrastructure and Utilities: HO and the Park road corridor. The ROI for utilities is focused on HO, which is separately served by Maui Electrical Company and Hawaiian Telecon.
10. Noise: HO and the Park road corridor.
11. Air Quality: HO, areas within HALE from which noise generated by the proposed ATST Project could be heard, and the Park road corridor.
12. Socioeconomics and Environmental Justice: Island of Maui.
13. Public Services and Facilities: HO and the Park road corridor.
14. Natural Hazards: HO and the Park road corridor.

Proposed projects identified in the Institute for Astronomy's (IfA) Long Range Development Plan (LRDP) and information from HALE was used to identify other actions for consideration in this cumulative effects analysis.

In November 2005, and again in February of 2009, agencies known to have facilities and operations within the ROI for the resource-specific affected environments were contacted with a request to provide information on current and planned activities that could occur within the reasonably known future and contribute to cumulative effects when considered with the proposed ATST Project at HO (KCE, 2005 and 2009). The agencies were:

1. County of Maui Police Department, Telecommunications
2. Department of Energy
3. Federal Aviation Administration
4. Federal Bureau of Investigation
5. Haleakalā National Park
6. Hawaiian Telcom
7. State of Hawai‘i Department of Accounting and General Services Public Works,
Information and Communications Services Division
8. Maui Electric Company
9. DLNR Maui Na Ala Hele
10. National Weather Service/National Oceanic & Atmospheric Administration (NOAA)
11. Raycom Media, Inc.
12. Sandia Laboratories
13. U.S. Coast Guard, Civil Engineering Unit
14. U.S. Air Force Research Laboratory

4.17.1 Past Actions at HO and Adjacent Neighbors

Within the ROI, the past history and important events at HO and those of its adjacent neighbors are described in Table 1-2 and an aggregate view of those facilities is shown in Figure 1-5. The past history of facilities along the Park road corridor and important events is described in detail in the National Park Service Cultural Landscapes Inventory 2008 (CLI, 2008). Past, present, and reasonably foreseeable future actions with effects associated with the proposed ATST Project considered are described in Table 4-7.

Table 4-7. Past, Present, and Reasonably Foreseeable Future Actions Associated With HO and Adjacent Neighbors.

Facility	Status	Reasonably Foreseeable Future Actions
Mees Solar Observatory	1966, currently used	Remain as-is, or be replaced by the proposed ATST Project
Atmospheric Airglow	1961, currently used	Remain as-is, or be replaced by Pan-STARRS or the proposed ATST Project
Zodiacal Light	1961, currently used	Remain as-is
Cosmic Ray Neutron Monitor Station	1961, currently inactive	To Be Determined
Baker-Nunn Site	1957, currently used	Remain as-is
Faulkes Telescope Facility	2003, currently used	Remain as-is
Pan-STARRS, PS-1 South	June 2007, currently used	Remain as-is (was formerly Lunar Ranging Experiment facility)
PS-2 North, 2nd Facility	2009, currently used	Remain as-is
Maui Space Surveillance Complex	Construction occurred over several years since 1963, currently used	Remain as-is
SLR-2000	Proposed	Reuse of site behind Mees facilityfor Laser Ranging
Haleakalā Visitor Center Comfort Station	Renovations in 2002	Upgrades to water and wastewater treatment system
HALE road cattle guards	Built 2006	HALE project. Edge of HALE road. Installed cattle guard to prevent feral goats from entering Park summit area from State land
FAA site adjacent to HO, Homeland Security tower	Constructed in 2006	Remain as-is
Maui Electric Co., Inc.	Proposed upgrades	Replace transformers, voltage regulators, upgrade and relocate substation for proposed ATST Project. Combined with the proposed ATST Project for effects.
Hawaiian Telcom	2007	Repair to damaged/exposed conduits
(Roadway)	Early 2009	Repair to 0.3 miles of Saddle access road
HALE road cattle guard	Early 2009	Installed cattle guard to prevent feral goats from entering Park summit area from State land.
HALE road Chip Sealing	January 2009	HALE road surfacing on upper miles, canceled due to potential adverse effect on ‘ua‘u burrows.

The history of HO is considered to have begun with Grote Reber, one of the pioneers of radio astronomy, when he experimented with radio interferometry using a large, steel and wood truss antenna at what is now called Reber Circle. The site was abandoned approximately one year later. In 1961, Governor Quinn set aside 18.1 acres of land on the summit to establish the HO site, in a place known as Kolekole to be under the control and management of the IfA for scientific purposes.

Observatories were constructed at HO beginning in 1957, with the establishment of a Baker-Nunn camera to obtain satellite tracking information. Over the next 50 years, a number of facilities were constructed for various astronomical and space surveillance activities. The first of these was the MSSC, which was built in 1963 as the Advanced Research Projects Agency (ARPA) Maui Optical Station (AMOS), The second facility built in 1964 was the MSO, named after Dr. C. Kenneth Mees of Eastman Kodak. About the same time, IfA was created as a separate entity within UH. Subsequently, the Airglow and Zodiacal Light programs were established in the facilities left behind by Dr. Reber, and a new Airglow facility was constructed in 1972.

Mees Solar Observatory was followed by the Lunar and Satellite Ranging Observatory (LURE), and the Cosmic Ray Neutron Monitor in 1974 and 1991 respectively. The AMOS facility was extensively modified and expanded between 1982 and 1995, with the addition of the Ground Based Electro-Optical Deep Space Surveillance (GEODSS) facility, and the Advanced Electro-Optical System (AEOS) facility in 1994.

Finally, in 1998 the University of Tokyo installed a 2-meter telescope in the north dome of the LURE complex, followed in 2004 by the Faulkes Telescope Facility (FTF) for educational outreach, and the two Panoramic-Survey Telescope and Rapid Response Systems (Pan-STARRS), designated PS-1 and PS-2, for the study of a wide range of astronomy and astrophysical problems in the Solar System, the Galaxy, and the Universe.

The following is a list of past construction of facilities and events in the past that did not occur within HO. These are:

1. The recently built Coast Guard tower on adjacent Federal Aviation Administration (FAA) property.
2. The RCAG facility, also on FAA property.
3. Road repairs in 2009 to the 0.3 mile section of the “Saddle” road to TV, microwave, and FAA facilities.
4. The MECO substation for electrical distribution on Kolekole.
5. Repairs to exposed cables on Kolekole by Hawaiian Telecom.

HALE, Park Road Corridor

For the purpose of this description and analysis, the Park road corridor consists of the Park road plus the area measuring out to 50 feet from each side of the road, including the historic bridge and multiple culverts. The physical history of the Park road corridor is described in the Cultural Landscape Inventory completed in 2008 (CLI, 2008) and detailed in Section 3.

In the 1960’s, HALE was the beneficiary of the Mission 66 Program, which was a high profile, ten-year nationwide initiative aimed at modernizing the Park Service and accommodating changing visitation patterns. The program was so-named because it would conclude in 1966 and commemorate the Service’s

50th anniversary year. The years of neglect brought about by the economic climate of the war years left many of the Park Service facilities in substandard condition. (Jackson).

The The most notable additions to the Park road corridor during that period were the Leleiwi Overlook, which is another location from which visitors can view the crater, the Kalahaku Overlook structure and rock wall along the Haleakalā silversword (ʻahinahina) enclosure, Puʻu ʻUlaʻula Summit Observatory, where an observation structure was placed at the top of the summit that provided spectacular views into the crater, as well as the 180-degree view of the island and ocean below and Hosmer Grove Area, a pine tree campsite near the entry to HALE.

More recently, Haleakalā Park road was a narrow, one-and-a-half lane road as late as the 1970s. The road was entirely resurfaced in a three-phase project that began in 1976 and was completed in the early 1980s. The large increase in traffic, especially buses, since the 1976 to 1980 time frame. The Haleakalā Park road was resurfaced in October 1999. This project added a pullout just before the Halemauʻu Trailhead and used the excavated materials to stabilize portions of the shoulder that were badly eroded. The excavated material also allowed the Park Service to enlarge a pullout near the turn at the 8,500-foot elevation.

Another notable action during the recent history of the Park road corridor was the upgrade to the restroom facilities at the Haleakalā Visitor Center, which were rebuilt to take advantage of surface water capture on the Park road and surrounding impervious surfaces. According to the excavation contractor, photographs show the excavation for this upgrade project at the eastern end of the Haleakalā Visitor Center parking area was 50 feet deep and more than 100 feet wide (B. Simison, personal communication).

4.17.2 Present Actions at HO and Adjacent Neighbors

HO and Adjacent Neighbor Activities

The present actions of HO are described in Table 1-3. The U.S. Air Force Maui Space Surveillance Complex (MSSC) occupies 4.5 acres of the HO complex. MSSC conducts optical space surveillance and sensor research for the Department of Defense. Attached to MSSC is the Ground Based Electro-Optical Deep Space Surveillance Complex (GEODSS) which conducts space surveillance operations focusing on the deep space regime.

Within the remaining approximately 13.5 acres, the Mees Solar Observatory of the Institute for Astronomy conducts investigations of the solar corona and chromospheres. The Zodiacal Observatory houses the test-bed Scatter-free Observatory for Limb Active Regions and Coronae (SOLAR-C) Telescope Facility. The two Pan-STARRS telescopes house a 1.8-meter wide-field optical imaging system equipped with a 1.44-billion pixel charge-coupled device camera. This unique combination of sensitivity and field-of-view address a wide range of time-domain astronomy and astrophysical problems.

Since 2004, the Faulkes Telescope Facility has been the largest educational outreach optical telescope in the world in support of astronomy research and education for grades Kindergarten through college in Hawaiʻi and the United Kingdom.

The Federal Aviation Administration operates and maintains a rectangular 2.96-acre property along the southwest boundary of HO, which is referred to as the Haleakalā Peripheral High Site. The site is dedicated to remote air/ground interisland and trans-Pacific communications to and from aircraft. A small support building on the rectangular site contains transmitter and electronic equipment, in support of multiple dipole antennas on two towers to the east of the support building. In addition to the FAA towers, the U.S. Coast Guard maintains a 100-foot lattice tower structure that is approximately 12-feet wide at its base. The tower houses various antennas that are used for government services, such as Homeland

Security. Another neighboring facility is a MECO substation for distribution of electrical power to facilities on Kolekole

HALE, Park Road Corridor
The corridor along the Park road is currently owned and managed by the NPS. It begins at the HALE entrance boundary at the northwestern corner of the Park and ascends the northwest slopes of the Haleakalā Crater with a series of switchbacks. Hosmer Grove, Park Headquarters Visitor Center, Halemau'u Trailhead, Leleiwi Overlook, Kalahaku Overlook, Haleakalā Visitor Center (or Pa Ka'oao Observation Station), and Pu'u' Ula'ula Overlook are all accessed from the road. Significant vehicular and bus traffic traverse the Park road each year. In 2007, there were 248,224 vehicular visits and approximately 3,650 buses that traversed the Park road; in 2008, there were 205,977 vehicular visits and approximately 6,570 buses (FHWA, 2008).

4.17.3 Reasonably Foreseeable Future Actions at HO and Adjacent Neighbors

HO and Adjacent Neighbor
Currently there is only one planned action within the foreseeable future at HO. The SLR 2000 is to be installed on the southwestern side of the MSO is an autonomous and eye-safe photon-counting Satellite Laser Ranging station.

HALE, Park Road Corridor
Currently there are no planned actions within the reasonably foreseeable future at HALE along the Park road corridor.

Actions Within Greater Maui
It would be difficult to predict which commercial and residential project would be proposed and/or permitted during the seven-year period when the proposed ATST would be under construction. However, the, County of Maui, Maui Island Plan for development (County of Maui, 2009) would be the framework that provides a guide for the future growth of the island to the year 2030. When finalized, the Maui Island Plan will establish a vision and a set of long-range guiding principles, goals, objectives, policies and maps to guide the growth and development of the island. The guidelines in the Maui island Plan specify where growth would be concentrated on the island. The draft plan would guide future development of commercial and residential projects within individual areas of Maui as shown below. The plan calls for a total of approximately 25,850 acres of planned urban expansion, new towns or high-density in-fill between now and 2030.

West Maui Pulelehua—New town Villages of Leiali'i—Develope Hawaiian Homelands Weinberg Development—new housing Wainee—Expansion above Honoapiilani Highway Kuia—Expansion above Wainee	***Central Maui*** Waiale—New town Waikapu—Expansion below Honoapiilani Highway Kahului—New housing and redevelopment
Kihei Expansion above Piilani Highway	***Pukalani*** Expand town upslope
Paia Expand toward Makawao	

4.17.4 Land Use and Existing Activities

For the purpose of evaluating the cumulative effects of the proposed ATST Project on Land Use and Existing Activities, the ROI is HO and the Park road corridor and the temporal extent is in 1961 when HO was an identified land user. Conservation Land, for purposes of this analysis, is defined in the same way that it is in HAR 13-5 as:

1. The placement or erection of any solid material on land if that material remains on the land more than fourteen days, or which causes a permanent change in the land area on which it occurs;
2. The grading, removing, harvesting, dredging, mining or extraction of any material or natural resource on land;
3. The subdivision of land; or,
4. The construction, reconstruction, demolition, or alteration of any structure, building, or facility on land.

Effects of Past, Present and Reasonably Foreseeable Future Actions

There are permitted uses within the various protective subzones of the Conservation District and there are uses that are inconsistent with the intent of the protective purposes of the rules. The subzones and permitting are discussed in detail in Section 3.1. Hawai‘i Administrative Rules 13-5 are designed to regulate land use within the Conservation District for the purpose of conserving, protecting, and preserving the natural resources of the State through appropriate management and use to promote their long term sustainability and the public health, safety, and welfare (HAR 13-5-1).

All new facilities within HO that involve conservation land use (excluding interior renovation and reuse of lands) since the rules were issued in 1994 have required CDUP. These permits involve a Conservation District Use Application (CDUA) that requires detailed effects analysis. In general, the permits are temporally limited (although often renewable), because the intent of the OCCL administering CDUPs is to return the land to its undeveloped conservation use when the permitted activity is completed.

The CDUPs for facilities at HO typically have attached terms and conditions requiring environmental and cultural/historic monitoring and mitigation measures, where required. For example, the CDUP for the FTF at HO requires maintenance of a buffer zone between FTF activities and nearby archeological resources. Facilities built before the rules are similar in land use characteristics, e.g., grading, permanent changes, etc. Therefore, by virtue of the variances granted to these non-conservation uses within the Conservation District, past and present facilities at HO may be considered to have at least, minor, adverse, and long-term effects on intended land use and existing activities.

The Coast Guard Tower and RCAG are permitted uses within the Conservation District under P-6 of HAR 13-5 for Public Purpose Uses by government, their land use is minimal (incidental ground disturbance) and therefore it is considered that they would have negligible, adverse, and long-term effects on land use and existing activities. Road repairs had virtually no affect on land use, but did permit easier access to facilities within the ROI (i.e., HO and the Park road corridor), and therefore may be considered to have a minor, beneficial, long-term effect on existing activities within the ROI.

The reasonably known future project at HO is the construction of the minor SLR 2000 facility located behind the southwest side of MSO. This project would be of little consequence with respect to land use or existing activities, since it would be located on a site that is less than 900 square feet.

Overall, the combined effects of all past, present, and reasonably foreseeable future actions, not including the impacts stemming from the proposed ATST Project, would be minor, adverse, and long-term.

Cumulative Effects of the Proposed ATST Project at the Mees Site

The effects of the Proposed ATST Project when added to the effects from past, existing and reasonably foreseeable future actions within the ROI would not result in increased cumulative impacts on land use within HO or the Park road corridor. The Proposed Action's impacts would be similar to those resulting from existing and planned land uses within the Conservation District. The Proposed ATST Project would be consistent with the goals and objectives of the LRDP, and would be the Proposed ATST Project would be consistent with the goals and objectives of the LRDP, and it would be similar to previous facilities with respect to requiring a CDUP with resultant minor, adverse, and long-term effects on land use and existing activities. The MECO upgrade that would accompany the proposed ATST Project would not change land use or existing activities, and therefore would have only a negligible, adverse, and long-term effect. Finally, the proposed ATST Project would be an incremental addition of approximately 4 percent to the use of Conservation District lands within HO and only a fraction of a percent of the total resource zone. In consideration of these factors, if constructed at the Mees site, the proposed ATST Project is anticipated to result in only a minor, adverse, and long-term cumulative effect.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site

The minor, adverse, and long-term effects of past and present land use within the ROI would provide the same baseline effects as for the Mees site. At the Reber Circle site, the effects of development activities from past, existing and reasonably foreseeable future actions, and the addition of the proposed ATST Project, would not change the intensity of the impacts to the identified land use within HO or the Park road corridor that constitute the ROI. The proposed ATST Project would require a CDUP, would still likely have terms and conditions, would still only result in an additional 4 percent to land use within the Conservation District. As an incremental addition to past and present projects, the resulting cumulative effects on land use and existing activities is anticipated to still be minor, adverse, and long-term.

No-Action Alternative

The effects from past, present, and reasonably foreseeable future actions when considered along with the No-Action Alternative would not contribute to changes in the identified land use within HO or the adjoining properties that constitute the ROI, thereby avoiding additional intensity or exhaustion of land uses within this Conservation District.

4.17.5 Cultural, Historic, and Archeological Resources

Cultural, historic, and archeological resources were evaluated within the ROI, which, for these resources, falls within both the HO, the summit area within HALE, and the Park road corridor. While portions of the ROI extends for more than 10 road miles down from the summit, it is clear from numerous sources, i.e., the two cultural resource assessments for the proposed ATST Project, many publications cited throughout this document, many hours of transcribed public testimony for the proposed ATST Project, letters to NSF, that the summit area of Haleakalā is a very sacred place for the Kanaka Maoli. The summit was thought of as "the Piko (navel), the center of Maui Nui O Kama (the greater Maui), and the summit is still revered by the Kanaka Maoli in present times.

With respect to the temporal extent for these resources, effects prior to Western contact are included. In order to properly assess future effects on the cultural, historic, and archeological resources, an historical perspective of Haleakalā must be included. The mountain's role in the history of Maui Island as a living entity, as well as the archeological record needs to be part of the discussion as to how activities in the summit area may affect the ongoing spiritual sacredness and cultural relationship of Hawaiians to

Haleakalā as a whole, and to the summit area in particular. Therefore, the temporal extent of the effects discussed below begins in Pre-contact history and extends beyond the present.

EFFECTS OF PAST AND PRESENT ACTIONS ON CULTURAL, HISTORIC, AND ARCHEOLOGICAL RESOURCES

Pre-Contact Effects on Cultural and Historic Resources

Accounts of Polynesian arrivals in the Hawaiian Islands vary, but even the earliest of these recognized the likelihood that the first settlers landed around 500 A.D. (Fornander). Successive emigrants arrived in the 11^{th} Century A.D. from the Marquesas, Society, and Samoan groups and established a migratory era for a number of generations, ultimately becoming isolated until rediscovery by Captain Cook in 1778. Some of these arrivals settled on Maui.

Religious pursuits and ceremonies were among the primary activities occurring atop Haleakalā during traditional Hawaiian times. The summit and crater of Haleakalā was considered a *wao akua* or distant mountain region, believed inhabited only by spirits (Vol. II, Appendix F(2).

Because the elevation above 7,000 feet would not have been well-suited for agriculture, the upper slopes of Haleakalā were likely used more for hunting and gathering by people who were recognized as specialists, as well as a travel route for messengers from the leeward to windward sides of the mountain.

The process of gathering information on traditional cultural practices on Haleakalā for the proposed ATST Project yielded much information from research of older and more recent literature on traditional Hawaiian cultural practices, as well as from the considerable oral and written testimony that was received during and after public hearings on the September 2006 DEIS, and from the cultural resource assessments (Vol. II-Appendices F(1) and F(2), which provided considerable insight into the rich oral tradition of Native Hawaiians. The sheer weight of accounts of traditional cultural practices on Haleakalā confirms that the summit area was used largely for religious pursuits, some of which are described in the SCIA and numerous references therein, and explained further in Section 3.2-Cultural, Historic, and Archeological Resources. The evidence for hunting and gathering is strong as well, with other accounts of these activities handed down from generation to generation. These are also described in Section 3.2 The evidence is compelling that pre-contact Haleakalā and in particular, the summit area, played a significant role in Hawaiian cultural practices.

Post-Contact Effects on Cultural and Historic Resources

It is within the context of this spiritual resource dating from the early part of the first millennium that the effects of post-contact activities on historic resources can be delineated. From the accounts of the first missionaries who ascended the mountain in 1828, there is no particular awareness of the deep meaning Haleakalā has for the Native Hawaiians they are charged to shepherd. In “Hawaiʻi Nature Notes” (NPS, 1959), the accounts of Reverends Andrews and Green, along with physician Dr. Gerrit P. Judd, are largely concerned with the secular aspects of the journey — provisions, spectacular scenery, and weather. Their guide is not named, but it would likely have been a Native Hawaiian during that period, since no one else would have been familiar with the upper slopes and crater of the mountain in 1828. Perhaps the largely secular account is the earliest evidence of an adverse effect on the cultural, historic and archeological resources of the summit area, considering from the earliest, the missionaries had written skills and were quite adept at describing first hand events (Hawaiian Historical Society, 1997) and according to most historians they had already alphabetized the Hawaiian language, but in their account seemed unaware or unconcerned about entering the sacred realm of the gods.

Table 2 in the SCIA (Vol. II, Appendix F(2) is a timeline of development of Haleakalā, beginning in 1600 and ending in the present. Each entry of events and new developments in the Table may be viewed by individual Native Hawaiians in different ways. One way of viewing development, within the context of preserving the *wao akua* and leaving the "realm of the gods" to those who are authorized and trained to practice their religion there, to hunt or gather there, or to teach others to do so, any past and present actions on the mountain that are not conducted by and for Native Hawaiians have been desecration.

This view was clearly expressed by Mr. Daniel Kanahele in testimony about the summit of Haleakalā at a public hearing for the proposed ATST Project in August 2008 (Transcript excerpt):

> "Well, my name is Daniel Kanahele. I am, from my father's side, many, many generations on this island. My father was born in Lahainaluna, his father was from here, going back I don't know how far. And we're talking - you mentioned that you are talking about sacredness. And I believe that there are some places on this Earth that are so special and so sacred that they should never have been - never be touched. They should be left untouched."

Post Contact Effects on Archeological Resources

The archeological record for the Park road corridor (Carson and Mintmier, 2007) and the archeological surveys of HO (Vol. II-Appendices F(1) and F(2) contain much evidence of transitory occupation of shelter sites and temporary structures suitable for short-term hunting or overnight protection from the elements. Specialized activities such as bird hunting for food and feathers, timber harvesting for canoes and other household uses, plant gathering for medicinal and ceremonial uses, and quarrying of fine grained basalts for adze materials and possibly weapons such as sling stones where likely carried out (Vol. II, Appendix F(2). Development of roads, buildings and other structures within the ROI has inevitably resulted in irretrievable loss of some of these resources. While passive preservation is the most widely used method of protecting archeological resources in the ROI, the effective loss is estimated to be moderate adverse and long term in its effect.

Summary of Effects on Cultural, Historic and Archeological Resources for Past and Present and Present Actions

As evidenced in the SCIA and during the Section 106 meetings, a few Native Hawaiians who participated in the NEPA and NHPA public processes only seem to take issue with certain kinds of activities at the summit and did not take issue with development within HALE or HO. But it is clear that, for those who believe that any portion of development within the ROI for cultural, historic, and archeological resources has resulted in major, adverse effects and the adverse effects from past development within the ROI have already occurred. For others, the past and present actions within the ROI, including HO and the Park road corridor are not of major consequence to the observer and would be considered moderate, adverse, and long-term

EFFECTS OF REASONABLY FORESEEABLE FUTURE ACTIONS ON CULTURAL, HISTORICAL, AND ARCHEOLOGICAL RESOURCES

The reasonably foreseeable future action within the ROI, excluding the proposed ATST Project is the installation of SLR 2000 at HO. This activity would have only minor, adverse effects, and that when added to the adverse effects of past and present actions, would be of little consequence to cultural, historic, and archeological resources within the ROI. Based on the discussions above, the following is an evaluation of the cumulative effects of the proposed ATST Project.

Cumulative Effects of the Proposed ATST Project at the Mees Site on Cultural Resources

For those who consider the summit area of Haleakalā a sacred site, the effects on cultural resources resulting from past, present, and reasonably foreseeable future actions are already major, adverse, and long-term, and the addition of the proposed ATST Project within the ROI for these resources at the Mees site would continue to, cumulatively, have major, adverse, and long-term effects. As discussed, some

Native Hawaiians consider that the proposed ATST Project would limit or prevent them from conducting their spiritual practices, in particular because of its size and color An uninterrupted view of the summit area is often cited as necessary to make an emotional and physical connection to a place of importance (Vol. II, Appendix F(2)-SCIA). Therefore, because the view is already interrupted by man-made structures in the summit area, the addition of the proposed ATST Project would be incremental in degradation of the spiritual values of the ROI with respect to the view, according to some individuals. While there is no way to quantify the cumulative effects of the incremental addition on spiritual values, in consideration of the past, present, and reasonably foreseeable future actions, the addition of the proposed ATST Project would result in readily detectable, localized effects, with consequences at the regional level to cultural practitioners within greater Hawai`i. Therefore, the cumulative effects on cultural and historic resources of the proposed ATST Project combined with past, present, and reasonably foreseeable future actions is considered major, adverse, and long-term.

Cumulative Effects of the Proposed ATST Project at the Mees Site on Historic and Archeological Resources

With respect to historic and archeological resources, the LRDP ensures that any activity at HO is required to follow procedures and practices that will avoid adverse, long-term effects on archeological sites. This effort has been successful in that passive preservation has worked well to avoid adverse effects to those resources. The LRDP also has detailed procedures for preservation of historic and cultural resources during construction or operations, through training, monitoring, and reporting for those resources. Moreover, the FHWA road report did not reveal that traffic activities related to the proposed ATST Project would result in more than negligible effects to resources along the Park road corridor. Therefore, it is anticipated that negligible, adverse, and long-term cumulative effects on the historic and archeological resources at HO would occur from the proposed ATST Project.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site on Cultural Resources

The effects on cultural resources resulting from past, existing, and known reasonably foreseeable future actions, and the addition of the proposed ATST Project within the ROI for these resources at the Reber Circle site would result in major, adverse, and long-term effects. Because of its location within HO, the proposed ATST Project at the Reber Circle site would appear to be more prominent at the HO site from locations within the upper HALE road corridor and from some populated areas of Maui (Section 4.5-Visual Resources and View Plane). As concluded by the cultural resources surveys prepared in support of this NEPA process, for those people who consider an uninterrupted view of the summit to be essential to cultural practices, a view that is obstructed by man-made objects would result in major impacts to cultural resource. Man-made objects already exist within HALE and HO, thus causing major impacts to cultural resources, and the addition of another object, such as the proposed ATST Project, would keep the intensity level of impacts at major, adverse, and long-term. Therefore, the cumulative impacts to cultural resources will be major, adverse, and long-term.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site on Historic and Archeological Resources

The Reber Circle site is closer to historic and archeological resources at HO than is the Mees site and, even with Passive Preservation procedures in place, there is a potential for cumulative, moderate, and adverse effects on those resources in the short-term during construction. With regard to historic and archeological resources within the Park road corridor, the effects from past, present, and reasonably foreseeable actions are anticipated to result in minor, adverse, and short-term impacts. The addition of the proposed ATST Project should not, as indicated by the FHWA report, result in more than negligible, adverse effects to the historic roadway, bridge, or culverts. Archeological resources near the Park road corridor are not anticipated to be impacted, as the project-related traffic is not expected to deviate from the roadway to any of the areas where the archeological resources are located. Adding the impacts of the proposed ATST Project to all past, present, and reasonably foreseeable actions within the ROI is anticipated to result in minor, adverse, and long-term impacts to historic and archeological resources.

No-Action Alternative
The No-Action Alternative would not contribute to changes in cultural, historic, or archeological resources within HO or along the Park road corridor that constitute the ROI. For those who believe that any man-made development in the summit area that are not dedicated to spiritual practices are a form of desecration would continue to find that such development results in major, adverse, and long-term effects to cultural resources. Therefore, the cumulative impacts on cultural resources relevant to the No-Action Alternative would remain major, adverse, and long-term. Because there are minor, adverse, and long-term impacts resulting from past, present, and reasonably foreseeable actions within the ROI for historic and archeological resources, the cumulative effects from the No-Action Alternative would remain at the minor, adverse, and long-term level.

4.17.6 Biological Resources

While biological resources may be found in abundance elsewhere in HALE or elsewhere on Maui, the scope of effects on those resources was analyzed within the HO and the Park road corridor. The temporal extent considered begins in 1961, at the time HO was identified as a separate land user within the ROI.

Effects on the biological resources within the ROI since the inception of HO are difficult to assess due to the limited amount of published data on the health and welfare of those resources within HALE and only intermittent, species-specific data from the last decade from within HO. Staff interest at HALE has been dedicated and devoted to protecting and preserving those resources and much of the assessment is based on consultations and personal communications with those individuals.

EFFECTS OF PAST AND PRESENT ACTIONS ON BIOLOGICAL RESOURCES

Effects on Native and Non-Native Botanical Resources Including Alien Invasive Species
HO and the Park Road corridor contain biological ecosystems that are both unique and fragile. In assessing the effects of past and present actions within the ROI, it is important to note that prior to the late 1980’s, these ecosystems were not well protected from feral goats and pigs and were subject to unrecognized AIS, such as *Miconia calvescens* DC (Melastomataceae) in HALE and at least two pine trees at HO (Section 3.3.1-Botanical Resources). However, considerable efforts have been expended in recent years to keep feral animals off the upper slopes of HALE (a feral animal control fence encloses Haleakalā Crater and much of Manawainui), and there are extensive HALE staff and volunteer efforts to check the spread of AIS. Within HO, surveys were conducted at various times to assess its botanical habitats (Section 3.3.1). These surveys were done as part of earlier HO development actions, the LRDP for HO, and more recently as part of the EIS assessment of the affected environment for the proposed ATST Project. Even so, the brief, approximately ten-year span of available data cannot identify all the effects of past and present actions at HO. However, within the ROI, past and present actions have resulted in a number of identifiable effects on those resources, which are described in the following paragraphs.
Within HO, undisturbed land is interspersed amid land that has been disturbed by construction. Areas of HO where construction has occurred generally support fewer native species and more weeds. Undisturbed sites are inhabited by predominately native shrubs, herbs, and, grasses. Three species of native ferns are found tucked into rock crevices and overhangs and on the steep slopes of the southeast part of the property. During an earlier botanical survey at HO (UH IfA, 2005), 32 plant species were observed, 11 of which were native and 21 were non-native. Three years later, in a survey conducted for the proposed ATST Project at the Mees and Reber Circle sites, 25 plant species were observed, 11 of which were native and 14 were non-native. Since many plant species are wind dispersed, the number of species would

vary from year to year and additional surveys would be undertaken as part of the programmatic monitoring plan discussed in Section 4.18.3-Biological Resources and shown in Table 4-12.

According to the botanical survey of HO conducted in 2005, there were more non-native plants on the HO site relative to similar adjacent "pristine" areas of HALE, Kahikinui Forest Reserve, and Kula Forest Reserve. The report cited a number of reasons. To some extent, development seems to promote plant growth, both native and non-native. This is likely due to disturbance to the soil from construction, additional water sources from discharge pipes and gutters, and protection from the elements by objects such as building foundations and sidewalk. Both native and non-native plants are able to find refuge in otherwise inhospitable locations. Intentional plantings were another way non-native plants have been introduced to the site. Aerial photographs from 1975 confirm rows of plants, presumably grasses, being cultivated near the center of the site (Starr and Starr, 2002). The large number of alien grasses at the HO site, compared to similar areas nearby may be attributable in part to these experimental plantings. The report also pointed out that weed control is an effective way of minimizing effects on native species and this is actively practiced at the MSSC site. Considering the effects from past and present actions, such as construction and operation of facilities at HO, the effect on botanical resources has been detectable, but since native species still flourish at HO and since small incidental benefits such as protection from the elements do occur at HO, the overall effects on botanical resources at HO is minor, adverse, and long-term.

Botanical resources along the Park road corridor can be grouped into the alpine and subalpine shrubland habitat zones, depending upon elevation. The upper, alpine zone largely contains the botanical diversity described above for HO. The lower elevations, below about 8,500 feet, are within the subalpine shrubland habitats, which contain common species such as the coriaceous, small-leaved shrub pukiawe (*Styphelia tameiameiae*). The tallest tree-shrub of subalpine shrublands is mamane (*Sophora chrysophylla*) whose golden yellow flowers in the spring provide food for native honeycreepers that seasonally travel from nearby rain forests. 'Ohelo (*Vaccinium reticulatum*) and kiipaoa (*Dubautia menziesii*) are common components of the subalpine zone; historically, both have been suppressed by feral goats and are recovering well in their absence. Other common and characteristic native subalpine species include the shrubs pilo (*Coprosma montana*), kukaenene (*Coprosma ernodeoides*), and hinahina (*Geranium cuneatum tridens*), and (ʻaʻaliʻi *Dodonaea viscosa*), and the herbs *Carex wahuensis*, *Deschampsia* nubigena and ʻuki (*Gahnia gahniiformis*). Non-native grasses, especially velvetgrass (*Holcus lanatus*) are common and persistent between native shrubs (Medeiros, et al, 1998).

Throughout the history of HALE, there has been encroachment by non-native botanical species. For example, pine seedlings that constantly are dispersed from the large pine plantings of the early to mid-20th century and encroach into native shrubland, especially around Hosmer Grove and the Park entry. Volunteer programs are offered by the organization Friends of Haleakalā National Park (http://www.fhnp.org/) and other organizations to remove Rabbit's foot clover and other weeds on a regular basis from the crater area. Other invasive species such as Clidemia (soapbush), Christmas berry, and strawberry guava are found within HALE and require active control to keep them from jeopardizing native species (A. Medeiros, personal communication 2005). Some of these threats gain entry through the Park road corridor as seed or pod hitchhikers on vehicles and people, some of which may be attributable to past and present actions at HO, since vehicles and personnel travel the Park road corridor every day. The overall effects of past and present activities on botanical resources within the Park road corridor are considered negligible, adverse, and long-term.

Effects on Endangered, Threatened, Proposed, and Candidate Plant Species

The ʻahinahina, or Haleakalā silversword, is Federally-listed as a "threatened" species, meaning they may become endangered throughout all or a significant portion of their range if no protective measures are taken. In 2002, nine live ʻahinahina and three dead ʻahinahina flower stalks were located within the HO property. None of the live plants were located on or around the proposed ATST Project areas. However, these plants can proliferate rapidly. During a July 2008 refurbishment of the Air Force GEODSS facility, KCE cataloged all ‘ahinahina located near the MSSC. A total of more than 40 young Silverswords were counted and photographed (KCE, unpublished data, 2008). These newer plants may be related in some way to nearby construction in 2006 to 2007, which occurred near the few extant ‘ahinahina at that time on HO property. By virtue of the substantial increase in these plants, the effects from past and present actions at HO would be considered minor, beneficial, and long-term. There are no other endangered, listed, or proposed plant species within HO.

There are a large number of ‘ahinahina in HALE, 382 hectares (944 acres), of designated ‘ahinahina critical habitat. Approximately seven miles of the Park road corridor traverse through Designated Critical Habitat for the ‘ahinahina. Beacham’s Guide to Endangered Species of North America reported in 2000 that “The Haleakalā Silversword represents one of the most dramatic conservation success stories of the Hawaiian Islands. As a result of management within Haleakalā National Park, human vandalism and feral ungulate browsing — formerly the most serious threats to the Haleakalā silversword — have been virtually eliminated. Almost all subpopulations of this species are within Haleakalā National Park, a successful protector of the plant since the 1930s, and only a few individuals survive just outside the boundaries of the park.” Since a portion of the “success story” can be attributed to activities at HO, the effect on this biological resource could be said to be minor, beneficial, and long-term.

The only other listed plant of concern is the *Geranium multiflorum*, part of the critical habitat which is within the Park road corridor. The USFWS does not have information that would indicate that the *Geranium multiflorum* critical habitat within the ROI would be affected by the proposed ATST Project (Vol. II, Appendix M-USFWS Informal Consultation), and therefore the effect on this biological resource could be said to be negligible, adverse, and long-term.

Effects on Endangered, Threatened, Proposed, and Candidate Avifaunal Species

The ‘ua‘u, a Federal- and State-listed endangered bird species, is present at HO. About 30 known burrows are along the southeastern perimeter of HO and several burrows are northwest of HO, as shown in Figure 3-5. The burrows constitute a colony of ‘ua‘u that return to the same burrows year after year. These burrows have been monitored at HO with unobtrusive day/night infrared cameras outside of most and inside of some burrows since 2006. HALE personnel also have monitored the burrows during nesting season to observe which burrows are in use. In response to comments on the draft SDEIS, HALE resource staff have said that the colony at HO is growing and could expand into areas closer to the proposed ATST Project. Video monitoring data from the last three years does not indicate any decline in burrow population during nesting seasons from 2006-2009 (KCE, unpublished, 2009). No ‘ua‘u mortalities have been attributed to any activity at HO, although the proximity to the burrow colony and thus to noise and vibration from nearby vehicles, telescopes, generators, etc. may have some effect on the outcome of fledgling success each year in the colony. The effects on his resource from activities at HO can be said to be minor, adverse, and long-term.

There are about 229 burrows along the Park road corridor and outside the crater rim (HALE unpublished data). As shown in Figure 3-5, many of these burrows are within the Park road corridor that constitutes part of the ROI for the proposed ATST Project. The ‘ua‘u at HALE is the only population of seabirds in Hawaii’s national parks that is intensively monitored and managed. Monitoring for ‘ua‘u distribution and breeding success at HALE occurs annually as part of regular resource management activities, and has since 1980.

With ‘ua‘u burrows along the Park road corridor, past road construction appears to have adversely affected the fledgling success of these birds. In 2001, road resurfacing in areas of the road (not connected with HO activities) with active nests resulted in fewer birds successfully fledging along the road during the heavy vibration and noise associated with road work (NPS, Nagata, 2001). The adverse effect was said to be substantial by the NPS and required mitigation measures. These would be moderate, adverse, effects in the short-term. The overall health of the ‘ua‘u colonies within the ROI appears to be stable. Overall, the effects of past and present actions at HO on ‘ua‘u along the Pak road corridor is minor.

Nēnē . No nēnē are reported to reside at HO. However, they have been seen as high as the summit area. The most likely effects that past and present actions have had on nēnē are mortalities due to vehicular strikes on the Park road by HO-bound or departing vehicles. It is reported that an average of one nēnē is killed each year by automobiles, or about one nēnē for every 224,454 round-trips taken by vehicles through the Park. Almost 206,000 vehicular visits and approximately 6,570 buses comprise most of that traffic and HO accounts for only a small fraction, based on the road survey (Vol. II, Appendix P-FHWA HALE Road Report, Table 3-10). Based on these statistics, HO would only contribute to a small fraction of one petrel killed each year by vehicles. However, HALE personnel are aware of at least one nēnē killed by a vehicle originating at HO (Natividad Bailey, personal communication, 2009). Since 1961, however, the overall effect of past and present actions on nēnē is negligible, adverse, and long-term.

‘Ope‘ape‘a. The ‘ope‘ape‘a is a Federal-listed endangered species that resides on the lower slopes of Haleakalā, but has been detected near HO, although it is unlikely that the bat is a resident of the area, due to the relatively cold summit temperatures and the lack of flying insects in the area, which is the preferred food source (AFRL, 2005). ‘Ope‘ape‘a have been detected near Park Headquarters Visitor Center and Hosmer Grove (Frasher, et al); HALE personnel have not made a determination as to whether bats occur along the Park road corridor. Since the ‘ope‘ape‘a is not a resident at HO, it is unlikely that past and present actions at HO have had more than a negligible, adverse, and long-term effect on that species within the Park road corridor. And, there is no information that indicates that any activities at HALE have resulted in adverse effects to this species within the Park road corridor.

Other Native and Introduced Fauna. Occasionally, feral goats, rats (*Rattus rattus*) cats, and mice have been seen or captured at HO, but not many other fauna have been present. The Park road corridor below the summit area has a much more abundant diversity of species that are not listed as Federal- or State-threatened or endangered species. Avian species are particularly abundant and those which are likely to be found along the Park road corridor include, but are not limited to, quails, francolins, pheasants, chukars, plovers, sandpipers, doves, pigeons, short-eared owls, northern mockingbird, common myna, house finch, common Amakihi (*Hernignathus virens*), Iiwi, (*Vestiaria coccinea*), (Conant and Stemmermann Kjargaard, 1984). Introduced fauna that could be observed closer to the summit area and along the upper Park road corridor include the chukar *(Alectoris chukar),* the feral goat *(Capra hircus),* the Polynesian rat *(Rattus exulans),* and the roof rat *(Rattus rattus)* (AFRL, 2005). The Indian mongoose *(Herpestes auropunctatus)* is occasionally observed on the summit. Cats (Felis catus) and mice (Mus musculus) are also found along the Park road, with cats occasionally seen crossing the Park road (HALE, unpublished data). Other than the likelihood that some lapses in refuse handling may have promoted rat and mice populations (HO employs vector control) the effects of past and present actions at HO on these native and introduced fauna does not appear to have been adverse. The location of HO is at an elevation high enough to be outside the range of many of these species and ,as is true for the endangered ‘ua‘u, HO traffic is not frequent enough to jeopardize bird habitats or other fauna in the Park road corridor and the effects on those resources would be negligible, adverse, and long-term. Similarly, there are no past or present activities within HALE that appear to have had adverse effects on those resources.

EFFECTS OF REASONABLY FORESEEABLE FUTURE ACTIONS ON BIOLOGICAL RESOURCES

The construction of SLR 2000 within the ROI poses some risk to the threatened and endangered species, but not to botanical resources or other native and introduced faunal. The construction of SLR 2000 behind the Mees Observatory would be a small scale modular facility on a pre-existing concrete pad. The pad is within 50 feet of the nearest burrow at Kolekole. However, only minimal use of motorized equipment would be necessary to assemble the building, and even though the project would only take a few days, it would be done during the non-nesting season to limit the potential for effects to minor, adverse, and short-term.

Cumulative Effects of Construction at the Proposed ATST Project at the Mees Site

Botanical Resources. The effects on native and non-native botanical resources including AIS from the proposed ATST Project at the Mees site would be clearly evident during construction. Construction at the Mees site would necessarily destroy hundreds of native and non-native plants and some AIS as well. None are endangered, threatened, proposed, or candidate species. Some would be able to re-colonize at undeveloped portions of the Mees site, but most would be displaced. There would be no irrevocable loss of these resources, despite destruction of individuals and the area affected at completion of construction would be less than an acre or about 5 percent of the total HO property.

Introduction or proliferation of AIS has been identified as a potential threat for most special status species located in the ATST ROI. The introduction of AIS from the proposed ATST Project originates from the same two major sources as elsewhere on Haleakalā. Equipment, supplies, and containers with construction materials that originate from elsewhere, such as the other islands or the mainland, could be infested by unwanted species when they arrive in Kahului. Secondly, vehicular traffic for the Mees site would increase during construction and operation of the proposed ATST Project, thereby increasing potential for the introduction of AIS, even though this increase in traffic is not expected to be major. These unwanted introductions are not anticipated to be a serious problem, given the mitigations described in Section 4.18.3-Biological Resources. In addition, provisions to control the introduction of AIS would be included in the SUP issued by HALE for Project-related traffic along the Park road corridor. Therefore, when combined with past, present and reasonably foreseeable future actions in the ROI the effects on botanical resources would be minor, adverse, and short-term.

Endangered, Threatened, Proposed, and Candidate Plant Species. It would be unlikely that the construction of the proposed ATST Project would affect endangered, threatened, proposed, or candidate plant species, specifically ‘ahinahina. At present no ‘ahinahina are within the Mees site for the proposed ATST Project. Prior to construction, monitoring for plant species would be accomplished as part of the programmatic monitoring measures described in Table 4-12, such that the risk of any ‘ahinahina being damaged or destroyed during construction would be minimal. Also, the proposed ATST Project would have no effect on the on *Geranium multiflorum* critical habitat.

The requirements of the LRDP and construction directives for the proposed ATST Project would provide for vehicle steam cleaning, invasive species inspections, and rapid response to on-site discoveries of introduced species. The proposed ATST Project would provide the best available level of protection against habitat-modifying invasive plants. Therefore, in combination with past, present and reasonably foreseeable future actions at HO and within the Park road corridor, the effects of the proposed ATST Project at the Mees site on these plant species would be negligible, adverse, and long-term.

Endangered, Threatened, Proposed, and Candidate Avifaunal Species. These species would be affected by construction of the proposed ATST Project at the Mees site. Construction activities that could induce ground vibration (i.e., heavy equipment grading, excavating, drilling, and compacting) or loud noise, e.g., diesel engines, could disrupt ‘ua‘u at HO, adversely affecting ‘ua‘u nesting and fledging success. ‘Ua‘u mortality could result from birds abandoning nests or failing to feed fledglings. Construction noise, vibration, or human proximity could affect the nesting habits of the ‘ua‘u to the extent that they may not return to, remain in, or otherwise utilize the burrows that are inhabited each year. Construction activity also has the potential of causing burrow collapse directly related to excavation, vibration, or other human activities. Collapse of a burrow could result in ‘ua‘u mortality.

During the heavy construction phase for the proposed ATST Project, nine average round trips per day by construction-related vehicles are estimated. This is a temporary increase in traffic that would end when construction is completed. Based on the estimate of 11,544 round- trips through the Park road corridor over the entire duration of construction, the risk to nēnē along the Park road corridor is only a fraction of 1 percent during that period. In fact, USFWS calculated that the risk of collision is 0.3 nēnē during the life of the proposed ATST Project. However, since the ‘ua‘u are nocturnal, large construction loads that must be moved at night could encounter ‘ua‘u outside of burrows. Therefore, in accordance with USFWS mitigation measures for the proposed ATST Project, large nighttime loads would not be permitted between April 15^{th} and July during petrel incubation periods. To even further reduce the chance of a collision with a nēnē, all drivers accessing the site during the life of the proposed ATST Project would receive a briefing on these endangered, threatened, proposed, or candidate species from IfA. Drivers would receive a refresher briefing regarding the nēnē at the beginning of breeding season, approximately November 1 of each year. These measures would further reduce the probability of affecting this endangered species within the ROI.

During Informal Consultation with the USFWS, it was determined that construction of the proposed ATST Project is not likely to adversely affect ‘ua‘u or nēnē with the implementation of the mitigation measures identified in Section 4.18-Mitigation. Formal consultation would take place in the event that Incidental Take was to occur in the future, which would include killing, injury, capture, or relocation that are incidental to the construction activities. The findings of the Informal Consultation that specify how the efforts agreed to for the proposed ATST Project have reduced potentially adverse effects for the ‘ua‘u and nēnē to a level of discountable effects for these species. In combination with past, present and reasonably foreseeable future actions within the summit area, this would be considered a minor, adverse, and long-term effect.

‘Ope‘ape‘a. The ‘ope‘ape‘a have been detected at HO, but has not been known to reside at those higher elevations. There is a risk during construction of an ‘ope‘ape‘a striking the building structure or a crane, but since these creatures are well equipped to detect obstructions, it is unlikely that they would be victimized by an obstruction. No ‘ope‘ape‘a carcass has ever been found near the other structures at HO. Construction at the Mees site would not result in changes to the ecosystem for this biological resource Bats have been detected near the Park Headquarters Visitor Center and Hosmer Grove (Frasher et al. 2007, HALE unpublished data), but according to HALE specialists (HALE, 2009) there has been no effort made to determine if bats occur along the Park road corridor. It is assumed that because their range of habitat is from sea level to 13,000 feet, that they would occur along the Park road corridor, but since they are evening foragers (Fullard, 1989) it is unlikely they would encounter routine construction traffic from the proposed ATST Project. Slow moving large or wide-load vehicles during nighttime hours would not pose a risk to these rapid flying vesper bats; therefore, the combined cumulative effects of the proposed ATST Project with past, present, and reasonably foreseeable future actions would be negligible, adverse, and long-term.

Other Native and Introduced Fauna. These fauna would be only slightly affected by construction of the proposed ATST Project at the Mees site. Avifaunal resources could be diverted in flyovers as the structure is built, if they were to be flying close to the ground. The diverse fauna along the Park road corridor could be discouraged from populating the area due to slow-moving, noisy construction traffic. For example, mongoose, and myna birds are commonly discouraged from remaining on roadways by traffic. However, in combination with past, present and reasonably foreseeable future actions, the effects on these fauna would be negligible, adverse, and long-term.

Cumulative Effects of Operations at the Proposed ATST Project at the Mees Site

Botanical Resources. As described above, to some extent, development at HO seems to promote plant growth, both native and non-native. Given that the proposed ATST Project would disturb the soil from construction, result in additional water sources from impervious sources, and provide protection from the structural elements, both native and non-native plants would be able to find refuge in otherwise inhospitable locations (Vol. II, Appendix E-Botanical Survey). It is assumed this trend would continue if the proposed ATST Project were to become operational that botanical resources would only be slightly affected. However, when combined with the effects of past, present, and reasonably foreseeable future actions described above, the cumulative effect would likely be higher in intensity, due to a wider loss of native habitat. It would be considered minor, adverse, and long-term.

Introduction or proliferation of AIS would continue to be a risk during operations at the Mees site. There would always be equipment and supplies that originate from elsewhere, such as the other islands or the mainland. There is always the possibility that these could be infested by unwanted species when they arrive in Kahului. Secondly, vehicular traffic for the Mees site would increase during operation of the facility, thereby increasing potential for the introduction of AIS, even though this increase in traffic is not expected to be substantial. Provisions to control the introduction of AIS would be included in the SUP issued by HALE for Project-related traffic along the Park road corridor. Therefore, when combined with past, present, and reasonably foreseeable future actions in the ROI, the effect on botanical resources would be minor, adverse, and short-term.

Endangered, Threatened, Proposed, and Candidate Plant Species. The potential for the appearance of ‘ahinahina at undeveloped portions of the proposed ATST Project would exist. These would not be removed or interfered with in any way. This species could potentially benefit from the additional sources of water around impervious surfaces (as has the ‘ahinahina around the Air Force facilities) and find refuge in the lee of the structures. In combination with the past, present, and reasonably foreseeable future actions in the ROI, the cumulative effects on these species would be negligible, adverse, and long-term.

Endangered , Threatened, Proposed, and Candidate Avifaunal Species. The operations of the proposed ATST Project would be close to the current configuration of burrows in the Kolekole ‘ua‘u colony. However, once construction would be completed, the risk to this species would diminish from “a level of discountable effects” (Vol. II, Appendix M-USFWS Informal Consultation Document) to even lower levels. With noise and vibration levels returning to their present values, there would be even less risk to nesting birds. There is no published evidence of differences in ‘ua‘u burrow activity and nesting success between sites near HO and those away from HO. This suggests that observatory-type operations have negligible, adverse effects on nesting ‘ua‘u (UH IfA, 2005). The normal operations of the proposed ATST Project would result in no adverse effects on the ‘ua‘u along the Park road corridor, since vehicle use would be the same as for other visitors to HALE, and the petrels along the Park road corridor do not seem to demonstrate distress from nearby traffic, perhaps due to habituation to noise (Vol. II, Appendix M-USFWS Informal Consultation Document, 2007). Therefore, in combination with past, present, and reasonably foreseeable future actions, the effects would be negligible, adverse, and long-term.

‘Ope‘ape‘a. This species has been detected at HO and would likely appear near the proposed ATST Project at some time during the operational lifetime of the proposed ATST Project. There is a risk of an ‘ope‘ape‘a striking the building structure when flying through the area, but none have been reported to have been killed by building collision during the nearly 50 years that HO has had structures taller than 30 feet. When combined with past, present, and reasonably foreseeable future actions, the risk of collision is small. Since operations of the proposed ATST Project would be largely daytime, and vehicle use would be limited to only a few cars per day, it is unlikely that ‘ope‘ape‘a would be affected by operations. Therefore, the cumulative effects are also anticipated to be negligible, adverse, and long-term..

Other Native and Introduced Fauna. These fauna would be only slightly affected by operations of the proposed ATST Project at the Mees site. Avifaunal resources could be diverted in flyovers of the site, if they were to be flying below 143 feet. The presence of towers and other tall structures within HO and adjacent properties is not resulting in collision mortalities. With proper trash procedures in place, occasional visiting of goats, cats, rats, and mice are not likely to be encouraged or deterred by the operations of the proposed ATST Project. It is likely that the proposed ATST Project, in combination with past, present, and reasonably foreseeable future actions would result in negligible, adverse, and long-term effects.

Cumulative Effects of Proposed ATST Project at the Reber Circle Site

Only minor differences in construction effects exist between the Mees site and the Reber Circle site; therefore, the cumulative effects for all the resources above would be the same for the construction and operation of the proposed ATST Project at the Reber Circle site, with the exception of the ‘ua‘u. The Reber Circle site is a greater distance from ‘ua‘u burrows in the Kolekole colony and is on previously developed land. The likelihood of adverse effects on the ‘ua‘u colony would be even less than for the Mees site, and with the nesting period limitations on heavy construction, along with noise and vibration restrictions during construction, the Reber Circle site would be even less likely to result in adverse effects on the ‘ua‘u at HO. The potential effects on ‘ua‘u along the Park road corridor during construction at Reber Circle site would be the same as for the Mees site, which is minor, adverse, and long-term. Therefore, when combined with the effects from past, present, and reasonably foreseeable future actions at HO, the effects on ‘ua’u within the ROI are anticipated to be negligible, adverse, and long-term.

No-Action Alternative

Under the No-Action Alternative, no construction would take place and operations would continue as at present. Therefore, the proposed ATST Project would result in no additional effects to those described above for past and present activities at HO, which would continue to occur.

For the No-Action Alternative, the ‘ua‘u monitoring program would be discontinued. This would have a minor, adverse, and long-term effect on the ability to assess the health, numbers, and behavioral characteristics of the colony population. This alternative would not result in the risks to biological ecosystems that have been identified in connection with the proposed ATST Project. The same risk of AIS introduction would be present from current HO traffic and materiel delivery. The botanical diversity and population would likely continue to exist as it is, and the endangered ‘ahinahina would likely continue to occur as windborne dispersal dictates. The same minor adverse effects from HO operations would continue at the Kolekole ‘ua‘u colony. The risk of ‘ope‘apes‘a mortality due to building collision would also be the same as it is at present. Overall, the cumulative effects of the No-Action Alternative would be minor, adverse, and long-term.

4.17.7 Topography, Geology, and Soils

The ROI for topography, geology, and soils is HO and the Park Road corridor. Temporal consideration for the HO portion of the ROI extends from 1961 when HO was identified as a land user and in 1935 for the Park road corridor when construction was completed.

EFFECTS OF PAST AND PRESENT ACTIONS ON TOPOGRAPHY, GEOLOGY, AND SOILS

In 1963, the University of Michigan team chosen to operate a space surveillance research facility on Haleakalā filmed the groundbreaking and excavation activities for the AMOS Observatory at HO. The 16 mm film (Jensen) shows a large area on the north side of HO being graded by bulldozers, even though only a small portion on the northern rim of Kolekole was to be occupied by the AMOS facility. Ground disturbance for construction of the Mees Solar Observatory on the southern side of HO followed the next year, and ultimately a substantial portion of HO underwent grading, excavation and reshaping for new facilities and modifications. More recently, topographic changes were accomplished at HO to better manage stormwater runoff at the site. The underlying geologic structures at HO are unchanged, with pyroclastic debris and ankaramitic lavas constituting the bulk of the subsurface structure (Section 3.4.2-Geology). Soils range from cinder sands to gravel (Vol. II, Appendix K-Soils Investigation Report) and have not been affected by past or present actions at HO.

The topography of the Park road corridor is discussed extensively in the NPS Cultural Landscapes Inventory (CLI, 2008), in which it is defined as topography that has been manipulated by human activity. The CLI discusses the extensive changes to the natural landscape that were associated with the building of the roadway. Because the slopes of Haleakalā are cut by deep gullies, lava dykes, and spurs, engineering techniques were required to create a pleasant, scenic road for Park visitors. The Park road required grading and rock cuts and cut and fill sections were required to negotiate the rough, sloping terrain. Subsequently, many of the rock cuts along the road were altered for safety concerns. Park workers frequently blasted and removed rocks from the upper banks along the road after they had been undermined by the weather. The CLI reports that even 18 years after construction, rockslides continued to be a problem and retaining walls were constructed to prevent the road from sliding. Today, rock falls can be seen during and after storms.

The CLI also reports that in 1959 crews blasted and widened cuts in the upper three miles of the Park road. Surplus material was used to reinforce fills and build up narrow shoulders. Despite these alterations, naturalistic rock cuts still characterize the Haleakalā Highway today. They continue to appear as natural lava rock outcroppings and rock walls along the road's edge. Although, they may have been somewhat altered to improve safety conditions, their appearance and locations remain.

The topography along the Park road corridor also has cuts and fills in which a typical cross section of the road features a cut-side travel lane carved into the adjacent slope. Where the excavation of large rock cuts resulted in an excess of fill material, the surplus was often piled to create berms on the fill side of the road on dangerous curves or where fill slopes were likely to erode during storm events. The geology of the Park road corridor is within a multi-faceted geological domain that constitutes the upper slopes of Haleakalā volcano. The road passes along or through volcanic rocks ranging in age from 900 to more than a million years of age (Sinton, 2003). No alteration of the geologic regime has occurred form past or present actions.

Soils along the Park road corridor vary between the upper and lower portions of the road, where the latter contains more organic content. The most common soils along the Park road corridor, however, are characterized as tephra (air-fall material produced by a volcanic eruption), containing feldspar, glass, pyroxene and olivine, with weathered alteration products including Fe oxides, phyllosilicates and sulfates (Bishop, et al). These have not been affected by past or present actions along the Park road corridor. Overall, the effects of past and present actions have resulted in minor, adverse, and long-term effects on topography, geology, and soils.

EFFECTS OF REASONABLY FORESEEABLE FUTURE ACTIONS ON TOPOGRAPHY, GEOLOGY, AND SOILS

The reasonably foreseeable future actions within the ROI, excluding the proposed ATST Project Project, is the installation of SLR 2000, which would likely individually result in additional minor, adverse effects to the topography, but negligible, adverse effects on soils and geology. Overall, the cumulative effects on these resources would be minor, adverse, and long-term.

Cumulative Effects of the Proposed ATST Project at the Mees Site

Topography, Geology, and Soils. Grading would alter the topography would be required for the proposed ATST Project. A grade cut at the Mees site would be at approximately the 9,980-foot contour elevation. This would be done using a bulldozer, backhoe, jackhammer, dump truck, and other standard heavy equipment. An estimated 2,500 cubic yards of soil and rock would be removed for leveling in order to prepare the site for construction. The grading would level about ten feet of existing topography, but within the context of HO that would not substantially alter the appearance of the Kolekole cinder cone land form in which HO resides. No additional soil would be brought into the site. The removed material would be distributed within HO and would not substantially alter the topographic profile of the area. Finally, the proposed ATST Project and associated MECO upgrade would add slightly to the runoff and infiltration at HO (Vol. II, Appendix J(4)-Supplemental Description of ATST Equipment and Infrastructure). No substantial changes to the soil or underlying geology would be required for the proposed ATST Project.

During construction and operations of the proposed ATST Project, the Park road corridor would not experience any change to its topography, soils, or geology. Overall, the cumulative effects on those resources, when combined with effects from past, present, and reasonably foreseeable activities within the ROI, would be considered minor, adverse, and long-term.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site

Construction at the Reber Circle site would have somewhat different consequences for the topography, soils, and geology in the ROI. The critical nature of the structural bearing condition requires that the level area immediately around the telescope be achieved primarily by cutting rather than by a cut and fill approach. At the Reber Circle site, the proposed grade cut would be down to approximately the 9,996-foot contour elevation; and therefore, approximately 5,000 cubic yards of soil and rock would be displaced during the leveling phase in order to prepare the site for construction. This would be twice as much material as at the Mees site and approximately 250 truck-trips would be necessary to relocate excess rock and soil. Although excavation techniques would be approximately the same as those for the Mees site structures, there could be more use of hydraulic hammers and jackhammers than at the Mees site because preliminary geotechnical investigations indicate that there is more subsurface rock at this site.

Approximately 7,150 cubic yards of soil and rock would be excavated from the Reber Circle site during construction. The amount of material removed for leveling would be approximately twice what would be required at the Mees site. This is primarily because no level area currently exists at the Reber Circle site for the Utility Building and service yard, as is the case at the Mees site. Since all of this material would still be accommodated at HO, the overall effect on the topography, geology, and soils would not result in more than minor, adverse, and long-term effect. There would be no additional effects on these resources from operations of the facility once construction was completed.

During construction and operations of the proposed ATST Project at the Reber Circle site, the Park road corridor would not experience any change to its topography, geology, and soils. Overall, the cumulative effects on those resources when adding the effects of the proposed ATST Project to the effects of past, present, and reasonably foreseeable actions within the ROI, would be considered minor, adverse, and long-term.

No-Action Alternative

Topography. Under the No-Action Alternative, the proposed ATST Project would not be constructed and, therefore, the topography would remain the same. Therefore, the cumulative effects of the No-Action

Alternative when added to the effects from past, present, and reasonably known future actions within the ROI would remain negligible, adverse, and long-term.

Geology and Soils. Under the No-Action Alternative, the proposed ATST Project would not be constructed and geology and soils would not be disturbed. Therefore, the cumulative effects of the No-Action Alternative when added to the effects from past, present, and reasonably foreseeable future actions within the ROI would remain negligible, adverse, and long-term.

4.17.8 Visual Resources and View Plane

The ROI for visual resources is portions of the Maui landmass, HO, the Park road corridor, and other areas within HALE from which structures within HO are visible. The temporal extent under consideration is from 1961 when HO was identified as a separate land user.

EFFECTS OF PAST AND PRESENT ACTIONS ON VISUAL RESOURCES AND VIEW PLANE

Visual resources within the ROI are discussed in Section 3.5-Visual Resources and View Plane. Past and present actions for this description are limited to HO. Past and present actions within HO have had quite variable effects on the visual resources and view plane within the larger ROI. The first HO facility constructed was the Baker Nunn camera site in 1957 — was, and still is, completely invisible with respect to any area outside of HO due to its position behind and below higher terrain at HO. Depending upon their position within HO, their size, color, and shape, subsequently built facilities may be visible at times from areas within HALE and the larger Maui landmass and may be seen from distances as far away as the Central Valley, South Maui, or windward shoreline. In addition, meteorology and time of day play an important role as well. The visual effects of past and present actions at HO are interdependent on all these factors. For the purpose of this evaluation, HO will be treated as a whole and it will be assumed that at least some of the time all or part of HO would be visible from those locations with direct line-of-sight, i.e., disregarding clouds, humidity, dust, and conditions of daylight.

To assess effects on visual resources in the analyses below, a combination of quantitative and qualitative evaluations was used. The quantitative evaluations include such information as estimates of how much the actual view planes are affected by past and present actions at HO, with a value of less than 1 percent considered to be negligible, less than 10 percent considered a minor effect, more than 10 percent but less than 20 percent considered to be moderate, and more than 20 percent considered to be a major effect. The qualitative seeks to describe in what ways those visual resources are affected. Although independently assessed, the two evaluations result in one effect intensity. The evaluation is also dependent on the location within the ROI. For example, the past and present effects of HO on the visual resources at Puʻu Ulaʻula might be considered quite different from the effects along the lower part of the Park road corridor, which could in turn be different from the effects on the visual resources and view plane at sea level on windward Maui.

Since there are numerous locations from which HO can be seen from within HALE and the populated areas of Maui, a baseline for quantitative and qualitative effects can be obtained by describing the effects of past and present actions at HO from the same locations used in Section 4.5-Visual Resources and View Plane to describe visual effects from the proposed ATST Project. These are:

1. Puʻu Ulaʻula Overlook,
2. The areas of HALE adjacent to HO, but not on Puʻu Ulaʻula, including Magnetic Peak,
3. The upper Park roadway, including the Haleakalā Visitor Center,

4. The crater,

5. The lower Park roadway, including Hosmer Grove; and,

6. Populated areas of Maui, including windward, Upcountry, Central Valley, and South Maui locations.

Puʻu Ulaʻula Overlook

Quantitatively, HO is clearly visible from the Puʻu Ulaʻula Overlook and occupies approximately 21 degrees of the 360-degree vista, or about 6 percent, of the view from the walkway outside the overlook. From the same location, by comparison, the 13-foot tall Puʻu Ulaʻula Overlook building would occupy about 34 degrees or about 9 percent of the available vista for a person standing in the same location (Tele Atlas Map, 2009). However, the HO facilities are not part of the natural landscape and with the exception of earth-toned paints on wall surfaces no attempts were made to conceal them or their activities. Based upon the table of intensity thresholds for visual effects in Section 4.5-Visual Resources and View Plane and the percentages for each, the visual quality of the landscape with 9 percent affected by HO would be detectable, localized, but are still small and of little consequence to the observer. Quantitatively, from this location 9 percent of the vista could be considered minor, adverse, and long-term.

The Areas of HALE Adjacent to HO, But Not on Puʻu Ulaʻula, Including Magnetic Peak

The relative amount of viewshed occupied by HO facilities would vary from about 3 to 4 percent of the 360-degree vista. Again, while the facilities do not blend in with the natural landscape and are not concealed in any way, the visual quality of the landscape affected by HO would be detectable, localized, but are even smaller and of little consequence to the observer. The cumulative effects from past and present HO activities at this location would be considered minor, adverse, and long-term.

The Upper Park Road Corridor, Including the Haleakalā Visitor Center

From the upper two miles of the Park road, depending upon exact location, HO occupies between < 1 percent to about 16 percent of the total 360-degree vista available to a viewer. For example, at the closest approach, just above the Haleakalā Visitor Center parking area, HO would occupy about 16 percent of the viewshed, but when first visible on the Park road above the Leleiwi Overlook, HO would only occupy about 1 percent of the available viewshed. Again, because HO is not part of the natural landscape and because it would be distinguishable from that landscape from all distances, the overall effect on the viewshed of HO facilities could be considered negligible, adverse, and long-term at the most distant portion of the upper Park road and minor, adverse, and long-term where the road is closest to HO.

The Crater

From the crater, the past and present actions at HO are not visible and therefore would contribute negligible, adverse, and long-term effects.

Lower Park Road Corridor, Including Hosmer Grove

From the lower Park road, from the entry station to just above the Park Headquarters Visitor Center, the facilities at HO are not all visible due to terrain and building shielding. The portion of the total vista occupied by those facilities that are visible constitutes less than 1 percent of the 360-degree viewshed in those locations. Therefore, the combined effect of all past and present actions at HO is considered to be negligible, adverse, and long-term.

Populated Areas of Maui, Including Windward, Upcountry, Central Valley, and South Maui Locations

From populated areas of Maui where HO can be seen, it occupies less than 1 percent of the total ridgeline of Haleakalā, as seen from locations near sea level. From Upcountry areas, HO may occupy a little more than 1 percent of the total ridgeline. The facilities are difficult to distinguish and partially shielded by terrain and each other. The cumulative effects on visual resources from these locations for all HO activities past and present would be negligible, adverse, and long-term.

Assessment of the effects on visual resources in populated areas of Maui from past and present actions of HO is somewhat subjective. The closest residence is 5 miles from HO. At that distance, past and present actions at HO are small in scale against the ridgeline. By comparison, other past and present actions on Haleakalā are closer and more prominent to some viewers. For example, the recently completed concrete overlay on Haleakalā Highway is highly reflective and appears as a prominent white stripe to viewers in the Central Valley for several miles on the mountain. Other developments on Haleakalā, such as the Kamehameha Schools and the King Kekaulike High School night-time ball field floodlights in Pukalani, can be prominently seen from many locations on Maui. With that perspective, the past and present actions at HO could be considered to have a minor, adverse, and long-term effect on the visual resources and view plane within that portion of the ROI that includes populated areas of Maui.

EFFECTS OF REASONABLY FORESEEABLE FUTURE ACTIONS ON VISUAL RESOURCES AND VIEW PLANE

The reasonably foreseeable future action to consider for effects on visual resources is the construction of SLR 2000. This action would constitute a negligible, adverse, and short-term effect on the visual resources within the ROI.

Cumulative Effects of the Proposed ATST Project at the Mees Site

The effects on visual resources and viewshed from the proposed ATST Project at the Mees Site are discussed in detail in Section 4.5-Visual Resources and View Plane. For this discussion, the same six areas within the ROI as in the previous paragraphs above are considered.

From Section 4.5, the effect on visual resources at the Puʻu Ulaʻula Overlook from the construction and operation of the proposed ATST Project at the Mees site is considered to be moderate, adverse, and both short- and long-term because of its size and color. From a quantitative standpoint, the proposed ATST Project would be partly shielded by topography and would be within the context of other facilities at HO, and as discussed in Section 4.5 it would also only increase the viewable portion of HO by about 3 percent of the total 360-degree viewshed. Added to the minor, adverse, and long-term effects from past, present, and reasonably foreseeable future actions at HO, the cumulative effects would not exceed moderate, adverse, and long-term.

The same would be true for the qualitative effects on visual resources. Within the context of an already identified area for science and astronomy, it is likely that most visitors to the Puʻu Ulaʻula Overlook would not consider the proposed ATST Project "out of place" although some would feel that it dominates the vista due to its height and/or color. Overall, the combined quantitative and qualitative cumulative intensity of effect would be moderate, adverse, and long-term.

From areas in HALE adjacent to HO, the quantitative effects of the proposed ATST Project at the Mees site on visual resources and view plane would be as described in Section 4.5, namely moderate, adverse, and long-term. Again, because there would be some terrain shielding from the rim of Kolekole and from Magnetic Peak, the entirety of HO would not be visible from any HALE location adjacent to HO except the summit of Magnetic Peak. Depending on exact location within this portion of the ROI, the proposed ATST Project would occupy between 3 to 6 percent of the available 360-degree vista. For example, from the Park road just above the Haleakalā Visitor Center, the angle of view occupied by the proposed ATST Project would be about 3 degrees or < 1 percent of the vista. From the summit of Magnetic Peak, it would be approximately 6 degrees, or less than 2 percent of the vista. In addition, the proposed ATST Project would be within the context of other HO facilities. Therefore, when added to the minor, adverse, and long-term effects of past, present, and reasonably foreseeable future actions, the quantitative cumulative effect of the proposed ATST Project would be moderate, adverse, and long-term.

Qualitatively, these areas of HALE would be close enough to the proposed ATST Project at the Mees site to permit viewers to see it clearly, although it would be partly shielded by topography. Depending upon an individual's feelings about large structures within the summit area, astronomical observatories, continuity of natural vistas in those locations, etc., the qualitative cumulative effects of the proposed ATST Project along with past, present, and known reasonably activities at HO would likely be moderate, adverse, and long-term. Overall, the combined quantitative and qualitative cumulative effects on visual resources would be moderate, adverse, and long term.

From the upper two miles of Park roadway, depending upon exact location, the Proposed ATST Project at the Mees site would occupy between < 1 percent to about 1 percent of the total 360-degree vista available to a viewer. For example, at closest approach, just above the Haleakalā Visitor Center parking area, the proposed ATST Project would occupy about 1 percent of the viewshed and would be within the context of other HO facilities. When first visible on the Park road above the Leleiwi Overlook, it would only occupy about 0.2 percent of the available viewshed and would be within the context of other HO facilities. Qualitatively, because the proposed ATST Project is not part of the natural landscape and because it would be distinguishable from that landscape from all distances, the combined effects of HO facilities could be considered minor, adverse, and long-term. Overall, the combined cumulative effect would be minor, adverse, and long-term.

From the crater, the upper part of the 250-foot crane that would be used during construction of the proposed ATST Project at the Mees site would be visible from trails and camping areas within the crater, during such times when the crane is extended. No other past or present actions at HO are visible within the crater, and the crane would not be distinguishable as other than a faint, short segment above the rim. It would appear dwarfed by the 3,000-foot crater walls. Qualitatively, the wilderness experience of visitors to the crater could be affected, insofar as the only other man-made structures visible from inside the crater are the Haleakalā Visitor Center and the Puʻu Ulaʻula Overlook. Therefore, the combined quantitative and qualitative cumulative effects on visual resources would be minor, adverse, and short term.

From the lower Park roadway, from the entry station to just above Park Headquarters Visitor Center, the proposed ATST Project at the Mees site would be visible, although not in its entirety, due to terrain and building shielding. Quantitatively, the portion of the total vista occupied the proposed ATST Project would constitute a fraction of 1 percent of the 360-degree viewshed in those locations, and less than 1 percent of the Haleakalā ridgeline visible from those same locations along the Park roadway. Qualitatively, visitors entering HALE would see part of the proposed ATST Project within HO, but it would not be visually resolvable as more than some type of structure and would not stand out clearly from the other HO facilities. Reasonably foreseeable future actions would not contribute to a loss of visual resources either. Therefore, the combined quantitative and qualitative cumulative effects on visual resources from these areas would be considered to be negligible, adverse, and long-term.

From populated areas of Maui near sea level, where the proposed ATST Project would be seen, it would not add to the approximately 1 percent of the total Haleakalā ridgeline already occupied by past and present actions at HO. From Upcountry areas, where HO may occupy a little more than 1 percent of the total ridgeline, it would not add to the area occupied by man-made structures. At those distances, the facilities are difficult to distinguish and partially shielded by terrain and each other and that would be the case for the proposed ATST Project. Qualitatively, from populated areas of Maui the facilities at the summit are not a substantial portion of the mountain landmass. As the renderings in Section 3.5-Visual Resources and View Plane show, at those distances the addition of the proposed ATST Project, even though it would be 143 feet tall, would not compromise the visual resources. Reasonably foreseeable future actions would not contribute to loss of visual resources either. Therefore the quantitative and qualitative effects on visual resources from these locations combined with the anticipated viewshed effects from the proposed ATST Project at the Mees site would, from the populated areas of Maui, be cumulatively negligible, adverse, and long-term.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site

When added to past and present actions at HO, as well as reasonably foreseeable future actions, the quantitative and qualitative cumulative effects on visual resources for the proposed ATST Project at the Reber Circle site would be similar for each of the visual regimes described above, with the following exceptions:

From a quantitative perspective, at the Pu‘u Ula‘ula Overlook, the proposed ATST Project at the Reber Circle site would have no partial terrain shielding from the rim of Kolekole. Moreover it would be closer to the Pu‘u Ula‘ula Overlook by about 250 feet, which translates to about 1 degree more loss of natural vista than the proposed ATST Project would incur at the Mees site. So too would the 250-foot construction crane appear larger and closer than at the Mees site. The quantitative cumulative effect on visual resources would be major, adverse, and both short- and long-term. Qualitatively, the crane would be the tallest structure on the mountain and would be difficult to overlook at the Reber Circle site. After construction, although the proposed ATST Project would be within the context of existing facilities at HO, at the Reber Circle site it would dominate the view in the direction of HO. It would appear substantially out of scale with respect to the natural surroundings with respect to size and color, and when added to the existing facilities at HO and reasonably foreseeable future actions, it would constitute combined quantitative and qualitative cumulative impacts on visual resources within the ROI that are major, adverse, and long-term. From areas within HALE adjacent to HO, the same cumulative effects would be incurred by the proposed ATST Project at the Reber Circle site as those incurred for the Pu‘u Ula‘ula Overlook. Because there would be no terrain shielding and because those areas are closer than 0.6 miles from HO, the view in the direction of HO would be dominated by the proposed ATST Project, and therefore the combined cumulative effects on visual resources from the proposed ATST Project, and the past, current, and reasonably foreseeable future actions would be considered major, adverse, and both short- and long-term.

No-Action Alternative

The No-Action Alternative would not contribute to changes in visual resources within HO or the adjoining properties that constitute the ROI, and therefore, the proposed ATST Project would not result in any additional effects on those resources.

4.17.9 Visitor Use and Experience

The visitor use and experience would be defined as that which has affected visitors to Maui, beneficially or adversely, including those who visit and experience HALE. The effects on visitor use and experience from past and present actions within the ROI are directly related to: 1) the visitor’s location on Maui, 2) disturbance of the visitor’s experience through diminution of visual appearance, noise, or air quality, and 3) disruption of a visitor’s enjoyment, e.g., traffic delays. To help quantify the cumulative effects of past, present, reasonably foreseeable future actions with the addition of the proposed ATST Project, the visitor use and experience in this section is divided into those that have taken place or are taking place within certain locations in HALE, including the Park road corridor, and those that have taken place or are taking place outside HALE, in what can be referred to as other landmass areas of Maui.

EFFECTS OF PAST AND PRESENT ACTIONS ON VISITOR USE AND EXPERIENCE

Effects of Past and Present Actions on HALE Visitor Use and Experience

Within the summit area of HALE, there are two visitor facilities. One, the Haleakalā Visitor Center, which includes the cinder cone known as Pa Kaʻoao (White Hill), located on the rim of the crater. The other is an overlook building located at the highest point at Puʻu Ulaʻula, which is also one of the main attractions for visitors to the summit. The activities at the Haleakalā Visitor Center include viewing the crater and educational exhibits. Visitors to this location do not have any visual, audible, or interpretative interaction with HO. Therefore, past and present actions have had only a negligible, adverse, and long-term effect.

Outside of these two locations, but still within the summit area, there are trails around and into the crater, as well as the upper Park road corridor, all of which permit visitors to explore the summit area while incidentally viewing HO activities visible from locations described in Section 3.5- Visual Resources and View Plane. Visitors in these areas are still within sight of road signs, vehicular traffic, and associated noise within HALE.

As such, these areas do not qualify as "Wilderness", as defined in Section 2 (c) of the Wilderness Act (16 U.S.C. 1131-1136, 78 Stat. 890). HO activities are visually but not audibly detectable by visitors in these locations. During the DEIS comment period, NSF received no reports of visitor dissatisfaction that can be directly attributable to HO activities. Thus, the facilities at HO result in a minor, adverse, and long-term effect on the experiences of those visitors.

The Park road corridor has two portions from which the past and present actions at HO have been and are currently visible. These are approximately the upper two miles, from Leleiwi Overlook to just south of the Haleakalā Visitor Center parking lot, and within the lower Park road corridor from the entry station to just above the Park Headquarters Visitor Center. In addition, the Park road corridor is used for HO access and for services in support of activities at the site. Depending on location along the upper Park road corridor, the activities at HO may be visually unresolved (indistinct) at longer ranges and occupy only a small fraction of the 360-degree viewshed (<1 percent), or they may be clearly visible at closer ranges and occupy as much as 6 percent of the viewshed. Visitors along the Park road corridor have been able to visually (but not audibly) experience the activities at HO, since the MSSS facilities were built in 1963, because those were the first that were visible outside of HO in the direction toward HALE. Visitors along the Park road corridor cannot stop and get out of their vehicles at most locations along the Park road corridor and HO activities are then only viewed from within those vehicles.

Since about 1961, the traffic along the Park road corridor has included personnel and service vehicles in support of HO activities. Occasionally, these vehicles have included slow moving construction or service vehicles that have caused visitor traffic to be delayed on the way to the summit area. These delays have ranged from very infrequent (once or twice a month) to very frequent short-term delays, e.g., during concrete pier construction of AEOS in 1993. Overall however, the past and present actions have resulted in detectable but not consequential effects on visitor use and experience along the Park road corridor, which is considered minor, adverse, and long-term.

The "Wilderness" Area of the Park is located over the majority of the eastern side of HALE. With respect to the ROI for visitor use and experience, these areas include the crater and its access from the "Summit Area" at Keonehe'ehe'e Trails, also called Sliding Sands and from Halemau'u at the 7,000-foot elevation along the crater road. The past and present actions at HO have not been visible or audible from the trails leading into the crater, or from any trails or campsites within the crater. Visitors to the crater are unaware of activities at HO from the time they begin descending Sliding Sands trail or from Halemau'u trailhead. There are no formal Park services in these areas. Therefore, the effects on visitor use and experience from these locations are considered negligible, adverse, and long-term. HO is, though, listed in some visitor brochures as an area of interest to tourists.

Visitors to Other Landmass Areas of Maui

Approximately two million visitors arrived on Maui last year (DBEDT, Visitor Report). Visitors come to Maui for various experiences, including honeymoons, conventions, business, schooling, meetings, military and other purposes. For those whose purposes include sightseeing and wilderness adventures, i.e., “ziplining”, hiking, camping, etc., the lower slopes of Haleakalā outside of HALE and recreational sea level areas are frequent destinations. From those locations, HO activities may be visible within the areas shown in Figure 4-4. These Maui visitors may or may not be aware of the activities at HO. There are no formal surveys as to which projects or activities on Maui result in adverse effects on visitors, including HO. A search of Maui visitor comments available on the Internet suggests (at least anecdotally), that of those visitors who become aware of HO during their visits, the most common knowledge or reaction concerning HO is that it is not open to the public.

EFFECTS OF REASONABLY FORESEEABLE FUTURE ACTIONS ON VISITOR USE AND EXPERIENCE

The reasonably foreseeable future action within HO is the installation of SLR 2000. The effects on this activity on visitor use and experience would be limited to HO. The installation of SLR 2000 would be a modular, small-scale project that would affect traffic for no more than one or two days during construction, and therefore, along with past and present actions at HO, would have a minor, adverse, and short-term effect on visitor use and experience at HALE.

Cumulative Effects of the Proposed ATST Project at the Mees Site

Some of the most important aspects of the visitor use and experience at HALE are enjoying the view from the Pu’u ‘Ula’ula Overlook and hiking along the Sliding Sands hiking trail for views of the crater. The Pu’u ‘Ula’ula Overlook is located approximately 0.3 miles from the HO, and as described in Section 4.5-Visual Resources and View Plane, the addition of the proposed ATST Project at the Mees site would result in a small loss of viewshed for anyone at that location, most of whom are visitors. The quality of the view towards the HO facilities from the overlook and various points along the Sliding Sands hiking trail and into the crater would also be affected during the period of construction (roughly from 2010 through 2014). Construction activities at the Mees Site would involve land clearing, demolition, grading/leveling, excavation, soil retention and placement, facility construction, remodeling of current facilities, and paving, and landscaping. Temporary changes to air quality, noise associated with construction activities, and visual resources would occur during the time of construction. For example, visitors would experience construction-related noise during construction hours that would adversely affect the quality of their experience while hiking and backpacking near the Sliding Sands trailhead.

Certain construction activities associated with the proposed ATST Project at the Mees site, such as caisson driving, would create more man-made noise than others, e.g., actual renovations and building of the new facilities. As noted in Section 4.10-Noise, noise attenuation from the construction site would decrease at approximately 6 to 7 dBA as distance is doubled. For the loudest construction impact sounds, at about 113 dBA, this would result in approximately 65 dBA heard at Pu‘u Ula‘ula Overlook and near the crater, e.g., Sliding Sands trailhead. The ambient sound level at these locations is about 47 dBA, and therefore would be considered a major, adverse, and long-term effect on visitor’s ability to enjoy ambient sound levels. The mitigation measures described in Section 4.6-Visitor Use and Experience and 4.10-Noise would reduce the effects of construction noise before sunrise and after sunset and between April 20^{th} and July 15^{th}. However, considering noise, visual losses and air quality effects, when combined with past and present actions at HO, construction of the proposed ATST Project would result in major, adverse, and long-term effects on the experience of visitors to the Pu'u 'Ula'ula Overlook, Sliding Sands trailhead and HALE areas adjacent to HO.

After construction, the proposed ATST Project would still result in loss of viewshed for visitors at these locations. As discussed in Section 4.17.8-Visual Resources and View Plane, the loss would affect those viewing from Pu'u 'Ula'ula Overlook and areas in HALE adjacent to HO, although no viewshed loss would occur for those entering Sliding Sands trailhead, once construction is completed. The overall cumulative effect on the visitor use and experience from these locations resulting from the operations of the proposed ATST Project combined with past, present , and reasonably foreseeable actions at HO would be moderate, adverse, and long-term.

For the upper Park road corridor, construction equipment and activity would be seen and heard on the road and at the Mees site, e.g., be readily detectable by visitors along the Park road corridor. Traffic levels during construction are expected to increase by about 15 trips per day. This is only a small increase of vehicular traffic entering and leaving HALE compared to the approximately 1.7 million annual visitors to HALE (HALE, 2006). This small increase would have a negligible effect on travel time and visitor use and experience s, except during transport of slower moving wide/heavy loads, as explained in Section 2.4.3-Construction Activities. The added traffic would also increase the noise level by approximately up to 3 dBA during construction. This increase would be barely perceptible to users and would have a minor, short-term effect on the visitor use and experience. During operations, the added traffic would be even less and the increase of noise would not be noticeable (less than 1 dBA) and would have a negligible, long-term effect on the visitor use and experience. When combined with the minor, adverse, and long-term past, present, and reasonably foreseeable actions at HO, these adverse effects on visual resources, noise, and air quality resources, would result in a cumulative moderate, adverse, but short-term effect on visitor use and experience. Operations of the proposed ATST Project combined with past, present, and reasonably foreseeable actions at HO would still result in moderate, adverse, and long-term effects on visitor use and experience.

For the lower Park road corridor, construction equipment and activity would be seen and heard on the road, e.g., be readily detectable by visitors along the Park road corridor, but would not be visible or audible at the Mees construction site. When combined with the minor, adverse, and long-term past, present, and reasonably foreseeable actions at HO, these adverse effects on visual resources, noise, and air quality resources, would result in a cumulative minor, adverse, but short-term affect on visitors. Operations of the proposed ATST Project combined with past, present, and reasonably foreseeable actions at HO would still result in cumulative minor, adverse, and long-term effects on visitor use and experience along the lower roadway.

Within the wilderness areas of HALE, including the crater, the only aspect of the proposed ATST Project construction at the Mees site that would affect visitors would be the visibility of the crane from the crater floor, as described in Section 4.5.3- Evaluation of Potential Effects at the Mees Site. When combined with the negligible, adverse, long-term effects of past and present actions at HO, the crane would have a minor, adverse, and short-term effect on the visitor use and experience at HALE. Operations of the proposed ATST Project would not be seen or heard by visitors in the wilderness areas and when combined with the negligible, adverse, and long-term effects of past, present, and reasonably foreseeable actions, the cumulative effects would be negligible, adverse, and long-term.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site

The effects on visitor use and experience from construction and operation of the proposed ATST Project at the Reber Circle site would, in general, be of higher intensity than those identified for the Mees site. Since the Reber Circle site would be closer and less terrain-shielded than it would be at the Mees site, it would be more visible from the Pu'u 'Ula'ula Overlook and from the summit of White Hill (Pa Ka'oao) and Magnetic Peak. Even without noise intrusion at this location in combination with the minor, adverse, and long-term effects on visitor use and experience from past, present, and reasonably foreseeable actions at HO, the cumulative combined visual intrusion alone would result in a major, adverse, and long-term effect on visitor use and experience at the Pu'u 'Ula'ula Overlook, at areas adjacent to HO i.e., Pa Ka'oao, and Magnetic Peak, and along the upper Park road corridor.

The effects to visitor use and experience due to traffic and noise along the upper Park road corridor would be similar to those described for the Mees site. If the proposed ATST Project were to be constructed at the Reber Circle site, it would be somewhat more visible along the Park road corridor due to its position within HO and the reduced terrain and facility blocking as described in Section 4.5-Visual Resources and View Plane. From closer than 0.6 miles from HO on the upper Park road corridor, this visual intrusion, when combined with the minor, adverse, and long-term effects of past, present, and reasonably foreseeable actions at HO, would likely result in a major, adverse, and long-term effect on the visitor use and experience. At longer distances along the upper Park road corridor, the effects would be not much different from past and present HO activities, namely minor, adverse, and long-term.

Unlike the Mees site, the proposed ATST Project at Reber Circle would likely be visible, at least from the upper carousel within the wilderness area that includes the crater, which would result in a combined cumulative moderate, adverse, and long-term effect on visitor use and experience from some locations in the crater.

No-Action Alternative

There would be no direct cumulative effect to visitor use and experience under the No-Action Alternative, as visitor use and experience would remain the same as the existing conditions outlined in Section 3.0-Description of Affected Environment.

4.17.10 Water Resources

The ROI for water resources is HO, the affected areas of HALE and the Park road corridor, which are all within the Waiakoa and Manawainui Gulch watersheds and Kahikinui Aquifer system. The water resources considered are both groundwater and surface water systems within the ROI. Temporal consideration extends to early records from Western sources.

<u>EFFECTS OF PAST AND PRESENT ACTIONS ON NOISE ON WATER RESOURCES</u>

An early account of ascending Haleakalā mentions finding water along the way. "Half way up the mountain, we found plenty of good water, and at a convenient fountain, we filled our calabash for tea." (Vol. II, Appendix F(2)- SCIA, pg. 25). Traditional Hawaiian practitioners ascending the mountain would have had no difficulty finding water on the lower slopes of Haleakalā, because surface water was and is, still very abundant in the watershed that covers much of the windward side of the mountain. For example, a researcher for the East Maui Watershed Partnership reports that the slopes of Haleakalā yield as much as 60 billion gallons of surface water each year, (East Maui Watershed Partnership). However, basal groundwater is confined to dike systems thousands of feet below the summit (FTF EA) and therefore the ROI does not have groundwater resources that are readily accessible to those who work at or visit the summit area.

Specifically, Section 3.7-Water Resources describes how water is supplied for the present actions at HO and HALE. During various times of the year at HO — particularly the winter months — rainwater is collected from building roofs, etc., and stored in water catchment systems. To supplement this source, water is trucked to each user in certified tanks where it is stored on-site. Users maintain their own collection systems and storage tanks for potable and/or non-potable water, as well as their individual pumping and distribution systems.

Within the affected ROI for HALE, there are only surface water resources. Catchment for both Visitor Center restrooms is from the impervious surfaces around the Visitor Center, and elsewhere in HALE there are storage tanks that take advantage of rainwater runoff. Streams in the affected portion of HALE are largely intermittent runs that are typically dry in good weather. These runs cross under the Park road corridor at the bridge, the 11 box culverts, and other natural drainage areas.

Past actions at HO have had a minor, adverse, and long-term effect on water resources, in that, due to inadequate maintenance of pathways, soil erosion occurred that changed local water drainage and infiltration patterns on Kolekole, at least in the short-term. Subsequent to implementation of the Storm Water Master Plan for Haleakalā High Altitude Observatory (SWMP) in 2006 (Vol. II, Appendix L), present actions do not result in local erosion or drainage issues.

Within HO and HALE, water resources are adversely affected from surfaces, such as roads, buildings, and parking lots that do not permit infiltration of water that could eventually make its way to the basal groundwater layers at lower elevations. Since the total area covered by these impervious surfaces is very small compared to the undisturbed portions of the ROI the effects on water resources are minor, adverse, and long-term.

EFFECTS OF REASONABLY FORESEEABLE FUTURE ACTIONS ON WATER RESOURCES

The reasonably foreseeable future actions within the ROI, excluding the proposed ATST Project, are not likely to affect the water resources of the ROI. The construction of the SLR 2000 would not require use of either surface water or basal groundwater for construction purposes. Ground disturbance for this project would be minimal, based upon use of pre-existing impervious surfaces (road beds and concrete pads) for construction. The effects would be negligible, adverse, and short term.

Cumulative Effects of the Proposed ATST Project at the Mees Site

At the Mees site, excavation would require land-disturbing activities, which could increase the potential for soil erosion to change infiltration routes and drainage patterns. However, land-disturbing activities would occur for a limited duration of time, and construction activities would comply with State-administered National Pollutant Discharge Elimination System (NPDES) regulations to minimize the effects on surface and groundwater resources. Compliance measures would include the use of BMPs to control erosion. The proposed ATST Project would be required to comply with the guidelines in the SWMP, which apply to all facilities and operations within the 18.166-acre HO complex. When added to the past, present, and reasonably foreseeable future actions, the proposed ATST Project and its associated MECO upgrade would result in cumulative minor, adverse, and long-term effects on the water resources.

The proposed ATST Project would also include removing the existing cesspool and replacing it with the Individual Wastewater System (IWS), which would capture and process domestic wastewater prior to infiltration into the ground. The effluent would be of high quality as compared to the effluent from the existing cesspool, and therefore a minor, beneficial, and long-term effect on groundwater would result.

Additionally, the proposed ATST Project facility would capture stormwater and surface water for reuse, thereby reducing the potential adverse effects on the infiltration basin. Since no changes to the Park road corridor are proposed, there would be no changes in stormwater runoff patterns, infiltration, or drainage within the remaining portions of the ROI. Overall, the addition of the proposed ATST Project would result in cumulative minor, adverse, and long-term effects to water resources within the ROI during construction and negligible, adverse, and long-term effects during operations.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site

If implemented at the Reber Circle site, cumulative effects of existing projects and the proposed projects on surface and groundwater resources would be similar to those described for the Mees site. The proposed ATST Project and other future proposed actions, including the MECO electrical upgrades and the construction of the SLR 2000 would require land-disturbing activities that may increase the potential for soil erosion. However, the land-disturbing activities would be of limited duration in time and construction activities would be required to comply with NPDES regulations to minimize the effects on surface and groundwater resources. Compliance measures would also include the use of BMPs to control erosion. Finally, the proposed ATST Project would be required to comply with the stormwater runoff requirements in the SWMP, which apply to all facilities and operations within the 18.166-acre HO complex. Thus, the anticipated cumulative effects of past, present, and reasonably foreseeable future actions, including construction of the proposed ATST Project at the Reber Circle site would be negligible, adverse, and short-term with respect to water resources.

A wastewater treatment plant would be built to capture and treat domestic wastewater from the facility for the proposed ATST Project, if it were constructed at the Reber Circle site. However, in this case the existing cesspool at the MSO facility would not be removed and untreated wastewater would continue discharging directly into the ground, resulting in minor, adverse, and long-term effects on groundwater. Overall, the cumulative effects from past, present, and reasonably foreseeable future actions, including operation of the proposed ATST project at Reber Circle, would be minor, adverse, and long-term.

No-Action Alternative

Under the No-Action Alternative, the proposed ATST Project would not be constructed and, therefore, the surface water features and groundwater resources would not be affected. However, future proposed projects, including road improvements and SLR 2000 could have minor, adverse, and short- term effects on the surface water resources as described above. Under the No-Action Alternative the existing cesspools at HO would not be removed and, therefore, the subsurface discharge of wastewater would continue.

Considering past, present, and reasonably foreseeable future actions, excluding the proposed ATST Project, the cumulative effects from the No-Action Alternative would be negligible, adverse, and long-term effects on surface water and groundwater resources within the ROI.

4.17.11 Hazardous Materials and Solid Waste

The ROI for HAZMAT and solid waste includes HO, the Park road corridor, and the portion of the State highway leading up to the Park entry boundary. Consideration of cumulative effects is focused primarily on HO because it is the main user of such materials and solid waste in the summit area. Temporal consideration extends back to 1961 when HO was identified as a separate land user.

EFFECTS OF PAST AND PRESENT ACTIONS ON HAZARDOUS MATERIALS AND SOLID WASTE

Hazardous Materials

Those organizations within HO that use HAZMAT and generate hazardous waste have had hazardous waste management plans for many years. The IfA "Hazardous Material and Hazardous Waste Management Program" (UH IfA, 2005b), governs the handling of HAZMAT for the HO site. The management plan complies with applicable Federal, State, and County regulations that govern the use of HAZMAT and the disposal of hazardous wastes. Since 2004, handling of hazardous waste emergencies at MSSC are in accordance with the Hazardous Material Emergency Response Plan for the MSSC, which is the responsibility of Boeing LTS, which has the prime responsibility for spill response (Boeing, 2005b).

The HAZMAT plan identifies emergency contacts, an emergency action plan, organizational roles and responsibilities, site-specific contingency plans, information on hazards analysis, response functions, public information and community relations, as well as information on containment and cleanup.

Recently completed projects, such as the AEOS MCF for the AEOS telescope require the use of HAZMAT with commensurate increases in the amounts of HAZMAT brought to HO. The materials used at the AEOS MCF are the same as those used to maintain smaller mirrors at the AEOS telescope building. The volume of hazardous waste that is generated from stripping the AEOS mirror is approximately between 207 and 376 kilograms (456 to 829 pounds), once every six years (U.S. AFRL, 2005). The recently constructed Pan-STARRS Telescope facility does not store HAZMAT or generate hazardous waste.

Past actions at HO have resulted in only one recorded spill incident since 1961. On September 11, 1999, a subcontractor working at MSSC released 330 gallons of a 20 percent mixture of propylene glycol and water into the cinders and rock. (NOTE: The Food and Drug Administration (FDA) has determined propylene glycol to be “generally recognized as safe” for use in food, cosmetics, and medicines.) All required notifications were made to the appropriate agencies and personnel. A containment trench and a plastic covering were installed immediately. The EPA was not contacted because the material did not violate RCRA and was not Federally-regulated.

The site was cleaned up on Saturday, September 18, 1999. A trench was dug around the contaminated area, plastic was used to cover it, samples were collected and prepared for shipment to a certified lab in Honolulu, and photographs were taken. Soils were excavated to a depth of six inches in the contaminated areas and at three feet along an area where a concrete slab acted as a dam. The excavated soil was placed in containers and covered with plastic sheeting. A “no further action” letter was received from the State of Hawai‘i, Hazard Evaluation and Emergency Response on September 27, 1999 (Ueshiro, 1999), and the site does not pose any risk to human health. To date, there have been no spills or releases at any of the other facilities on HO (Shimko, 2005).

In consideration of the increased amounts of HAZMAT stored at HO since the MCF was completed, and in consideration of the small but always present risk of uncontained spills, the effects of past and present actions on HAZMAT are minor, adverse, and long-term.

Solid Waste

With respect to solid waste, the remote location of HO has required certain practices and procedures. Each facility has its own trash receptacle and each facility’s building maintenance personnel are responsible for trash collection. Non-hazardous trash is disposed of off-site in a licensed landfill, with computer paper and aluminum being recycled (UH IfA, 2001).

At IfA, approximately four to five bags of solid waste are produced from the MSO facility and other facilities at HO under their jurisdiction (i.e., the Atmospheric Airglow facility, the Zodiacal Observatory, and the FTF). Municipal solid waste from MSSC, such as food trash, is collected twice a week for off-site disposal at the Central Maui Landfill. Other wastes associated with MSSC operations and maintenance, such as used oil, are collected in containers within the AEOS facility and transported off-site for disposal as non-hazardous waste. Amounts of solid waste vary, with MSSC as the largest producer, generating 3,335 pounds of non-RCRA waste in fiscal year 2004 (Shimko, 2004). These amounts are an almost infinitesimally small fraction of the total daily capacity permitted at the receiving landfill in Central Maui, which accepts approximately 450 tons per day.

Past and present actions at HO do not result in more than miniscule additions to the solid waste stream on Maui, therefore, the effects have been negligible, adverse, and long-term.

EFFECTS OF REASONABLY FORESEEABLE FUTURE ACTIONS ON HAZARDOUS MATERIALS AND SOLID WASTE

The reasonably foreseeable future action within the ROI for HAZMAT and solid waste is the installation of SLR 2000 at HO. This activity would not involve the use of HAZMAT as defined in OSHA 29 CFR part 1910, subpart Z (Toxic and Hazardous Substances). Therefore, there would be no effect on HAZMAT. This project would generate a small amount of solid waste during construction, which would need to be disposed of at the Central Maui landfill. Small scale construction does not typically result in large quantities of solid waste and it is anticipated that this project would have a negligible, adverse, and short-term effect on solid waste within the ROI.

Cumulative Effects of the Proposed ATST Project at the Mees Site

During construction, some activities such as welding and metal working could generate minor quantities of hazardous waste and air pollutants. Other HAZMAT or substances that may be used in the construction phase would include fuels, oils, and lubricants in machinery operations and paints on building structures. Petroleum products are Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-defined HAZMAT and would be monitored, handled, and reported through RCRA, if necessary. No other HAZMAT or substances would be used in construction. The LRDP imposes construction constraints, such that no oil or chemical treating may be used at the site for dust control. While the contribution of the proposed ATST Project would be negligible, the added risk and volume of HAZMAT combined with the past, present and reasonably foreseeable future actions at HO would increase the intensity of cumulative effects to minor, adverse, and short-term.

In accordance with LRDP requirements, construction contractors would remove construction trash frequently, particularly food sources that could increase the population of mice and rats. Most construction waste would be removed in roll-off trash receptacles that would be covered before transport. During demolition and construction activities at the Mees site, solid waste requiring disposal would be generated. Construction waste and debris would be secured to minimize windblown materials, particularly during non-working hours. The amount of demolition and construction debris generated by the proposed ATST Project at the Mees site is expected to be minimal, with only a small effect on waste streams; however, the short-term cumulative effects on the solid waste management from past, present and reasonably foreseeable future actions within the ROI would raise the expected cumulative intensity to minor, adverse, and short-term.

When operational, the proposed ATST Project would be a Conditionally Exempt Small Quantity Generator of hazardous waste, in that it would not generate more than 100 kilograms (approximately one-half of a 55-gallon drum, 27 gallons, or 220 pounds) of hazardous waste, nor would it generate more than 1 kilogram (2.2 pounds) of acute hazardous waste in one month, and it would not have more than 1,000 kilograms (approximately five 55-gallon drums, or 275 gallons, or 2,200 pounds) of total accumulated hazardous waste, or no more than 1 kilogram (2.2 pounds) of accumulated acute hazardous waste at any time (U.S. AFRL, 2005). Mirror recoating operations every approximately two years would require the largest use of HAZMAT, as described in Section 2.4.4-Telescope Operation Activities and shown in Table 2-5. Overall, while these amounts are considered small enough to not require regulations imposed on large generators, when added to the small quantities generated by past, present, and future known activities within the ROI for HAZMAT, the combined cumulative effects would be minor, adverse, and long-term.

After completion of the proposed construction, the facility would be operational and solid waste generated on-site would be carried out of the building by facility workers and kept in covered refuse containers. Non-hazardous trash and recyclable material would be disposed of off-site at Maui's licensed landfill. There would be no change in the long-term solid waste disposal practices from the Mees site, although solid waste generation would increase somewhat, perhaps by as much as 4 to 8 bags of solid waste a week. The increase would be generated by the approximately 6 to 8 additional personnel at the site in two shifts, when combined with the past, present and reasonably foreseeable future actions would still be cumulatively negligible, adverse, and long-term.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site

Hazardous materials storage and handling, and solid waste collection and disposal at the Reber Circle site would be identical to that for the Mees site, with the exception of diesel fuel. For the Reber Circle site, a new aboveground fuel tank would be installed, which would comply with all USEPA and State requirements. All applicable inspection, maintenance, and safety regulations related to the fuel tank and generator would be enforced during ATST operations. Operating the diesel fuel tank at the Reber Circle site would result in increased risk of contamination of on-site soils when handling and storing diesel fuel, but overall the safety and HAZMAT procedures that would be in place would result in a small risk and negligible, adverse, and long-term effects on HAZMAT. Overall, the cumulative effects of past, present, and reasonably foreseeable future actions on HAZMAT would be the same as for the Mees site, minor, adverse, and long-term. The effects on solid waste would be cumulatively negligible, adverse, and long-term.

No-Action Alternative

For the No-Action Alternative, the proposed ATST Project would not be constructed, thereby not involving any short or long term use of HAZMAT. Existing facilities would continue to use such materials for mirror coating and cleaning, lubrications, refrigerants, etc. Therefore, the potential for a release would still exist. Based on the historical record of HAZMAT and waste handling at HO, which is excellent and does not include any EPA-reportable spills of HAZMAT in the more than 30 years since reporting requirements were imposed, only negligible, adverse, and long-term effects are expected as a result of the No-Action Alternative.

4.17.12 Infrastructure and Utilities

The ROI for infrastructure is HO, its adjacent neighbors, and the Park road corridor. The temporal consideration for this section begins in 1961 with the identification of HO as a separate land user in the summit area. Infrastructure is defined as those systems that pertain to wastewater and solid waste disposal, stormwater and drainage, electrical service and communications, and roadways and traffic. The cumulative effects considered are those from the past, present, and reasonably foreseeable future actions at HO and adjacent neighbors on co-located properties in the Kolekole area.

EFFECTS OF PAST AND PRESENT ACTIONS ON INFRASTRUCTURE AND UTILITIES

Wastewater and Solid Waste Disposal

There is no centralized means of sewage disposal within the ROI. Septic tanks have been used since at least the first facilities were installed at HO in 1963. Most facilities at HO have their own septic systems and these generally have either simple cesspools or separation tanks and leach fields. Occasionally, throughout the history of HO, some of these systems have needed to be serviced via off-site waste removal contractors. The effluent from these systems has not affected the remainder of the ROI, since groundwater levels are thousands of feet below the summit area (FTF EA, 2001). Therefore, the effects of past and present actions with respect to wastewater are, in general, negligible, adverse, and long-term.

Each user at HO also provides for trash collection. Non-hazardous trash is disposed of off-site in a licensed landfill and paper and aluminum are recycled. Hazardous wastes and petroleum product wastes are segregated at the generation point and handled separately. There has been little effect on the rest of the

ROI from past and present solid waste activities at HO, and as a result, these effects are also considered negligible, adverse, and long-term.

Stormwater and Drainage System

On the slopes of Haleakalā, virtually all precipitation will infiltrate into the soil profile (Section 3.7-Water Resources). Once in the soil, gravity continues to flow water down into the soil; and when the water hits a less permeable layer, such as basalt, it will flow in the path of least resistance. At the HO site, this confining layer of basalt ranges from depths of 5 to 20+ feet. This confining layer of basalt in and around the summit area causes precipitation falling near the summit to infiltrate and flow subsurface toward the natural drainage courses, e.g., Manawainui Gulch. As a result, runoff from the impervious surfaces associated with HO facilities and adjacent roads has not been likely to increase the total volume of stormwater flow entering natural drainages, although it may have affected the way it is transported there (UH IfA, 2005a). Past and present actions at HO have had a minor, adverse, and short-term effect on stormwater and drainage systems, due to inadequate maintenance of runoff pathways within HO; between 2002 and 2006 soil erosion occurred that changed local water drainage and infiltration patterns on Kolekole, at least in the short-term. Subsequent to implementation of the Storm Water Master Plan for Haleakalā High Altitude Observatory (SWMP) in 2006 (Vol. II, Appendix L), present actions do not result in local erosion or drainage issues. Also, within HO, minor, adverse effects on stormwater systems have occurred from surfaces, such as roads, buildings, and parking lots that may direct flow off Kolekole as sheet flow that also causes minor erosion of soil at the site. In recent years, sheet flow has been redirected at both the north and south sides of Kolekole to minimize such effects. Therefore, the overall long-term effects of past and present actions at HO on stormwater and drainage are minor and adverse.

Electrical and Communications Systems

MECO generates electricity for the HO site and has since the inception of HO. There have been minor upgrades since 1963, including newer substation components on the north side of HO during the 1990s. MECO currently provides a 3750/4688 kilovolt-ampere (kVA) transformer at the Kula substation that presently serves HO. The site is connected via 23 kV conductors on power lines to a 450 kVA transformer bank and voltage regulators at a substation within HO and distributed from there. Past and present actions at HO have and continue to utilize considerably less than the current reserve capacity of the main power line to Haleakalā, which is estimated by MECO to be approximately 1900 kVA. As such, the effects on electrical systems from past and present actions at HO have been negligible, adverse, and long-term.

Hawaiian Telcom provides telephone and other communications services for the HO complex. Over the years, HO communications have been upgraded by the addition of new technologies, and are currently served for data and telephone connectivity by a range of copper, fiber-optic, and microwave lines. The U.S. Air Force facilities are served by a dedicated fiber cable with OC3C capacity. The IfA facilities are served by a microwave link with DS3 capacity. Hawaiian Telecom provides commercially available copper and fiber-optic lines to HO. With more than 100 percent reserve capacity, these communication links result in negligible, adverse, and long-term effects on communications within HO.

The Federal Aviation Administration **(**FAA) operates and maintains 50 Watt transmitter and receiving equipment for remote air/ground interisland and trans-Pacific communications to and from aircraft. The antennas for these transmitters/receivers are located on two towers within the FAA property adjacent to HO. The frequencies for transmission and receiving are in the Very High Frequency (VHF) and Ultra-High Frequency (UHF) radio bands, to and from transiting aircraft at altitudes from 8,000 to 50,000 feet. These FAA communications systems do not use substantial power from the reserve available through the MECO substation, and according to the FAA, they have not been or are currently affected by HO operations (FAA, 2009). The overall effects of past and present HO activities on communications within the relevant portion of the ROI are negligible, adverse, and long-term.

Roadways and Traffic

As the only route to the summit for visitors and HO users, the Park road is traveled by upwards of 1.7 million persons each year. The road also experiences extremes of weather throughout the year and therefore the condition of the Park road is the result of a combination of factors that include travel to and from HO. As shown on Table 3-10, a 2003 traffic study included in the LRDP showed an average daily total traffic volume of 48 vehicles entering and leaving HO. That approximate number has not changed substantially since about 1995, when the last major facility (AEOS) became operational at HO. Prior to AEOS construction, HO contributed smaller numbers of vehicles to the traffic on the Park road corridor. The volume of average daily traffic on the Park road over the last four years is 600 passenger cars and 16 buses, (Vol. II, Appendix P-FHWA Report, Table 10), and so from the available data, HO traffic constitutes approximately 8 percent of the daily traffic. The condition of the road has been described in the 2009 FHWA Report. In addition, the FHWA study of the condition of the road through HALE also characterized the current traffic volume on that road based on statistics provided by the NPS. Tables 9 and 10 in the FHWA Road Report depict an average traffic volume from 2004 to 2008 of approximately 225,000 total vehicle trips annually, comprising approximately 600 daily passenger car trips and 16 daily bus trips. Considering the fraction of daily vehicular traffic that can be ascribed to HO, the past and present actions at HO are considered to have resulted in minor, adverse, and long-term effects on the condition of the Park road.

The road within HO is used exclusively by those going to and from HO. Traffic patterns and parking have been modified over the years to accommodate new facilities and security concerns. However, with less than 50 cars each day using the road, it has not required much surface maintenance other than berms and shoulder work for stormwater control. The past and present actions at HO have resulted in only minor, adverse, and long-term effects on the condition of the HO roadway.

State Road 378 is the access road from lower elevations on Maui to the entry of the Park road. Much of the road traverses Haleakalā Ranch (Fig. 4-41), which is privately-owned land (County of Maui, Real Property). The State road has been used for access to HO through HALE since 1961. Traffic on this road was measured by the State of Hawaiʻi Department of Department of Transportation (DOT) in a recent traffic survey on September 19 and 20, 2007 (DOT, 2007). Route 378, the State-maintained portion of the Haleakalā access road was reported to have total, two-way, 24-hour traffic of 1,439 vehicles (September 19, 2007) and 1,562 vehicles (September 20, 2007) in the traffic count conducted by the DOT. The traffic from past and present actions at HO would constitute approximately 3 percent of that volume, which is small enough to be considered negligible, adverse, and long-term with respect to effects on that roadway.

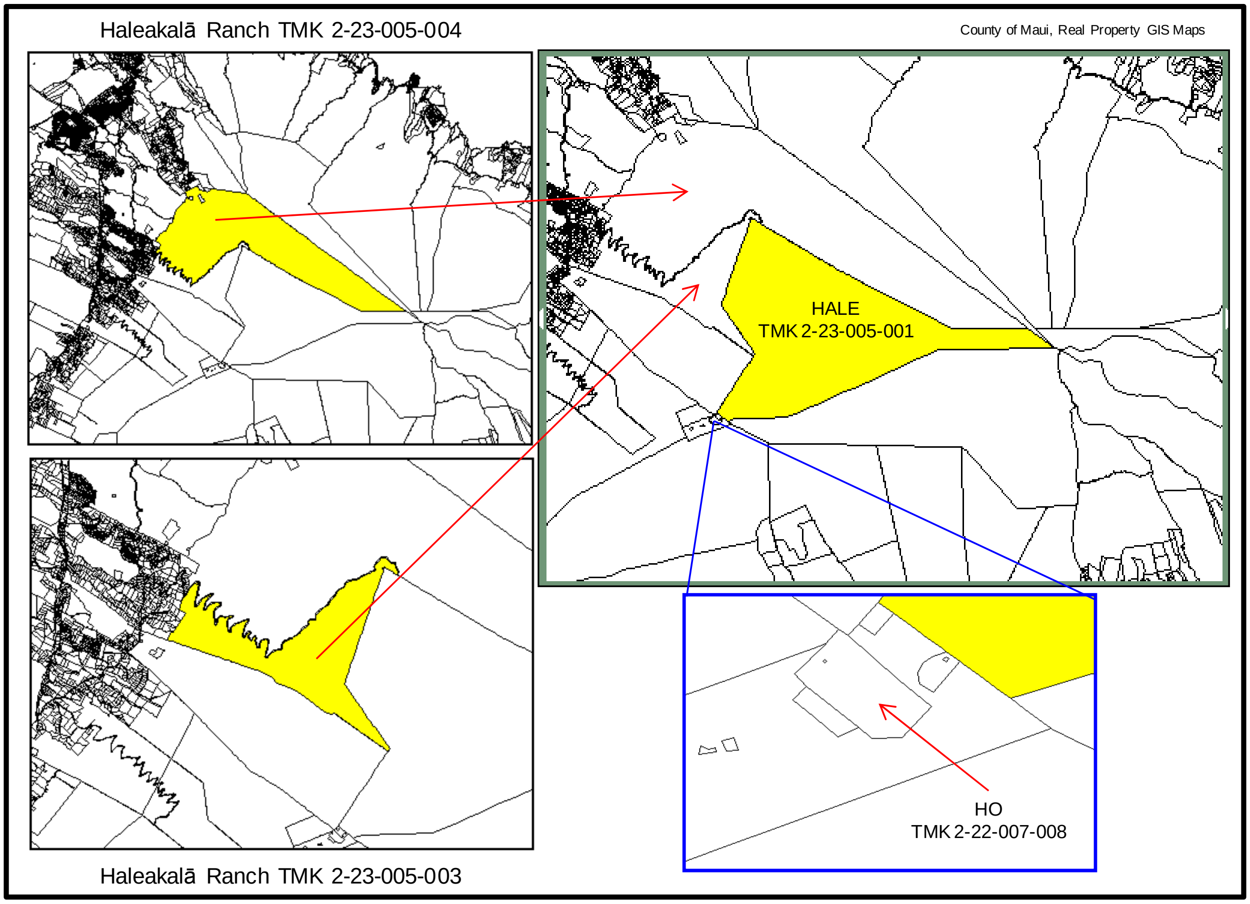


Figure 4-41. TMK Maps Showing Haleakalā Ranch and HALE Land.

There are two other access roads that serve the Haleakalā summit area. The FAA maintains an exclusive access road to facilities in the Saddle Area and the FAA Low Site. There is also an unimproved access road known as Skyline Drive, which originates at the Saddle Area and traverses the Southwest Rift zone, ultimately leading to Spring State Recreation Area (also known as Polipoli State Park) (DLNR, Hawai'i State Parks). Its entire length is within State land and most of it is within the fog belt of the Kula Forest Reserve. Approximately half of Skyline Drive is in the Limited Subzone of the State Conservation District and the remaining half in the Resource Subzone. A locked gate near the Saddle Area restricts vehicle access to the road from the Haleakalā summit to those holding DLNR permits. Hikers, hunters, and bicyclists use the unpaved road. The slopes along the existing road range from flat to 28 percent.
Due to the steep grades, tight turns, and soft roadbed conditions of this access road, it is not appropriate for the range of vehicles necessary for construction, maintenance, and operation of HO facilities and this road has experienced negligible, adverse, and long-term effects from past and present actions at HO.

EFFECTS OF REASONABLY FORESEEABLE FUTURE ACTIONS ON INFRASTRUCTURE AND UTILITIES

The reasonably foreseeable future action within the relevant areas of the ROI exclusive of the proposed ATST Project is the installation of SLR 2000 at HO.

Cumulative Effects of the Proposed ATST Project at the Mees Site

The cumulative effects of the proposed ATST Project and its associated MECO upgrade on wastewater, stormwater, drainage, electrical systems, communication systems, roadways, and traffic are considered in the paragraphs below. Construction effects are only considered for roadways and traffic, since the remaining infrastructural elements would not contribute to cumulative effects before the proposed ATST Project becomes operational.

Wastewater. The existing cesspool at the MSO facility would be removed and an advanced aerobic Individual Wastewater System (IWS) would be installed to treat sanitary wastewater. In order to receive a permit, the IWS must meet Hawaiʻi Department of Health requirements. Effluent from the IWS would be discharged to the subsurface through a septic tank leach field, except that the effluent from the proposed system would be treated as opposed to the current untreated effluent. The proposed IWS would not increase the amount of effluent, but it would increase the effluent quality relative to current conditions. Therefore, construction of the proposed ATST Project would likely result in a beneficial change in effluent quality that, along with present and past actions at HO and adjacent neighbors, would constitute a minor, beneficial, and long-term effect on wastewater generation.

Stormwater and Drainage System. A majority of the HO site is served by a stormwater collection system of paved channels designed to convey runoff from impervious areas to a central infiltration basin. The proposed ATST Project facility design would include stormwater capacity and path configuration that would tie it into the operating drainage system for HO. As a requirement, the proposed ATST Project would implement the guidance of the SWMP for HO (Vol. II, Appendix L). In so doing it, would capture stormwater for reuse through gutters, rainwater leaders, and catchment drains piped to an underground storage tank, and ultimately to the existing cistern near MSO. As such, changes to runoff are not expected to increase and no measurable or perceptible consequences on the existing stormwater management system or drainage patterns would result. Capturing stormwater and implementing the guidance of the SWMP for HO would reduce the potential for increased runoff entering the stormwater management system. Therefore, in combination with the minor, adverse, and long-term effects on stormwater and drainage patterns from past, present and reasonably foreseeable future actions within Kolekole, it would be expected that the proposed ATST Project would result in cumulative minor, adverse, and long-term effects.

Electrical Systems. The estimated total electric service for the proposed ATST Project is 960 kVA, although the entirety of that load would not be concurrent. Applying a diversity factor of 70 percent the maximum anticipated new electrical demand would be approximately 670 kVA. The reserve capacity in the existing MECO substation at HO is estimated by MECO engineers to be adequate for the existing connected loads and all currently identified future loads, including the proposed ATST Project (Kauhi). The other anticipated future electrical loads that would be served by that substation are the AEOS Mirror Coating Facility (680 KVA, non-concurrent), the Pan-STARRS facility (400 kVA), and the NASA Transportable Laser Ranging System (120 kVA).

Although the existing HO substation has adequate capacity, the equipment is considered obsolete. MECO is planning to upgrade it to a new 2500 kVA substation with improved efficiency and safer reserve capacity (Kauhi, 2005). The upgrade itself would require small scale construction within HO that would not have more than negligible effects on the other elements of infrastructure described in these sections. A "Request for Electric Service" has been submitted to MECO on behalf of the proposed ATST Project to allow incorporation of the anticipated electrical power requirements into planning and capital budgeting processes. A MECO-funded study (AMEL, 2005) was completed that identified ways to reduce the peak ATST electrical load through specification of more efficient equipment and shifting cooling loads to off-peak times. These identified strategies have been incorporated into the planning for the proposed ATST Project. All connections would be via underground electrical lines. The MECO upgrade would alter the existing electrical system by improving efficiency and providing a safer reserve capacity, which in combination with past, present, and reasonably foreseeable future actions would result in cumulative minor, beneficial, and long-term effects on the electrical system at HO.

Communications Systems. The proposed ATST Project at the Mees site would require data connectivity of approximately 1 Gigabit per second to a base facility at lower elevation; however, the location of the Maui base facility and ATST data repository has not been determined. Connectivity from the site to the base headquarters would use existing dark optical fiber from the proposed ATST Project. Arrangements would be made with the commercial provider to lease the necessary capacity. The hardware to implement the connection and the service agreement with the commercial provider would be supplemental to the existing communications connections within the ROI. These required changes to the existing communication system would have no perceptible consequence to the other facilities on Kolekole. In addition, communication connections to serve the proposed ATST Project at the Mees site would be through existing reserve lines or new lines that would follow the path of existing lines. Any required new lines would be placed during site excavation.

The FAA RCAG system on Puʻu Kolekole maintains two sets of frequencies for contact with interisland air traffic down to 8,000 feet. As a result of the potential addition of the proposed ATST Project at the Mees site, physical obstruction to the geometric line-of-sight for signals from RCAG could occur. These frequencies could experience attenuation, which would be defined as signal loss in a narrow swath of 5 degrees originating at the RCAG antennas and intersecting the width of the proposed ATST Project structure about 800 feet away. Signal refraction around objects occurs at Puʻu Kolekole, since some of the current natural terrain as well as man-made objects (AEOS, Zodical Light Building) are up to about 60 feet higher than the RCAG line-of-sight to the horizon, but do not interfere with FAA signals (FAA, 2007). FAA specialists working with NSF will address any potential issue involving a degradation of signal as a result of the proposed ATST Project. If there is such a degradation of signal, a resolution of the issue will be developed and accompanied by the appropriate level of NEPA compliance. In addition, NSF will work with the FAA to obtain adequate funding for implementation of the resolution. This would reduce the effects to negligible, adverse, and long-term.

Overall, in combination with past, present and reasonably foreseeable future actions at HO and adjacent neighbors, the cumulative effects of the proposed ATST Project at the Mees site on communications would be negligible, adverse, and long-term.

CONSTRUCTION-RELATED CUMULATIVE EFFECTS ON ROADWAYS AND TRAFFIC

Roadways and traffic include both the roads within the HO property and the Park road corridor leading to HO. The different areas of roadway are subject to different levels of traffic, are managed by different agencies, and require varying levels of maintenance. They are treated separately in this analysis to allow for appropriate assessment of the cumulative effects of construction of the proposed ATST Project.

Cumulative Effects on Roadways at HO. During the construction phase of the proposed ATST Project, the roads at HO would continue to be used for ongoing observatory operations. Any necessary barricading would be temporary and would be prearranged with HO users. Some roads within the HO complex may be temporarily widened to allow through-traffic during construction. The access road that leads from north of the MSO facility down to the main staging area would be reopened for use during construction. This would require removing rock and soil that have been placed at the entrance to the road as a surface water diverter. The rock and soil diverter would be reconstructed after the proposed ATST Project construction is complete. All of these activities would be done in accordance with and to a level not to interrupt the effective use of the HO stormwater management, discussed in Section 3.7.1-Surface Water. The roads within HO are maintained by IfA, with contributions from all users of roads and easements.

Vehicular traffic is normally slow-speed and low in volume and would not be substantially affected by the cyclic integration of construction vehicles and equipment related to the proposed ATST Project. Currently, roadways within HO require very little maintenance and have considerable longevity. These observatory roads were not designed, however, to support unusually heavy loads, such as large trucks and construction vehicles. When combined with past, present, and reasonably foreseeable future actions at HO and adjacent neighbors, construction of the proposed ATST Project would inevitably result in cumulative moderate, adverse, and short-term effects on the condition of the roads within HO.

***Cumulative Effects on Roadways Leading to HO*.**
The roadways leading to the construction site for the proposed ATST Project include State-maintained highways up to the Park entrance and the Park road itself. Traffic along these routes would primarily be affected by slow moving heavy equipment, delivery of concrete and materials, and miscellaneous service trips as characterized in Section 2.4.3-Construction Activities. The following discussion deals first with effects that are common to all these highways – both State- and Park-managed – and then addresses the issues that are particular to each.

Large trucks, delivery vehicles, van shuttles and passenger vehicles would all travel the State and HALE roadways leading to HO during construction of the proposed ATST Project at the Mees site. Construction vehicles would include heavy vehicles, such as dump trucks, flatbeds, water trucks and vehicles to transport large construction equipment such as bulldozers, backhoes, trenchers, a truck-mounted auger, and a large crane. The most intensive period of construction-related traffic would be during the first years of the project when heavy earth-moving equipment and most of the concrete for foundations and the telescope pier would be transported to the project site. The heavy equipment would remain at the site for as long as practicable to minimize conveyance over the roads. During the entirety of the construction period all large-vehicle traffic would be coordinated around heavier traffic periods and neighboring activities to minimize adverse effects. Furthermore, to minimize highway traffic and the need for on-site vehicle parking, construction workers would be required to carpool.

Even with these measures, traffic on the State and Park roadways leading to the site would be adversely affected by the construction traffic. The effects from construction-related traffic would be most evident on the mountain highways – State Route 378 and the Park road, which together form the only access route leading to the summit and into HO. The majority of this route is a two-lane highway with steep inclines and numerous switchback curves. This is a speed-limiting factor for large trucks causing inevitable queuing of vehicles behind the trucks. Considering the characteristics of the road, coupled with the normal tourist traffic and combined with past and present actions at HO, it is anticipated that the combination with past, present, and reasonably foreseeable future actions at HO and adjacent neighbors would result in cumulative moderate, adverse, and short-term effects to traffic on the State highways and the roadway through the Park. These are expected to occur during periods of heavy equipment use and material deliveries to the proposed ATST Project site.

***Cumulative Effects on State Road*.** In response to the DEIS, the DOT — the agency with jurisdiction over this portion of the road — identified no special concerns regarding road conditions or traffic related to the proposed ATST Project. They did, however point out that "…any heavy or wide truck transportation of project equipment on our State highways would require that your project staff and/or construction contractor contact our Highways Maui District Office for the appropriate truck permit and traffic route coordination." The ATST Project engineering team has researched the applicable statutes regarding standard authorized dimensions and weights of loads on State Highways, as well as the permitting requirements for loads that exceed these limits (HRS §291-34 to 36). The Project would fully comply with these requirements. It is anticipated that when combined with past, present, and reasonably foreseeable future actions at HO, the effects associated with construction-related traffic on this roadway would be minor, adverse, and short-term.

Cumulative Effects on Park Road. Large trucks carrying heavy loads and other construction-related traffic as defined in Section 2.4.3-Construction Activities, would utilize the Park road corridor leading up to HO during construction of the proposed ATST Project. The FHWA Road Report (Vol. II, Appendix P) concluded that the estimated traffic required for construction of the proposed ATST Project would increase the road wear factor by approximately 4 percent, which is considered in the report to be a relatively small increment**.** The report also provided recommendations regarding road maintenance and measures for protection of drainage structures (culverts and bridge) along the road during construction of the proposed ATST Project, as noted above in the summary of the report. These recommendations would be considered to prevent road damage from construction-related traffic. In addition, all construction-related traffic within the Park road corridor would be coordinated with HALE and conducted in compliance with an SUP issued by HALE, so as to avoid or minimize: damage to the road pavement, potential damage to historic structures along the Park road corridor, traffic congestion, and other potential adverse effects on Park resources and the visitor use and experience. Even with these provisions, based on the conclusions of the FHWA Road Report, the use of the Park road by these vehicles in combination with past and present actions at HO and adjacent neighbors would have a cumulative minor, adverse, and long-term effect on the longevity of the pavement. The contribution of the proposed ATST Project to a future road repair project to compensate for this effect would be addressed in the provisions of the SUP.

Table 2-4 contains information on the anticipated wide loads that would need to be employed during construction of the proposed ATST Project. The entry to the Park road at the station is insufficiently wide to accommodate these wide loads. In consultation with HALE, a preferred option was chosen to temporarily widen and improve the shoulder on the entry station (uphill side) to permit wide construction loads to enter the Park road past the entry station. This would consist of installing compacted fill for a distance of approximately 12 feet beyond the existing paved roadway at the widest point, tapered back to the roadway on each end of the widened lane. Modifications would also include relocating an existing light pole, upgrading utility pull boxes to withstand the anticipated loads, and other related work.

In order to limit adverse effects on that location within the Park road corridor several measures would be employed. Metal plate covers, beam structures or similar protective devices would be deployed to prevent damage to the underlying septic system. If protection proves impractical, relocation of the septic tank could be considered as an option. Secondly, the improved shoulder would need to be adequate for the heavy loads anticipated by the proposed ATST Project and maintenance of the shoulder improvement area would also be necessary. To deter Park visitors and others from driving on the new temporary shoulder, a barricade system such as removable bollards or similar devices would be installed on the improved shoulder.

This portion of the Park road corridor contains native plants and is also a nēnē habitat area. Therefore, construction would be completed outside of the nēnē nesting season, which is November through March. Native plants would be protected where possible in coordination with HALE staff. When the widened shoulder is no longer needed for the project the area, would be fully restored and rehabilitated through a restoration/rehabilitation plan reviewed and approved by HALE resource staff.

The addition of a temporary shoulder using locally obtained compacted fill and employing the precautions described above, when combined with past, present, and reasonably foreseeable future actions at HO and its adjacent neighbors, would not cause more than short-term, recoverable minor, adverse effects on a very small portion of the Park road infrastructure that cumulatively would be considered minor, adverse and short-term.

OPERATIONS-RELATED CUMULATIVE EFFECTS ON ROADWAYS AND TRAFFIC

The operational phase of the proposed ATST Project would, if approved, begin approximately in late 2015. An estimated on-site staff of six would operate the facility, with others staffing remote locations on Maui or off-island. Four to seven round trips per day are estimated during the preliminary operational phase, which accounts for three shifts for observing, maintenance, and engineering staff. The estimated round trips per day includes three carpooling van trips to accommodate the three shifts and one to four additional cars. After the initial operational phase, the round trips per day are expected to decrease to about one to five.

Cumulative Effects on Roadways at HO. Once construction is complete, there should be no further need for barricading of roadways for normal operational access to the proposed ATST Project. All truck and passenger vehicle parking is expected to be accommodated within the ATST service yard. During operations of the proposed ATST Project the cumulative effects of past, present, and reasonably foreseeable future actions on roadways within HO is anticipated to be negligible, adverse, and long-term.

Cumulative Effects on State Road. The State roadways in the Upcountry area and State Route 378 would continue to be utilized for access to the proposed ATST Project during its full operational lifetime. Given that the additional ATST-bound traffic would be minimal in comparison to normal traffic, as described in the traffic survey (DOT, 2003) in combination with past, present and reasonably foreseeable future actions at HO and adjacent neighbors the cumulative effects would be negligible, adverse, and long-term.

Cumulative Effects on Park Road. The Park road corridor would continue to be utilized for access to the proposed ATST Project during its full operational lifetime. Any necessary mitigation measures related to this use, such as continued carpooling by ATST staff, advance notification and approval of occasional large or heavy loads, compliance with established procedures for transportation of HAZMAT, etc., would be arranged with HALE pursuant to the SUP. Given these measures, and the fact that additional ATST-related traffic would be minimal in comparison with normal park traffic as documented in the FHWA Road Report, there would be negligible, adverse, and long-term effects on the Park road from operation of the proposed ATST Project.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site

With the exception of the removal of the Mees septic system, the cumulative effects on wastewater, stormwater, electrical systems, communication systems and roadways and traffic would be similar to the cumulative effects that would result from past, present, and reasonably foreseeable future actions at HO and adjacent neighbors, if the proposed ATST project were implemented at Reber Circle. Constructing the proposed ATST Project at the Reber Circle site would include the installation of a wastewater treatment plant and the cesspool at the MSO would continue to operate, which would result in a cumulative minor, adverse, and long-term effect on wastewater.

No-Action Alternative

Under the No-Action Alternative, the proposed ATST Project would not be constructed. The demands on the existing infrastructure and utilities would be minimally increased due to the only reasonably known future activity that would be added, the SLR 2000. The MECO upgrade would not be pursued without the proposed ATST Project. The SLR 2000 would have negligible, adverse, and long-term effects on infrastructure and the cumulative effects on infrastructure and utilities in the ROI from past, present, and future proposed projects combined with effects from the No-Action Alternative would be negligible, adverse, and long-term.

4.17.13 Noise

The ROI for assessing noise effects includes HO and the Park road corridor portions affected by on-site construction, installation, and operations including the Pu'u 'Ula'ula Overlook, and the area between the Haleakalā Visitor Center and Magnetic Hill. Noise-sensitive receptors within the ROI include cultural practitioners, scientists, staff, recreational users, and other visitors. Temporal consideration extends to opening of the Park roadway to general traffic in 1935.

EFFECTS OF PAST AND PRESENT ACTIONS ON NOISE

Past and present actions listed in Table 4-1 have resulted in a small continuous ambient noise level increase within the ROI, which can be attributed primarily to the increase in vehicular traffic in HALE over the years and to the increased traffic to facilities at HO since 1964, which constitute a small fraction of the total traffic through HALE. Additional short-term noise increases have occurred as a result of construction and installation associated with the activities listed in Table 4-1. See Sections 4.6-Visitor Use and Experience and 4.10-Noise for discussions of ambient noise levels associated with past and present actions within the ROI. General operations of telescope facilities are inherently low-noise activities and have made a negligible contribution to the ambient noise level. Visitor activities within HALE are generally low-noise in nature as well.

The current ambient noise level within the ROI is low; however, some users of Haleakalā may be particularly noise sensitive. In particular, cultural practitioners within the immediate vicinity of a noise source could potentially be disturbed. Most disturbances are low level, discrete events rather than a substantial increase in the overall ambient noise level. In general, current noise levels are compatible with existing activities within the ROI. Consequently, noise levels from past and present actions have resulted in a combined minor, adverse, and long-term effect.

EFFECTS OF REASONABLY FORESEEABLE FUTURE ACTIONS ON NOISE

Reasonably foreseeable future actions within the ROI excluding the proposed ATST Project would have short-term noise consequences. The construction of SLR 2000 would involve relatively low levels of noise, considering that much of the construction would be the erection of pre-fabricated sections. Without need for heavy construction equipment, there would be only minor, adverse effects for a short-term during construction.

Overall, effects from the reasonably foreseeable future actions other than the proposed ATST Project are anticipated to generate noise at levels comparable to those of past and present actions. Construction and installation activities would lead to larger increases in noise levels within the ROI for short periods of time, but it is anticipated that noise levels would remain compatible with existing activities within the ROI, constituting a minor, adverse, and long-term effect.

Cumulative Effects of the Proposed ATST Project at the Mees Site

The data in Section 4.10.2-Evaluation of Potential Effects at the Mees Site indicates that minor adverse effects on ambient noise levels at HO would occur from the proposed ATST Project construction. While short-term, non-impulse, and impulsive noise emissions generated during construction may be audible throughout the ROI and outdoor levels would likely exceed respective State standards for Class A zoning districts on occasion, human receptors at HO work primarily indoors in structurally insulated facilities. This would substantially attenuate any sound and vibrational emissions. The noise contours in Figure 4-40 suggest that construction noise would be heard within HALE to a distance of about 2,500 feet from the proposed ATST Project at the Mees Site. It would be attenuated with distance, but nevertheless at times of peak impact construction noise it would constitute a cumulative major, adverse, and long-term effect on ambient noise levels within the areas of HALE out to about 2,500 feet from the proposed ATST Project site.

There would be no permanent increase in background noise levels in the ROI above existing conditions. Should the construction coincide with the MECO upgrade and/or the SLR 2000 installation, noise and vibrations generated from all of these phases would be even higher. Mitigation measures restricting noise would be implemented from a half-hour before sunrise and a half-hour before sunset, and from April 20th to July 15th, in coordination with USFWS and NPS mitigation measures, reducing the effects to negligible, adverse, and long-term during those periods. Operational noise levels of all facilities within the ROI would be expected to remain compliant with State-wide community noise regulations applicable to Class A districts. Therefore, it is anticipated that the cumulative effects on noise levels would be minor, adverse, and long-term with a contribution of minor, adverse, and short-term effects from the proposed ATST Project.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site

The cumulative noise effects from existing conditions, the proposed ATST Project at Reber Circle site, and future proposed projects would essentially be identical to those described for the Mees site, considering that noise from construction would not be any closer to HO or HALE receptors. The other reasonably foreseeable future actions may occur simultaneously with construction, thereby creating multiple sources of noise. Adverse effects would have a cumulative intensity of major, adverse, and short-term.

No-Action Alternative

The cumulative effects of existing and reasonably foreseeable future actions from the No-Action Alternative would have negligible, adverse, and short-term effects on noise conditions within the ROI. Under the No-Action Alternative, the proposed ATST Project would not be constructed therefore noise conditions would not change. However, reasonably foreseeable future actions would generate short-term, non-impulse, and impulsive noise emissions during construction which may be audible throughout the ROI and outdoor levels would likely exceed respective State standards for Class A zoning districts on occasion. Therefore, effects from existing conditions and reasonably foreseeable future actions would result in minor, adverse effects on noise conditions within the ROI and the proposed ATST Project would not alter that (as it would not be constructed under this alternative).

4.17.14 Air Quality

The ROI for cumulative effects on air quality is HO and the Park Road corridor.

EFFECTS OF PAST AND PRESENT ACTIONS ON AIR QUALITY

As described in Section 3.11.2-Air Quality all areas in Hawai‘i are considered to comply with Federal and State ambient air quality standards; no areas of Hawai‘i are classified as non-attainment or maintenance areas. Therefore, all of Maui, including Haleakalā, is currently an attainment area for EPA “criteria” pollutants. Furthermore, HALE is categorized as a “Class 1” area under the Clean Air Act’s Prevention of Significant Deterioration Program, a category the EPA reserves for the most pristine areas of the country in order to maintain the excellent level of air quality already attained. In addition, the excellent air quality at the summit of Haleakalā is due to the favorable meteorological conditions, including a temperature inversion layer that rings the mountain at an elevation of approximately 5,000 and 7,000 feet ASL (HALE, 2005b). This inversion layer stabilizes the atmosphere above the basin and limits airborne pollutants from rising to the summit, including that of the largest source of air pollution in the area, Kilauea Volcano on the island of Hawai‘i (HALE, 2005a). Additionally, prevailing trade winds from the northeast are persistently gusty at HO, which accelerates the dilution of any locally generated air emissions.

Observatory operations generally do not produce air emissions, and the passive electro-optical telescopes, sensors, and other equipment at HO are no exception. Minor emission sources at HO include facility maintenance that could emit minimal levels of nitrogen oxides. These include occasional testing of emergency generators for those facilities. While there are no known emission sources at HALE facilities, the increased popularity of HALE as a visitor destination has increased traffic to the summit, which has generally increased vehicular emissions and fugitive dust generation. These emissions have not resulted in reported substantial deterioration of the air quality within HALE. Overall, past and present actions within the ROI have resulted in minor, adverse, and long-term effects on air quality.

EFFECTS OF REASONABLY FORESEEABLE FUTURE ACTIONS ON AIR QUALITY

The reasonably foreseeable future actions within the ROI, with the exception of the proposed ATST Project, would have minor, adverse, and temporary effects on air quality. These would be similar to past projects with respect to release of fugitive dust and pollutants. The small SLR-2000 modular facility at HO is not likely to result in more than a minor, adverse, and short-term effect on air quality.

Cumulative Effects of the Proposed ATST Project at the Mees Site

It is anticipated that only minor, adverse, and long-term cumulative effects on air quality would occur within the ROI with the addition of the proposed ATST Project and its associated MECO upgrade during from construction. The other two reasonably foreseeable future actions within the ROI would be temporary and these activities would not likely contribute substantially to fugitive construction dust emissions. Contractor compliance with applicable State regulations under HAR 11-60.1-33, implementation of reasonable precautions at the job site, and adoption of the operational practices mandated under the LRDP for HO would minimize fugitive dust emissions during construction as well. Meteorological conditions at the summit, which facilitate rapid dispersion and the off-site transport of airborne pollutants, would further reduce the potential for noticeable suspended particulate matter adversely affecting neighboring parts of the ROI. In particular, the prevailing wind direction during the majority of time in the summit area would be away from HALE toward the southwest slopes of Haleakalā, reducing any adverse effects even further. It is not anticipated that there would be substantial changes to the operations of the observatories and surrounding facilities in the future, or substantial increases in vehicular emissions at HALE. Cumulative operational effects resulting from existing projects, the proposed ATST Project at the Mees site, and the reasonably foreseeable future actions would be considered negligible, adverse, and long-term.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site

The cumulative effects on air quality with the ROI from past, present, and reasonably foreseeable future actions, including the proposed ATST at Reber Circle would essentially be identical to those described for the Mees site above. The cumulative effects resulting from existing projects, the proposed ATST Project at the Reber Circle site, and the reasonably foreseeable future actions would be considered negligible, adverse, and long-term.

No-Action Alternative

The cumulative air quality effects from past, existing, and reasonably foreseeable future actions when added to those from the No-Action Alternative would result in negligible, adverse, and short-term effects on air quality within the ROI. Under the No-Action Alternative, the proposed ATST Project would not be constructed and, therefore, air quality would not change. The reasonably foreseeable future actions may generate fugitive dust emissions, however these activities would be temporary and the adoption of the operational practices mandated under the LRDP would continue to minimize emissions at HO. The cumulative effects from existing conditions, the No-Action Alternative, and the reasonably foreseeable future actions would result in negligible, adverse, and short-term effects on air quality within the ROI.

4.17.15 Socioeconomics and Environmental Justice

The ROI for socioeconomics and Environmental Justice is the island of Maui.

EFFECTS OF PAST AND PRESENT ACTIONS ON SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

For this analysis, the scope of past and present actions at HO are considered with respect to their effects on the economy and the sociological environment of the ROI as well as any effects on minority or low-income communities or the health and safety of children within this region. The socioeconomic indicators of any such effects are in three key areas:

1. Population and housing,
2. Employment, economy, and income; and,
3. Education

Additionally, environmental justice issues and the protection of children from environmental health risks are also considered.

Population and Housing

No major, adverse effects on population and housing have been associated with past or present actions at HO. Although approximately 195 people on Maui are directly employed through activities at HO (County of Maui, 2006) these employees have not increased the demand for housing, given that a majority are drawn from the local Maui population. As much as possible, many employment positions are filled from the growing number of available qualified Maui-based individuals. There has been no displacement of residents in their communities and demand for housing can be accommodated with existing vacant housing units. Therefore, there has been a negligible, adverse, and long-term effect on population and housing.

Employment, Economics, and Income

The past and present actions at HO have had minor, beneficial, and long-term effects on local economy and employment because these activities have contributed to Maui-based technical industry through well-paying jobs that are generally stable and do not have high turnover rates. Some employees at HO have more than thirty years of service. In addition nearly 2,000 people on Maui perform services and provide materiel for direct use at HO. These include subcontractors, vendors, repair services, and others (UH IfA, 2009).

Education and Outreach

The past and present actions at HO have had minor, beneficial, and long-term effects on the schools within the ROI. Section 3.12.1.3-Education describes the numerous educational and professional outreach programs that have been offered in the Maui community by the participating agencies at HO.

Environmental Justice

HO is located in a Conservation District where no urban or rural population or housing is permitted. It is not in a predominantly minority or low-income community, so none of the activities have disproportionately affected minority or low-income groups.

Protection of Children from Environmental Health or Safety Risk

The past and present actions at HO have not had disproportionate health and safety effects on children. Effects have been negligible and changes so small that they are not measurable or perceptible consequences. HO is close to HALE, where children may be present; however, since HO is not open to the public, unescorted and unauthorized children cannot gain access to the site to potentially suffer any mishaps. Children are only allowed into HO accompanied by adults and supervised as part of a visiting group to HO facilities.

EFFECTS OF REASONABLY KNOWN FUTURE ACTIONS ON SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The reasonably foreseeable future action within the ROI is the installation of SLR 2000. This small project would contribute negligibly to employment and income and would have no effect on education, outreach, environmental justice or protection of children. In addition to the past and present actions at HO, it would have only a combined negligible, beneficial, and short-term effect on these resources within the ROI.

Cumulative Effects of the Proposed ATST Project at the Mees Site

Population and Housing. Approximately 25 to 30 people (half of the estimated personnel) proposed to work at ATST on Maui would be hired and brought in from off-island, and this is not likely to substantially increase the demand for housing given the vacancy rates from the last few years (U.S. Census Bureau, 2006a). This small and localized demand is expected to be minor and of little consequence when added to the past, present, and reasonably foreseeable future actions at HO, in comparison with the annual increase in residents to the island of Maui, which has averaged approximately 2,600 per year since 1990 (County of Maui, 2006). With a 1.68 percent projected annual population growth rate, the cumulative needs for housing related to existing and reasonably foreseeable future actions within the ROI, including the proposed ATST Project would have only an inconsequential effect on population and housing. It is not anticipated that the population would exceed population projections and there would be no displacement of residents in their communities, so demand for housing can be accommodated with existing vacant housing units. Further, the change in demand for socioeconomic resources would be so small that it would not be of any measurable or perceptible consequence. The overall cumulative effect on housing from the proposed ATST Project at the Mees site would be minor, adverse, and long-term.

Employment, Economics, and Income. The construction of the proposed ATST Project itself at the Mees site would have minor, beneficial, and short-term effects on the local economy and employment because it would require employment of local contractors to build the facility and it would increase associated spending within the ROI during the construction phase. The proposed ATST Project also would have a minor, beneficial, and long-term effect on employment with an estimated 50 to 55 new hires by the final year of commissioning. Because present employment within HO is stable, the overall cumulative effects from the proposed ATST Project on employment, economics and income would be minor, beneficial, and long-term.

Education and Outreach. The proposed ATST Project at the Mees site would have minor, beneficial, and long-term effects on the schools within the ROI. The estimated number of personnel and dependents relocating to Maui is expected to be relatively small and temporary. As described in Section 1.4.3.2-ATST Education and Public Outreach, the ATST consortium would provide education and outreach on several fronts that leverage and expand existing programs within the partnering groups and create unique opportunities during both its development and operation of the proposed ATST Project. Along with the education and outreach programs already provided by other agencies at HO, the proposed ATST Project would constitute a cumulative minor, beneficial, and long-term effect on education and outreach within the ROI.

Environmental Justice. The proposed ATST Project would have no adverse environmental justice effects. The Mees site is in a Conservation District where no urban or rural population or housing is allowed. The potentially affected area is not a predominantly minority or low-income community, so none of the effects of construction and operation of the proposed ATST Project would disproportionately affect minority or low-income groups. When combined with past, present, and reasonably foreseeable future actions at HO, there would be a cumulative negligible, adverse, and long-term effect.

Protection of Children from Environmental Health or Safety Risks. The proposed ATST Project would not have disproportionate health and safety effects on children. Effects would be negligible and changes would be so small that it would not be of any measurable or perceptible consequence. The proposed ATST Project would be near HALE, where children may be present. However, construction fencing and other precautions would prevent children from gaining access to the site during construction**.** Children allowed into HO would be accompanied by adults and supervised as part of a visiting group to HO facilities.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site

Population and Housing. Potential effects on population and housing resulting from the proposed ATST Project at the Reber Circle site would be identical to those discussed for the Mees site. Effects are expected to be small and localized and would be minor and of little consequence. When added to past, present, and reasonably foreseeable future actions at HO, the cumulative effect would be minor, adverse, and long-term.

Employment, Economics, and Income. Effects on employment, economics, and income for the proposed ATST Project at the Reber Circle site would be identical to that of the Mees site. The development duration and the estimated cost are the same as those for the Mees site. Minor, beneficial, and short-term effects would be realized during the construction phase for local vendors and materials hiring and spending. Minor, beneficial, and long-term effects to employment would result from operational staffing of the proposed ATST Project facility. When combined with the minor, beneficial, and long-term effects from past, present, and reasonably foreseeable future actions at HO, the overall cumulative effects would remain minor, beneficial, and long-term.

Education and Outreach. There would be no difference in effects for the proposed ATST Project at the Reber Circle site. No adverse effects are expected on the schools and community within the ROI and when combined with the ongoing education and outreach efforts of the current HO users, the overall cumulative effect would be minor, beneficial, and long-term.

Environmental Justice. The intensity of effect for environmental justice for the proposed ATST Project at the Reber Circle site would be identical to that of the Mees site. No adverse effects on low-income or minority communities are anticipated, and when combined with the negligible effects from past, present, and reasonably foreseeable future actions, the cumulative effects would be negligible, adverse, and long-term.

Protection of Children from Environmental Health or Safety Risks. The evaluation of effects for the protection of children is identical for the proposed ATST Project at the Reber Circle site as for the Mees site. No adverse effects on children are anticipated and therefore when combined with the negligible, adverse and long-term effects from past, present, and reasonably foreseeable future actions at HO, the overall cumulative effect would be negligible, adverse, and long-term.

No-Action Alternative
The No-Action Alternative would result in the proposed ATST Project not being constructed. Thus, it would not contribute to effects on socioeconomic resources and environmental justice within HO.

4.17.16 Public Services and Facilities

The ROI for public service and facilities is HO and the Park road corridor. Due to their remote location, HO and the Park road corridor are between 10 and 22 miles from the nearest public services and facilities. The nearest school is in Kula, approximately 27 miles from HO and 17 miles from the entry to the Park road, as is the nearest healthcare facility. With a travel time of nearly an hour from HALE to the closest police or fire stations, and an hour and a half to the facilities at HO, neither is able to utilize timely services from Maui public departments. For practical purposes, both HO and the Park road corridor can be considered to be independent of most public services and facilities.

<u>EFFECTS OF PAST AND PRESENT ACTIONS ON PUBLIC SERVICES AND FACILITIES</u>

Police Protection
The nearest police substation is located in Kula, which is the community closest to the summit of Haleakalā, but still approximately 22 miles away from HO. Park rangers are the designated policing authority within the Federal jurisdiction of HALE. The Maui Police Department has no jurisdiction over Park activities. Park rangers have responded to emergency needs on the Park road corridor and have on occasion assisted HO personnel with emergency needs. Law enforcement requirements at HO have been and are at present minimal. The Maui Space Surveillance Complex at HO maintains its own security personnel who control access to that area and provide some monitoring functions at the site. Past and present actions at HO have not resulted in more than negligible, adverse effects on the police services provided by HALE for the Park road corridor.

Fire Protection
The closest fire station is located in Kula approximately 28 miles away from the summit of Haleakalā and 18 miles from the entry to the Park road. Another fire station serving the Upcountry community is located in Makawao, approximately 29 miles from the summit. These two fire stations, although the closest to HO and the Park road corridor, are beyond fire fighting capabilities for both. In the event of a wildlife fire, National Park Wildlife Firefighters comprised of a militia of approximately 10 to 12 certified, wildland firefighters residing on Maui would undertake this responsibility (Section 3.13.2-Fire Protection). HO does not maintain trained fire fighters and would not have the equipment to fight fully engaged fires. The few small fires that have occurred at HO in the past have been extinguished with hand-held fire extinguishers. Therefore, past and present actions at HO and on the Park road corridor have resulted in negligible, adverse, and long-term effects anticipated on fire protection services.

Schools
The closest schools to the ROI are in the Kula community (Haleakalā Waldorf School, King Kekaulike High School, Kula Elementary, the Carden Academy**,** and the Kamehameha Schools) and are approximately 25 to 27 miles from the summit of Haleakalā and about 12 miles from the beginning of the Park road corridor. The past and present actions of HO and those along the Park road corridor have had negligible, adverse, and long-term effects on these schools, which are too far away to experience any interaction.

Recreational Facilities
As described in Section 3.13.4-Recreational Facilities, Puʻu Ulaʻula Overlook, located about 0.3 mile east of HO along the Park road between the Haleakalā Visitor Center and the summit, is a major visitor attraction. The past and present actions at HO can be seen from Puʻu Ulaʻula Overlook and for those who

prefer the vista to be completely free of man-made structures, those activities have had a minor, adverse, and long-term effect. The Haleakalā Visitor Center is located approximately two-thirds of a mile east of HO and is one of the main attractions for visitors to the summit. HO is not visible from that location, and past and present actions at HO have had only a negligible, adverse, and long-term effect on that facility. The same is true of the Leleiwi and Kalahaku overlooks along the Park road corridor. HO cannot be seen from these overlooks and past and present actions at HO have not had more than negligible, adverse, and long-term effects.

The nearby Skyline Trail begins at the 9,750-foot elevation at the lowest point of the paved access road near the Saddle Area and continues for about 6.5 miles, ending at the Polipoli Spring State Recreation Area. The activities at HO have been visible to those enroute to Skyline Trail, but are not visible along the trail. The effects of past and present actions at HO have been negligible, adverse, and long-term. The Park road corridor provides access to the Skyline Trail for those approaching it through HALE rather than through the Polipoli area. Throughout the existence of HO, no access to the Park road corridor has been blocked or impeded and no trails have been re-routed. Vistas from the Park road corridor have been affected by past and present actions at HO, in that natural landscapes are interposed with HO facilities from some parts of the viewshed. Although the effects have not constituted a substantial loss of visual resources, the recreational facilities have experienced and continue to experience minor, adverse, and long-term effects.

Healthcare Services

The closest healthcare facility is the Kula Hospital and Clinic which provides limited acute-care services and urgent care and limited rural emergency care on a 24-hour, 7-day a week basis. The past and present actions within HO have resulted in only negligible, adverse, and long-term effects on this facility and the more distant Maui Memorial Hospital. The higher traffic volume on the Park road corridor correlates with a higher vehicular accident rate than at HO. Bicycle tours accounted for three fatalities in 2007 requiring healthcare services (KHNL, 2007). Even so, the activities within the ROI have not affected healthcare services substantially and the overall effect is negligible, adverse, and long-term.

EFFECTS OF REASONABLY FORESEEABLE FUTURE ACTIONS ON PUBLIC SERVICES AND FACILITIES

The reasonably foreseeable future action within the ROI is the installation of the SLR 2000 facility at HO. This action would have no affect on schools, since the closest are approximately 25 to 27 miles from the summit of Haleakalā and about 12 miles from the beginning of the Park road corridor. This action would also have no effect on healthcare services. Overall, this project would result in minor, adverse, and short-term effects to public services and facilities.

Cumulative Effects of the Proposed ATST Project at the Mees Site

Police Protection. Construction or operations of the proposed ATST Project at the Mees site would not affect MPD operations, which are too distant to be summoned for emergencies typically requiring such services. Police communication facilities in the summit area would not be affected by the construction or operations of the proposed ATST Project at either the Mees or Reber Circle sites. The number of extra vehicles on the road during construction and operation of the proposed ATST Project relative to the approximately 1,600 vehicles that ascend the summit each day would not appreciably increase demands on Park rangers or MPD services. In combination with past, present, and reasonably foreseeable future actions, Park rangers or MPD would cumulatively experience negligible, adverse, and long-term effects on police protection.

Fire Protection. The proposed ATST facility would be equipped with standard fire prevention and fire fighting capabilities. Aside from these capabilities, fire fighting would be difficult, since the closest fire station is located in Kula approximately 28 miles away from the summit of Haleakalā, which is beyond fire fighting capabilities. National Park Wildlife Firefighters comprised of a militia of approximately 10 to 12 certified firefighters residing on Maui would not be able to undertake this responsibility either. The few extra vehicles on the road during construction and operation of the proposed ATST Project relative to the approximately 1,600 vehicles that ascend the summit each day would not contribute substantially to the demands on fire protection services within the ROI for these services, Therefore, the cumulative effects of the proposed ATST Project along with past, present, and reasonably foreseeable future actions is negligible, adverse, and long-term.

Schools. Due to the distance to the nearest schools, the addition of the proposed ATST Project at the Mees site would contribute a negligible, adverse, and long-term effect to the already negligible, adverse effects of the past, present, and reasonably foreseeable future actions within the ROI. The cumulative effect would be negligible, adverse, and long-term.

Recreational Facilities. The activities at HO already pose a minor, adverse effect on recreational facilities from some locations along the Park road corridor, i.e., those closer than 0.6 mile from HO. The addition of the proposed ATST Project at the Mees site would pose more loss in the value of those recreational facilities, but recreational resources at HALE are neither limited to nor mostly present on the Park road corridor. The main attractions for recreation are the locations where most visitors congregate, i.e., the Puʻu Ulaʻula Overlook, the Haleakalā Visitor Center, the Leleiwi Overlook, the Park Headquarters Visitor Center, and the crater trails. The Park road corridor has a few pullouts and visitors are not encouraged to leave their cars on the road to view scenic vistas. Of the main attractions in HALE, only Puʻu Ulaʻula Overlook offers visitors a close-up view of HO, where the proposed ATST Project would also be seen. During construction, high impact noise, as described in Section 4.10-Noise, would affect recreational facilities at HALE within about 2,500 feet from the proposed ATST Project site. The effects would be loud enough to be considered major, adverse, and long-term at that distance. Mitigation measures also described in Section 4.10 would reduce the effects part of the time to minor, adverse, and long-term. At distances greater than 2,500 feet, the effects would be negligible, adverse, and long-term. Therefore the cumulative effect from past, present, known and reasonably known activities, including the proposed ATST Project on recreational resources for the Park road corridor would be minor, adverse, and long-term.

Healthcare Services. As was true for the past and present actions within the ROI, the proposed ATST Project and its associated MECO upgrade would not add more than negligible, adverse, and long-term effects on healthcare services. The traffic on the Park road resulting from the proposed ATST Project at the Mees site would only increase very slightly and it is unlikely that such traffic would result in more than minimal requirement for healthcare services for vehicular mishaps. The overall cumulative effect of the proposed ATST project along with past, present, and reasonably foreseeable future actions would remain negligible, adverse, and long-term.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site

The proposed ATST Project at the Reber Circle site would have similar effects on most public services and facilities as it would at the Mees Site, with the following exceptions: for recreational facilities, minor, adverse, and long-term effects are anticipated due to the visibility of the proposed ATST Project from locations along the Park road corridor. The proposed ATST Project would appear to be taller and closer within HO if located at the Reber Circle site and would be more imposing and would dominate part of the viewshed from the Puʻu Ulaʻula Overlook. While it would not obstruct more than about 4 percent of the view from that location, the loss of visual resources in addition to those already compromised by past and present actions at HO could be considered a cumulatively moderate, adverse, and long-term effect on that

HALE recreational facility. Other recreational facilities within HALE would only experience a cumulative minor, adverse, and long-term effect with the addition of the proposed ATST Project at the Reber Circle site.

No-Action Alternative
If the proposed ATST Project were not constructed, there would continue to be negligible, adverse, and long-term effects on most public services and facilities. There would be no measurable or perceptible consequence as a result of the No-Action Alternative. The Pu‘u Ula‘ula Overlook would not have an additional facility within its viewshed and the effect on that recreational facility would continue to be minor, adverse, and long-term.

4.17.17 Natural Hazards

The ROI for Natural Hazards is HO and the Park road corridor.

EFFECTS OF PAST AND PRESENT ACTIONS ON NATURAL HAZARDS

The natural hazards of concern within the ROI are high winds, extreme rain, ice, and snow due to storms or hurricanes; earthquakes due to Hawaii’s position within a seismically active zone, and, hypoxia due to the high altitude of the site. These have all occurred within the ROI in the last decade and the effects on the ROI have included structural damage to facilities from wind, flooded facilities, structural damage to facilities from ice, vehicular accidents, and personnel requiring medical treatment for illness. As described in Appendix J(4)-Supplemental Description of ATST Equipment and Infrastructure and the NSO “Preliminary Seismic Design Analysis: Advanced Technology Solar Telescope” (NSO, 2007), the proposed ATST Project has been designed to resist damage from both earthquakes and wind and thus would not contribute more than very little to risk from those hazards.

The stormwater management system for the proposed ATST Project is also designed to minimize the addition of stormwater runoff to the pathways within HO and would not contribute more than slightly to the potential for flooding of the infiltration basin at HO. Altitude-related conditions, including hypoxia, is a potential affect experienced by some personnel working at the summit. Working at high altitudes requires proper planning, specialized training, and adequate equipment. As required of all personnel working at HO, employees of the proposed ATST Project, both during construction and operation, would be required to attend training prior to beginning work at the site.
HALE takes precautionary measures to prevent or minimize the effects of natural hazards by closing the Park during severe weather events. In addition to patrols for traffic issues, Park rangers patrol the road corridor for problems relating to natural hazards and respond rapidly to alerts or help calls from visitors in the event of rock falls, flooding, or other problems arising within the Park road corridor.

The cumulative effects on natural hazards from past and present actions within the ROI are considered to be negligible, adverse, and long-term.

EFFECTS OF REASONABLY FORESEEABLE FUTURE ACTIONS ON NATURAL HAZARDS

The reasonably foreseeable future action within the ROI is the installation of SLR 2000. It would not have any effect on the outcome of natural hazards within the ROI.

Cumulative Effects of the Proposed ATST Project at the Mees Site
Implementing the proposed ATST Project at the Mees site, including the MECO upgrade would not increase the potential for natural hazards and would not change the nature of natural hazards which occur

Within the ROI; therefore, the cumulative effects from existing projects, the proposed ATST project at the Mees site, and the reasonably foreseeable future actions would be negligible, adverse, and long-term. The construction and operation of the proposed ATST Project would have a negligible, adverse, and long-term effect on the safety of the public and adverse effects on the environment would be negligible such as to cause damage, destruction, or loss of life.

Cumulative Effects of the Proposed ATST Project at the Reber Circle Site

The cumulative effects on natural hazards at HO from the proposed ATST Project at Reber Circle site and the reasonably foreseeable future actions would essentially be identical to those described for the Mees site. The cumulative effects resulting from existing projects, the proposed ATST Project at the Reber Circle site, and the reasonably foreseeable future actions would be considered negligible, adverse, and long-term.

No-Action Alternative

Under the No-Action Alternative, the proposed ATST Project would not be constructed at HO. However, the potential for natural hazards at HO, including high winds, extreme rain, ice, and snow due to storms or hurricanes, earthquakes due to Hawaii's position within a seismically active zone, and hypoxia due to the high altitude of the site would remain. These natural hazards may affect the HO site and personnel at any time and would exist with the construction of future proposed projects; therefore, cumulative effects resulting from existing projects, the No-Action Alternative, and the reasonably foreseeable future actions from natural hazards would be negligible, adverse, and long-term.

4.17.18 Summary of Intensities of Effects

Tables 4-8 to 4-10 summarize the highest intensities of effects, both adverse and beneficial, during past, present, and reasonably foreseeable future actions at HO and its adjacent neighbors, as described for the fourteen aspects of the affected environment in the sections above. Table 4-11 summarizes the overall anticipated cumulative effects on the fourteen aspects of the affected environment from the addition of the proposed ATST Project at the Mees and Reber Circle sites.

Table 4-8. Intensity of Effects from Past Actions.

		Affected Environment (see Affected Environment Number Codes, Legend, and Notes below)													
Facility	**Past Actions**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
MSO	Built 1966	Mi A L	Mi A L	Mi A L	Mi A S	Mi A L	Mi A L	N A L	Mi A L	Mi AL	Mi A L	N A L	N A L	N A L	N A L
Atmospheric Airglow	Built 1961	Mi A L	Mi A L	Mi A L	Mi A S	Mi A L	Mi AL	N A L	N A L	Mi A L	N A L	N A L	N A L	N A L	N A L
Zodiacal Light	Built 1961	Mi A L	Mi A L	Mi A L	Mi A S	Mi A L	Mi A L	N A L	N A L	Mi A L	N A L	N A L	N A L	N A L	N A L
Cosmic Ray Neutron Monitor Station	Built 1961	Mi A L	N A L	Mi A L	Mi A S	N A L	Mi A L	N A L	Mi A L	Mi A L	N A L	N A L	N A L	N A L	N A L
Baker-Nunn Site	Built 1957	Mi A L	N A L	Mi A L	Mi A S	N A L	Mi A L	N A L	N A L	Mi A L	N A L	N A L	N A L	N A L	N A L
FTF	Built 2001	Mi A L	Mi A L	Mi A L	Mi A S	Mi A L	Mi A L	N A L	Mi A L	Mi A L	Mi A L	N A L	N A L	N A L	N A L
Pan-STARRS, PS-1 South	Refurbished facility 2007 (formerly LURE)	Mi A L	Mi A L	Mi A L	Mi A S	Mi A L	Mi A L	N A L	Mi A L	Mi A L	Mi A L	N A L	N A L	N A L	N A L
PS-2 North, 2nd Facility	Refurbished facility 2009	N A L	N A L	N A L	N A L	Mi A L	Mi A L	N A L	Mi A L	Mi A L	Mi A L	N A L	N A L	N A L	N A L
MSSC	Built 1963 with several years of building remodel construction; Construction of AEOS MCF	Mi A L	Mi A L	Mi B L	Mi A S	Mo A L	Mi A L	N A L	Mi A L	Mi A L	Mi A L	N A L	N A L	N A L	N A L
Haleakalā Visitor Center Comfort Station	Renovations in 2002	Mo B L	Mi A L	Mi A L	Mi A S	N A L	Mi B L	N A L	N A L	Mi B L	N A L	N A L	N A L	Mi B L	N A L
FAA RCAG Towers	Constructed in Mees era	N A L	Mi A L	Mi A L	Mi A S	Mi AL	N A L	N A L	N A L	Mi AL	N A L	N A L	N A L	Mi B L	N A L
FAA site adjacent to HO, Homeland Security tower	Constructed in 2006	N A L	Mi A L	Mi A L	Mi A S	Mi A L	N A L	N A L	N A L	Mi A L	N A L	N A L	N A L	Mi B L	N A L
Hawaiian Telcom		N A L	N A L	Mi A S	Mi A S	N A L	N A L	N A L	N A L	Mi B L	N A L	N A L	N A L	Mi B L	N A L

Table 4-8. Intensity of Effects from Past Actions (cont.).

		Affected Environment (see Affected Environment Number Codes, Legend, and Notes below)													
Facility	**Past Actions**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
(Roadway)		Mi B S	NAS	Mi A S	Mi AS	N A L	Mi B L	N A L	N A L	Mi B L	Mi A S	Mi A S	N A L	Mi B L	Mi B L
HALE road cattle guard		Mi B L	Mi A L	Mi A S Mi B L	N A L	N A L	N A L	N A L	N A L	N A L	Mi AS	N A L	N A L	N A L	N A L

Affected Environment Number Codes

1 Land Use and Existing Activities
2 Cultural, Historic, Archeological Resources
3 Biological Resources
4 Topography, Geology, and Soils
5 Visual Resources and View Plane
6 Visitor Use and Experience
7 Water Resources
8 Hazardous Materials and Solid Waste
9 Infrastructure and Utilities
10 Noise
11 Air Quality
12 Socioeconomics and Environmental Justice
13 Public Services and Utilities
14 Natural Hazards

Legend

A Adverse; Mi Minor; B Beneficial; N Negligible; L Long-term; Mo Moderate; Ma Major; S Short-term

Notes

For simplicity, where there are multiple effects for any of the 14 aspects of affected environment, for past, actions, only the highest intensity is displayed in each box, whether it is adverse or beneficial. It should not be assumed that only one adverse or beneficial effect has occurred or would occur for the 14 aspects of affected environment.

Table 4-9. Intensity of Effects from Present Actions.

		Affected Environment (see Affected Environment Number Codes, Legend, and Notes below)													
Facility	**Present Actions**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
MSO	Currently used	Mi A L	Mi A L	Mi A L	N A L	N A L	Mi AL	N A L	Mi A L	Mi A L	Mi A L	N A L	N A L	N A L	N A L
Atmospheric Airglow	Currently used	Mi A L	Mi A L	Mi A L	N A L	Mi A L	Mi A L	N A L	N A L	Mi A L	N A L	N A L	N A L	N A L	N A L
Zodiacal Light	Currently used	Mi A L	Mi A L	Mi A L	N A L	Mi A L	Mi A L	N A L	N A L	Mi A L	N A L	N A L	N A L	N A L	N A L
Cosmic Ray Neutron Monitor Station	Inactive	Mi A L	Mi A L	Mi A L	N A L	N A L	Mi A L	N A L	N A L	N A L	N A L	N A L	N A L	N A L	N A L
Baker-Nunn Site	Currently used	Mi A L	Mi A L	Mi A L	N A L	N A L	Mi A L	N A L	N A L	Mi A L	N A L	N A L	N A L	N A L	N A L
FTF	Currently used	Mi A L	Mi A L	Mi A L	N A L	N A L	Mi A L	N A L	Mi A L	Mi A L	Mi A L	N A L	Mi B L	N A L	N A L
Pan-STARRS, PS-1 South	Currently used	Mi A L	Mi A L	Mi A L	N A L	Mi A L	Mi A L	N A L	Mi A L	Mi A L	Mi A L	N A L	N A L	N A L	N A L
PS-2 North, 2nd Facility	Currently used	Mi A L	Mi A L	Mi AL	N A L	Mi A L	Mi A L	N A L	Mi A L	Mi A L	Mi A L	N A L	N A L	N A L	N A L
MSSC	Currently used	Mi A L	Mo A L	Mi A L	N A L	Mo A L	Mi A L	N A L	Mi A L	Mi A L	Mi A L	N A L	N A L	N A L	N A L

Affected Environment Number Codes

1	Land Use and Existing Activities
2	Cultural, Historic, Archeological Resources
3	Biological Resources
4	Topography, Geology, and Soils
5	Visual Resources and View Plane
6	Visitor Use and Experience
7	Water Resources
8	Hazardous Materials and Solid Waste
9	Infrastructure and Utilities
10	Noise
11	Air Quality
12	Socioeconomics and Environmental Justice
13	Public Services and Utilities
14	Natural Hazards

Legend

A	Adverse	B	Beneficial	L	Long-term	Ma	Major
Mi	Minor	N	Negligible	Mo	Moderate	S	Short-term

Notes

For simplicity, where there are multiple effects for any of the 14 aspects of affected environment, for present actions, only the highest intensity is displayed in each box, whether it is adverse or beneficial.

Table 4-10. Intensity of Effects from Reasonably Foreseeable Future Actions.

		Affected Environment (see Affected Environment Number Codes, Legend, and Notes below)													
Facility	**Future Actions**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
SLR-2000	Reuse of site behind MSO for Laser Ranging	N A L	Mi A L	Mi A L	Mi A S	N A L	Mi A S	N A L	N A L	Mi A L	N A L	N A L	N A L	N A L	N A L
MECO	Replace Transformers, voltage regulators, upgrade and relocate substation for proposed ATST Project	N A L	Mi A L	Mi A L	Mi A S	N A L	Mi A L	N A L	N A L	Mi B L	Mi A S	N A L	N A L	N A L	N A L

Affected Environment Number Codes

1 Land Use and Existing Activities
2 Cultural, Historic, Archeological Resources
3 Biological Resources
4 Topography, Geology, and Soils
5 Visual Resources and View Plane
6 Visitor Use and Experience
7 Water Resources
8 Hazardous Materials and Solid Waste
9 Infrastructure and Utilities
10 Noise
11 Air Quality
12 Socioeconomics and Environmental Justice
13 Public Services and Utilities
14 Natural Hazards

Legend

A	Adverse	B	Beneficial	L	Long-term	Ma	Major
Mi	Minor	N	Negligible	Mo	Moderate	S	Short-term

Notes

For simplicity, where there are multiple effects for any of the 14 aspects of affected environment, for foreseeable future actions, only the highest intensity is displayed in each box, whether it is adverse or beneficial.

Table 4-11. Summary of Cumulative Effects from the Addition of the Proposed ATST Project.

		Affected Environment (see Affected Environment Number Codes, Legend, and Notes below)													
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Baseline of Effects For Past, Present, Reasonably Foreseeable Future Actions Other Than the Proposed ATST Project		Mi A L	Mo A L	Ma A L	Mi A L	Mi A L	Mi A L	Mi A L	Mi A L	Mi A L	Mi A L	N A L	Mi B L	Mi A L	N A L
Proposed ATST Project at the Mees Site Cumulative Intensities	**Construction**	Mi A L	Ma A L	Ma A L	Mi A S	Mo A L	Mi A L	Mi A L	Mi A L	Mo A S	Ma A L	Mi A S N AL	Mi B S	Mo A S	N A L
	Operation	Mi A L	Mo A L	Ma A L	Mi A L	Mo A L	Mo A L	N A L	N A L	Mi A L	Mi A L	N AL	Mi B L	Mo A L	N A L
Proposed ATST Project at the Reber Circle Site Cumulative Intensities	**Construction**	Mi A L	Ma A L	Ma A L	Mi A S	Ma A L	Mi A L	Mi A L	Mi A L	Mo A S	Ma A L	Mi A S N A L	Mi B S	Mo A S	N A L
	Operation	Mi A L	Ma A L	Ma A L	Mi A L	Ma A L	Mo A L	N A L	N A L	Mi A L	Mi A L	N A L	Mi B L	Mo A L	N A L

Affected Environment Number Codes
1 Land Use and Existing Activities
2 Cultural, Historic, Archeological Resources
3 Biological Resources
4 Topography, Geology, and Soils
5 Visual Resources and View Plane
6 Visitor Use and Experience
7 Water Resources
8 Hazardous Materials and Solid Waste
9 Infrastructure and Utilities
10 Noise
11 Air Quality
12 Socioeconomics and Environmental Justice
13 Public Services and Utilities
14 Natural Hazards

Legend

A Adverse	B Beneficial	L Long-term	Ma Major
Mi Minor	N Negligible	Mo Moderate	S Short-term

Notes

The designations in each box for cumulative effects are the overall combined anticipated effects from the addition of the proposed ATST Project to the past, present, and reasonably foreseeable future actions.

4.18 MITIGATION

CEQ CFR, Title 40, Parts 1500 to1508, Section 1508.20-Mitigation, where "Mitigation" includes:

(a) Avoiding the effect altogether by not taking a certain action or parts of an action.

(b) Minimizing effects by limiting the degree or magnitude of the action and its implementation.

(c) Rectifying the effect by repairing, rehabilitating, or restoring the affected environment.

(d) Reducing or eliminating the effect over time by preservation and maintenance operations during the life of the action.

(e) Compensating for the effect by replacing or providing substitute resources or environments.

The following subsections describe mitigation measures to reduce, minimize, or avoid effects for resources that would be adversely affected by the proposed ATST Project.

4.18.1 Land Use and Existing Activities

Removal of the proposed ATST facility after its operational lifetime would constitute a significant mitigation of its potential long-term impact. Such decommissioning is taken into consideration as part of life-cycle project planning, and, in the case of facilities constructed with NSF's financial assistance, it is determined on a case-by-case basis. With regard to the proposed ATST Project, if funding for construction is approved, NSF anticipates that the estimated lifetime of the telescope would be at least 45 years (spanning two, 22-year solar cycles) after it becomes operational. As a mitigation measure under Section 106 of the NHPA, and relating to other categories of impact as well, NSF is seriously considering decommissioning, deconstruction, or divestment of the proposed ATST Project at the end of its productive lifetime.

In response to a request for concurrence to NSF's determination of negligible adverse effect, the FAA issued a Notice of Presumed Hazard in October 2007, suggesting that the proposed ATST Project would result in radio frequency shadowing at the FAA RCAG facility located about 800 feet to the West of the proposed ATST Project. In accordance with 14 CFR Part 77.35, FAA Obstruction Evaluation and Spectrum Management personnel are working to identify and help quantify the predicted effect to the RCAG. Once the attenuation is sufficiently quantified and if a potential hazard may result, FAA obstruction specialists are working to identify whether mitigation would be necessary and if so, which acceptable engineering solutions would mitigate any adverse effect to RCAG transmit and receive capability.

4.18.2 Cultural, Historic, and Archeological Resources

Mitigation of Cultural Effects from ATST Construction and Operations of the Proposed ATST Project

There are three basic aspects to the strategy proposed by NSF and cooperating Native Hawaiian individuals to minimize or mitigate effects to what is acknowledged to be a Traditional Cultural Property (TCP). The first of these strategies is to design the preservation of cultural resources into the proposed ATST Project construction as was defined by IfA policy in the LRDP, in order to minimize the effect on cultural resources to the maximum extent practicable.

The 2003 cultural resource evaluation conducted for the LRDP, offered a series of recommended rules to ensure preservation of cultural resources at HO. The IfA adopted the preservation recommendations in

2003, and maintains a program that includes "Sense of Place" training for everyone working at HO, coordination with and oversight by a cultural specialist for all construction projects, and set-aside areas for exclusive use by Kanaka Maoli to practice cultural and spiritual ceremonies. (CRE, 2003, p. 16).
Specifically, proposed ATST Project construction would require the consultation and monitoring of a Cultural Specialist. The Cultural Specialist would be engaged at the earliest stages of the planning process, monitor the construction process, and consult with and advise the on-site Project Manager with regard to any cultural or spiritual correction. That includes disposition of rock and soil, rehabilitation of disturbed areas, and the appropriate prayers at the beginning and end of work. Because NSF has found that the proposed ATST Project would affect cultural resources on this portion of the summit area, the Cultural Specialist must be a Kanaka Maoli, preferably a kupuna (elder) and if possible a kahu (clergyman) as well, and one who has personal knowledge of the spiritual and cultural significance and protocol of Haleakalā.

All construction crewmembers would attend UH-approved "Sense of Place" training prior to working on the proposed ATST Project. This training has been required for all projects initiated since 2004, as mitigation of the cultural and spiritual effects that may arise from activities at the site. These requirements would be included in all related land-use Memoranda, Facility Use Agreements, Operating and Site Development Agreements and Leases applying to the proposed ATST Project at HO.

During construction of the proposed ATST Project, all cultural, historic, and archeological sites and features identified in the 2003 and 2006 Archeological Inventory Surveys would be protected and preserved in accordance with HAR, Title 13, Sub-Title 13, Chapter 277 "Rules Governing Requirements for Archeological Site Preservation Development". Protection would include the establishment of clearly marked buffer zones and periodic monitoring by both a project Archeologist and Cultural Specialist throughout the construction process.

A preservation plan was recommended by SHPD, which was prepared subsequent to the survey and was submitted to SHPD in March 2006. The plan calls for passive as-is preservation for all of the sites described above except for the remnant of Reber Circle, which was constructed in 1952. It also calls for no-signage for individual sites discussed in this preservation plan. Signage could potentially draw unwanted attention to these sites, possibly causing negative effects and/or security concerns. The DLNR accepted this preservation plan on July 10, 2006 (DLNR, 2006).

The second mitigation strategy is directed under guidance of Section 106 of the NHPA, which requires Federal agencies to take into account the effects of their undertakings on historic properties. The NSF has been consulting with HALE, the Advisory Council on Historic Preservation (ACHP), the State Historic Preservation Division (SHPD), Native Hawaiian organizations and individuals, and other members of the public to find ways to resolve adverse effects from the proposed ATST Project. To that end, these parties are working on developing provisions that could, ultimately, be included in a Memorandum of Agreement (MOA) and/or Programmatic Agreement (PA). This document, if finalized, would include enforceable provisions designed to address adverse effects related to the proposed ATST Project. Pursuant to Section 106 of the NHPA, consulting parties can sign an MOA/PA even if they oppose the proposed ATST Project that is the subject of the document. The next consultation meetings are scheduled for June 8, 9, and 10, 2009, and NSF continues to encourage the input from consulting parties during this process.

Certain kinds of programs designed to mitigate adverse effects and to help provide a public benefit package, such as those suggested in the OHA response (OHA, 2005 and Vol. III, Appendix A-Pre-DEIS Public Comments) to the NSF notification of proposed ATST Project have been presented to NSF. These include:

1. Development of programs with institutional partners in the Maui community (e.g., UH, MCC, Kamehameha Schools) with the goal of integrating traditional Hawaiian navigation and astronomy practices and modern astronomical principles. These could include curriculum development, scholarly activities, teacher training, laboratory activities, etc.

2. Development of programs within the Maui community that would link educational and research institutions with local high-tech industry. The goals of such programs would be to grow the ability of the Maui community to provide technically and scientifically adept workers for jobs within Maui's high-tech enterprises thereby imbuing the high-tech community with employees who recognize and respect the traditional Hawaiian cultural practices. Such programs would be designed to advance local students, particularly Native Hawaiians and women, into the Maui technical and scientific workforce. Also, these programs would develop courses and programs to prepare students for the local workforce by involving the scientific and technical community in teaching and mentoring.

Programs could be designed to develop courses and programs that promote equity in science and technology, integrate awareness and respect of host culture, and open opportunities for students from underrepresented groups, particularly Native Hawaiians.

A third mitigation strategy is the removal of the proposed ATST facility after its operational lifetime, which would constitute a significant mitigation of its potential long-term impact. Such decommissioning is taken into consideration as part of life-cycle project planning, and, in the case of facilities constructed with NSF's financial assistance, it is determined on a case-by-case basis. With regard to the proposed ATST Project, if funding for construction is approved, NSF anticipates that the estimated lifetime of the telescope would be at least 45 years (spanning two, 22-year solar cycles) after it becomes operational. As a mitigation measure under Section 106 of the NHPA, and relating to other categories of impact as well, NSF is seriously considering decommissioning, deconstruction, or divestment of the proposed ATST Project at the end of its productive lifetime.

As mentioned above, NSF is working closely with the ACHP, the SHPD, HALE, and the consulting parties to develop the basis for a Memorandum of Agreement/Programmatic Agreement pursuant to Section 106 of the NHPA. The mitigation requiring cultural monitors would be included as components of this document and it is possible that a mitigation proposal designed to provide education and outreach programs to Native Hawaiians (such as one of those submitted to NSF and included in their entirety in Section 5.0-Notification, Public Involvement, and Consulted Parties) might also be included. Likewise, mitigation measures, such as those identified in the FHWA report that are intended to protect the historic Park road, bridge, and culverts, would also be considered for inclusion in the document. Further mitigation would likely be included in another component of the document that would constitute a Programmatic Agreement. Efforts to address adverse effects to Native Hawaiian culture would be the cornerstone of this component of the document and it is NSF's intent to have, through such a Programmatic Agreement, mitigation measures developed and suggested by representatives of the Native Hawaiian Community and other consulting parties for consideration by NSF.

4.18.3 Biological Resources

Mitigation measures to address effects to biological resources related to construction of the proposed ATST Project would include more than one approach. First, coordination with the USFWS to fulfill monitoring, avoidance, and minimization requirements for endangered species set forth in the USFWS Section 7 Informal Consultation Document would continue throughout the construction process. Second, implementation of the BMPs described in the LRDP would be a rigorous mitigation measure.

Third, programmatic monitoring of the status of biological resources would be accomplished throughout the construction as detailed below.

As is true for other human activities within the ROI, i.e., visitors damaging ‘ahinahina (silversword) plants by walking on them or taking them as trophies, HO workers leaving food wastes that could support rat populations around the summit, the proposed ATST Project has the potential to affect the distribution, density, and diversity of botanical, invertebrate, and avian populations. For the proposed ATST Project, this would be especially true as ground disturbance occurs during excavation, grading, caisson placement, etc., and with development of structures within the site plan. As a result of construction traffic and importation of equipment, AIS could inadvertently be introduced, even with strict inspection and BMPs to prevent such introduction.

In order to ensure that endangered botanical, invertebrate, or avian populations at HO are not inadvertently adversely affected during construction, NSF would implement programmatic monitoring surveys of those species at HO, and, along selected portions of the Park road corridor

> (*NOTE: Monitoring measures/studies need to be coordinated/approved by HALE and would be included in the final version of the EIS. Any activities conducted along the Park road corridor would be approved within the SUP process.*)

Monitoring would be accomplished by accredited experts, who would also monitor changes to endemic species, along with any introduced AIS. Formal reports to interested parties would be made available, and mitigation measures to address adverse effects would, as appropriate, be designed and implemented. Since effects can take several months to become evident, monitoring would be conducted at planned intervals during the construction phase and continue for a period of one year after major construction is completed. Table 4-12 summarizes the type, frequency and description of these monitoring surveys.

MITIGATION OF CONSTRUCTION-RELATED EFFECTS AT THE MEES SITE

Avoidance, Mitigation and Monitoring Program

The ESA Section 7 Informal Consultation document prepared by USFWS in 2007 contains a number of specific requirements to avoid or minimize potential effects to ‘ua‘u at the Mees site during ATST construction. These include predator control to keep rats from invading nests, invasive species interdiction and control to prevent unwanted hitchhiking predators from entering the site, restrictions on heavy construction during nesting season to avoid noise and vibration, and noise monitoring.

Also, to help minimize potential consequences of construction and increase the scientific understanding of ‘ua‘u, the NSF has undertaken a monitoring program (Vol. II, Appendix I-Petrel Monitoring Plan) and scientific investigation comparing ‘ua‘u activity at burrows and fledgling success at active burrows located near the proposed ATST Project construction site, and is working with HALE to locate a control site located near and below the Haleakalā Visitors Center (KCE, Inc., 2006). To determine ‘ua‘u activity, individual day/night cameras have been placed to view about 30 selected, active burrows at the proposed construction site and an equal number are being installed at 30 active burrows at the control site. An additional camera at each site records daily activities, i.e., vehicular and foot traffic, or construction. Monitoring is minimally intrusive.

Monitoring for a 3-year duration was originally planned and began in 2006. Objectives for the first year (FY 06) was to validate monitoring system performance and to provide data analysts with sufficient information to evaluate statistical models for ‘ua‘u activities within the Haleakalā colony; during this year some non-ATST related construction activity was anticipated. The following years of data collection (FY 08-09) were during periods of no planned construction, which would serve as a baseline for ‘ua‘u activity at HO and HALE. Additional years of data collection would monitor construction while observing ‘ua‘u activities at a control site. To help determine fledging success, video data from the burrows would be examined throughout each season, in addition to routine site visits by HALE personnel.

Table 4-12. Programmatic Monitoring for Active Preservation of Invertebrates, Flora, and Fauna at HO During and For One Year After Construction of Proposed ATST Project.

Survey Type	Frequency/ Duration	Description
Botanical Reconnaissance	Semi-Annually/ three days	Characterization of types, diversity, stage of development, coverage, and health of endangered ‘ahinahina, and non-endangered endemic or AIS plant species at HO and within selected areas of the Park road corridor. Report new occurrences of ‘ahinahina to HALE and USFWS. *(NOTE: Monitoring measures/studies need to be coordinated/approved by HALE and would be included in the final version of the EIS. Any activities conducted along the Park road corridor would be approved within the SUP process*.)
Invertebrate Collections	Semi-Annually/ one week	Day and night collection of invertebrates during one week in winter and one week during summer months. Identification and taxonomy for both ground and shrub dwellers. Population estimates for developed and undeveloped areas within HO, and selected areas of the Park road corridor. Report collections at HO to State Forestry Division and to NPS for endangered arthropods. Collections transmitted to Bishop Museum or other authorized repository. *(NOTE: Monitoring measures/studies need to be coordinated/approved by HALE and would be included in the final version of the EIS. Any activities conducted along the Park road corridor would be approved within the SUP process*.)
Field Faunal Survey	Semi-Annually/ one week	Field observations at HO and selected areas of the Park road corridor for faunal presence, e.g., scat, tracks, eaten plants, etc. *(NOTE: Monitoring measures/studies need to be coordinated/approved by HALE and would be included in the final version of the EIS. Any activities conducted along the Park road corridor would be approved within the SUP process*.)
Video Avian Monitoring	Throughout Nesting Season	Ongoing monitoring using visible and nighttime infrared techniques to observe endangered ‘ua‘u in and around HO during construction to identify any behavioral changes. Monitoring also includes tracking threats to ‘ua‘u, such as rats, feral domestic animals, goats, and pigs. Report to USFWS, HALE resource management.
Faunal Radar Survey	Upon Project Completion/ 10 days during ‘ua‘u nesting season	Radar observations for endangered ‘ua‘u and ‘ope‘ape‘a flight patterns around the Proposed ATST Project, upon completion of the structure. Characterization of flight paths, altitudes, frequency, to compare with baseline obtained earlier in decade. Assess and document any effects due to proximity of structure near ‘ua‘u burrow colony. Provide report to USFWS upon request.

MITIGATION FROM THE LRDP

To minimize the potential effects of construction on the ‘ua‘u and other special status species, ATST construction would, if approved, be conducted in accordance with practices and measures outlined in the LRDP, although the proposed ATST Project would likely require excavation and other heavy construction during some part of a nesting season. Therefore, video monitoring would be conducted throughout the construction process as described in the Petrel Monitoring Plan (Vol. II, Appendix I), which was submitted to and approved by the USFWS with a copy provided to HALE (KCE, 2006).

Before construction begins, the contractor would participate in briefings on environmental sensitivities. Biological resource topics addressed in the briefings would include protecting the biological species in the area, preventing the introduction of unwanted species, confining activities to the construction site and staging area, and minimizing the risk to species from vibration, noise, and lighting.

A qualified biologist or agricultural inspector would inspect equipment, supplies, and containers that originate from other islands or the continental United States before these items are transported from Kahului to the summit of Haleakalā. Specimens of non-native species found in these inspections would be offered to the State for curation, those not wanted would be destroyed. The contractor would notify HALE one week before the initial entry to coordinate inspections. Construction vehicles would be steam-cleaned before being transported through HALE. The contractor would maintain certification of inspections and vehicle cleaning.

All material obtained from excavation from the site would remain on Haleakalā and would be used as fill material at the proposed building site or would be trucked to a designated soil placement area on Haleakalā.

The contractor would not park heavy equipment or store construction materials outside the HO boundaries. Activities would be limited to the construction site and staging area to minimize risk to ‘ua‘u in adjacent areas.

The contractor would use tight-lidded trash containers and would remove organic waste and trash daily, in particular, materials that could serve as a food source and increase the population of mice and rats that prey on native species, including ‘ua‘u. Construction-related trash would be removed on a timely basis.
Although there are no ‘ahinahina (Haleakalā Silversword) plants within the proposed construction, staging, or lay-down areas, the locations of plants at HO would be identified to ensure construction activities and workers do not disturb them.

HALE would provide the contractor with the most current HALE maps of ‘ua‘u burrow locations to identify and avoid these areas and ‘ua‘u burrows would be monitored both by human inspection and video surveillance during construction in cooperation with HALE. The contractor would notify IfA of any ‘ua‘u mortalities, and the USFWS would then be notified. These measures and others would be included in the final mitigation plan to be coordinated with USFWS during consultation. The contractor would not construct fences in order to prevent ‘ua‘u mortality from collisions.

Should extra lighting be unavoidable, contractors would make every effort to use lighting that is red, blue, or orange, or similar colors. Furthermore, IfA would approve any unavoidable lighting for construction hazards or night work prior to installation. All lighting would be shielded from above, so that night-flying birds would not be disoriented by upward projecting lights that are mistaken for natural sources of navigable lighting.

During construction activities conducted when ‘ua‘u may be present outside the nesting season, steps would be taken to minimize the level of vibration. Ground disturbance activities at the construction staging area would not exceed current and past operations (vehicle movement, personnel walking, equipment/supply storage and handling). Cranes used during construction would be lowered at night and when not in use to reduce the risk of collision with either ‘ua‘u or ‘ope‘ape‘a.

MITIGATION TO PREVENT INTRODUCTION OF AIS

Introduction or proliferation of AIS has been identified as a potential threat for most special status species located in the ATST ROI. Therefore, to minimize the potential introduction of AIS, ATST construction would be conducted in accordance with required policies and procedures outlined in the LRDP.

The contractor would participate in pre-construction briefings on environmental sensitivities. Biological resource topics addressed in the briefings would include protecting the biological species in the area, preventing the introduction of unwanted species to the area, confining activities to the construction site and staging area, and minimizing the risk to species from vibration, noise, and lighting.

Any equipment, supplies, and containers with construction materials that originate from elsewhere, such as the other islands or the mainland, would be checked for infestation by unwanted species by a qualified biologist or agricultural inspector before they are transported from Kahului. Specimens of nonnative species found in these inspections would be offered to the State for curation, and those not wanted would be destroyed.

All construction vehicles would be steam cleaned before they are transported through HALE. The contractor would certify compliance with this paragraph for inspection and steam cleaning. Contractors would also notify IfA a week prior to their initial entry into HALE so that arrangements could be made with HALE or other provider of inspection services. After the initial entry, coordination would be directly between the inspectors and the contractor.

With the extensive mitigation measures described above, effects to biological resources associated with construction of the proposed ATST Project at the Mees site or Reber Circle site would not result in more than negligible adverse effects.

4.18.4 Topography, Geology, and Soils

With the participation of interested Native Hawaiians and as part of the Section 106 process, construction of the proposed ATST Project at the Mees site could result in a mitigation measure for topography effects to cultural resources. Native soils and rock could be used to restore the pu‘u at Reber Circle from its present truncated cone shape to a closely rounded natural appearance (Vol. II, Appendices A-Archaeological Field Inspection, F(1)-Cultural and Historical Evaluation, and G-Geological Report). From the geologist’s calculations, an estimated 24 feet of additional height would be needed to restore the natural slope. Although the restoration was suggested by a Native Hawaiian practitioner during the DEIS process, there has been little support in the Native Hawaiian community for this potential mitigation, and it remains to be determined whether the restoration of the pu‘u at Reber Circle would obtain sufficient interest to become a mitigation measure.

4.18.5 Visual Resources and View Plane

No mitigation measures are anticipated or planned for these resources.

4.18.6 Visitor Use and Experience

The SUP to be issued by HALE would include mitigation measures to reduce impacts to visitors, such as restrictions on wide load traffic and hours during which outside, on-site construction activities can occur. More specifics on these restrictions are provided in Section 4.18.15-SUP Mitigation Measures.

4.18.7 Water Resources

No mitigation measures are anticipated or planned for these resources.

4.18.8 Hazardous Materials and Solid Waste

No mitigation measures are anticipated or planned for HAZMAT and solid waste.

4.18.9 Infrastructure and Utilities

Roadways and Traffic
Prudent cumulative traffic effect methodology is to plan for the scenario that would include all cumulative actions in the ROI that may be undertaken, which could result in dramatically lowering a Level-of-Service (LOS) rating or exceed V/C ratios for an affected roadway, The most practicable and prudent mitigation measure to address potential traffic effects is to coordinate construction-related projects and traffic with affected parties (e.g., HALE roadway improvements and the other concurrent projects). For long-term operational related traffic, a preferred mitigation measure would be implementing carpooling programs to HO. In addition, provisions contained in the SUP to be issued by HALE would also include mitigation measures to address traffic issues, potentially including those recommended in the FHWA HALE Road Report (Vol. II, Appendix P) and listed in Section 4.9.1- Methodology for Effect Assessment.

The FHWA HALE Road Report (Vol. II, Appendix P) provides future performance predictions for the road and its related structures as well as recommendations for specific repair measures and mitigations. These include general guidance for future maintenance and specific recommendations regarding an immediate repair project for the distressed section 2. These measures have some relevancy to the potential effect of the proposed ATST Project, especially as to the timing of road repair work related to ATST construction. Other FHWA recommendations are specifically targeted at mitigating the potential effect of the proposed ATST Project, including: (Note: page number citations are from Vol. II, Appendix P.)

1. Submittal to the NPS by the ATST project team of diagrams showing vehicle configurations (axle spacings and widths), weights and dimensions along with notification of heavy and wide loads entering the Park. (p. 30). This information shall be submitted to HALE sufficiently in advance of the proposed transport date to permit review for compliance with legal load requirements and conformance with load rated capacity. No loads heavier than historic bridge load rating will be allowed on the Park road.
2. Written notification of higher than legal vehicle loadings (see Note 1) crossing the bridge, to allow verification of conformance with load-rated capacity by the Federal Lands Highway Bridge Office. (p. 31). Certification of legal load limits will be required.
3. Periodic monitoring [of the bridge] during construction to verify that legal load limits (see Note 1) are not being exceeded. (p. 31)
4. Photo logging of the entire route to document the condition of the road before and after the proposed ATST Project. (p. 30).
5. Consideration of an on-site concrete batch plant to reduce the number of required concrete delivery trucks – the biggest single factor in ATST construction-related ESALS. (p. 27).
6. Pre-construction photographing of all the drainage structures, especially the bridge and the masonry stone work of box culverts and retaining walls, to help substantiate any construction-related damage. (p. 30).

7. Monitoring during construction of the culvert identified to have a lower-than-recommended amount of cover. (p. 30).

8. Precautions to ensure that no damage from construction vehicles occurs to man-hole covers, underground utilities and bituminous curbs. (p. 31).

9. It is recommended that the Park begin planning for a rehabilitation project in [section 2].While the rehabilitation may not have to occur in the next 3 to 5 years (see Note 2) it is expected that reactive and routine maintenance (small patches and pothole repairs) would increase until the rehabilitation is completed. (p. 32).

NOTES:

1. Note that in the context of the FHWA report, the term "legal" in relation to vehicle loads is understood to mean below the load rated capacity of the bridge, as described in its most recent inspection reports, and the standard allowable dimensions and weights of vehicles on State roads, per HRS 291-34 and HRS 291-35.

2. Postponement of this repair work, if feasible, until after the majority of ATST-related heavy truck traffic may be considered as a mitigation measure to prevent potential damage to newly repaired or replaced pavement from that traffic.

A general traffic plan would be submitted by the Project for approval by the NPS prior to the start of work. To the extent that it is reasonably foreseeable in advance, this plan would addresses the timing for moving large loads through the park, staging and parking areas, prior notification for wide loads, signage, press releases, pilot cars, coordination with Park staff, etc.

If the proposed ATST Project is approved, the SUP to be issued by HALE would address any mitigation measures related to construction traffic, including any contribution to Park road maintenance and repair necessary. NSO is developing a management plan to ensure implementation of mitigation measures associated with the proposed ATST Project. The action alternatives would incorporate these measures by using monitoring and evaluation mechanisms to determine if the proposed ATST Project is achieving the mitigation objectives and adjust actions accordingly. This management plan would cover both phases of the proposed project, including construction and operations.

The provision of wide-load truck access at the HALE entrance station would require special mitigations related to that project, as described in Section 2.4.3-Construction Activities, Construction Traffic. This would include:

1. Assurance by the ATST Project that the septic system is adequately protected. Mitigation may include metal plate covers, grade beams, other protective structures, or relocation of utilities as a last resort.

2. Protection of existing utility man-hole covers. Specifically, the Project would:

    a) avoid direct axle loading on the covers,
    b) replace the existing covers with heavier gage steel; or,
    c) reinforce the existing covers with additional steel bracing.

3. Provision of a barricade system, such as a gate, removable bollards or similar devices on the widened shoulder to deter Park visitors and staff from driving on it.

4. To minimize potential effect to the nēnē habitat in this area, the access widening project would be completed outside the nēnē nesting season, which is November through March.

5. Native plants in the area of the access widening project would be protected when possible and HALE staff would work with the Project on this mitigation.

6. When the widened access is no longer needed for the proposed ATST Project the area would be fully restored and rehabilitated to its pre-existing condition to the satisfaction of HALE staff.

Communications

In response to a request for concurrence to NSF's determination of negligible, adverse effect, the FAA issued a Notice of Presumed Hazard in October 2007, suggesting that the proposed ATST Project would result in radio frequency shadowing at the FAA RCAG facility located about 800 feet to the West of the proposed ATST Project. In accordance with 14 CFR Part 77.35, FAA Obstruction Evaluation and Spectrum Management personnel are working to identify and help quantify the predicted effect to the RCAG. Once the attenuation is sufficiently quantified and if a potential hazard may result, FAA obstruction specialists are working to identify whether mitigation would be necessary and if so, which acceptable engineering solutions would mitigate any adverse effect to RCAG transmit and receive capability.

4.18.10 Noise

Construction-related non-impulse and impulsive noise emissions would increase existing ambient noise levels in the summit area above background levels, although these effects over the duration of the proposed ATST Project would be temporary and intermittent, and would fluctuate, depending on the particular type and the extent of machinery and equipment used. Project construction plans do not include explosive blasting methods or the use of pile drivers for caisson placement; all holes would be drilled to reduce vibrational effect potential.

To mitigate this noise, contractors would implement reasonable noise-reduction practices and abatement procedures. These would include the following source control mitigation measures, all regarded as somewhat standard in the industry. These mitigation measures to minimize expected noise effects during construction at HO would be as follows:

1. Conduct all noise-emitting activities within strict day and time constraints, with work prohibited during sensitive nighttime periods,

2. Reduce or substitute power operations/processes through use of proportionally sized and powered equipment necessary only for tasks at hand,

3. Maintain all powered mechanical equipment and machinery in good operating condition with proper intake and exhaust mufflers,

4. Turn off or shut down equipment and machinery between active operations; and,

5. Erect temporary acoustical shielding or noise curtains around stationary and fixed-position equipment, such as compressors and generators.

Contractors would be required to comply with applicable State noise regulations, under HAR 11-46. For example, all construction equipment and machinery with a motor or exhaust system must have properly functioning mechanical mufflers to reduce noise emissions, and the use of altered or modified equipment with effected or limited noise reduction capabilities is strictly prohibited. Furthermore, although State noise control regulations do allow for issuance of permits to generate excessive noise sources "which (are) in the public interest," the following construction permit restrictions relating to nuisance noise are mandated (HAR 11-46-7):

1. No permit shall allow any construction activities that emit noise in excess of the maximum permissible sound levels before 7:00 a.m. and after 6:00 p.m. of the same day, Monday through Friday,

2. No permit shall allow any construction activities that emit noise in excess of the maximum permissible sound levels before 9:00 a.m. and after 6:00 p.m. on Saturday; and,

3. No permit shall allow any construction activities that emit noise in excess of the maximum permissible sound levels on Sundays and on holidays.

The above-noted mitigation measures and BMPs would further reduce any effects.

Regarding potential noise effects from construction operations on workers and related job-site receptors, the contractor and applicable subcontractors would be required to comply with all federal OSHA regulations and State of Hawaiʻi occupational noise exposure safeguards stipulated under HAR 12-200.1. These safeguards include establishing a hearing protection program and issuing hearing protectors during operations for all employees exposed to an eight-hour time-weighted average of 85 dBA or greater. These requirements would be formalized in the contractor's Hawaiʻi Department of Health-approved project health and safety plan.

Of concern during construction would be the effect of noise on the ʻuaʻu in the Kolekole colony. No effects due to prior construction have been noted, e.g., FTF, Vol. II, Appendix H-Movement of Hawaiian Petrels, but the potential for effect on nesting or fledging success would be addressed by mitigations during construction of the proposed ATST Project. The suspension of heavy construction during nesting season along with the ʻuaʻu video monitoring system described in Section 4.18.3-Biological Resources would be employed as mitigation measures, augmented by noise monitoring equipment that would be capable of correlating on-site noise, video of construction activities and ʻuaʻu activity, to establish whether noise is affecting the ʻuaʻu habitat. Monitoring can assist in determining at what threshold level construction noise can occur without disturbing the colony. In coordination with the USFWS and HALE avian experts, baseline data for at least a year of pre-construction ʻuaʻu behavior at Puʻu Kolekole is already being collected.

Noise levels from the Utility Building are also a concern for ʻuaʻu and Native Hawaiian practitioners in the ROI. The Utility Building would house exhaust fans, a, chiller unit, and backup generator. Thus, all new stationary noise sources associated with the proposed ATST Project would be contained within the building's interior. The Utility Building would be an enclosed structure with minimal window surface areas or wall openings. Because the equipment within would generate a lot of noise, mitigation would focus on sound-abatement devices that would be built into the equipment, and the walls and roof of the Utility Building would incorporate effective sound blocking materials, resulting in a significant dampening of any internally produced noise emitted to the outside. The new backup generator, which would operate only approximately 30 minutes per month for testing and during emergencies, would replace the generator at the MSO facility resulting in no net gain of the total number of fixed-position generators at HO.

Construction plans call for placing fans on the west side of the Utility Building where noise and vibrations would be emitted away from neighboring operations allowing for a less disruptive geometric spread pattern at the summit. Atmospheric noise levels in the area, attributable to the summit's persistent winds, would also provide some degree of acoustical masking of exhaust fan output. Additionally, all existing research facilities at HO have cooling and ventilation systems in place, so the incremental increase in exhaust fan sound attributable to the proposed ATST Project would not significantly increase the current background level of fan-emitted noise.

Although sound abatement devices would be built into the equipment, the potential for noise effect on the nearby colony of ‘ua‘u and on Native Hawaiian practitioners at the East Ahu was considered to assess mitigation measures. Sound levels immediately outside of the equipment building and at the nearby ‘ua‘u burrows and ahu were modeled. How these locations may be affected was evaluated from both the Mees site and the Reber Circle site.

High levels of low frequency sound were of particular interest with respect to the ‘ua‘u burrows. It would be unacceptable to emit noise levels that might contribute in any way to the collapse of any burrow. Also, noise levels that exceed the rumble and/or hiss threshold would be unacceptably distracting for those who may use the East Ahu.

To evaluate whether specific mitigation measures would be necessary for the Utility Building, an acoustic evaluation was conducted (Phelps, 2005) using the Room Criterion accepted by the American Society of Heating, Air-conditioning and Refrigeration Engineers (ASHRAE). The data established that the baseline configuration described above, and the location and orientation of equipment and the Utility Building at the Mees site would not require any extraordinary measures for noise control. As designed, the sound proofing for the Utility Building would achieve sound levels (at the frequencies of interest) at the nearest ‘ua‘u burrows and East Ahu that are lower than the ASHRAE guidelines for Churches, Mosques, and Synagogues as well as private rooms and operating rooms in hospitals. In addition, the baseline configuration, location, and orientation of equipment and the Utility Building at the Reber Circle site would not require any extraordinary measures for noise control to achieve the same sound levels. Should Reber Circle be used for the proposed ATST Project, a slightly different orientation of the Utility Building would result in even lower levels. Therefore noise mitigation would consist entirely of standard sound proofing methods.

4.18.11 Air Quality

No mitigation measures are anticipated or planned for this resource.

4.18.12 Socioeconomics and Environmental Justice

No mitigations are anticipated or planned for socioeconomics and environmental justice.

4.18.13 Public Services and Facilities

No mitigations are anticipated or planned for these resources.

4.18.14 Natural Hazards

Mitigation measures for the proposed ATST Project to reduce potential for cumulative effect on other facilities at HO and within the ROI from natural hazards would include the following:

1. To mitigate risk of earthquake damage, all structural elements of the proposed ATST Project would meet or exceed currently in-force building code requirements for seismic risk on the Island of Maui. The current design standard is Seismic Zone 2b as defined by the 1997 Uniform Building Code.
2. To minimize the potential for hypoxia, training for employees would include information on how to avoid this hazard. It would be suggested employees and visitors at the proposed ATST Project walk slowly at the high elevation and drink plenty of water throughout their working hours to avoid dehydration. The high altitude at the summit area may complicate health conditions and

cause breathing difficulties. Pregnant women, young children, and those with respiratory or heart conditions should consult their doctors prior to traveling to high elevations.

3. When weather conditions such as hurricanes, high winds, snow, and ice become extreme, the HALE closes its gates to prevent people from endangering themselves. Each facility within HO may or may not require a skeleton crew to remain on site while other employees and visitors are required to vacate. The personnel serving the proposed ATST Project would have policies and procedures in place for minimum manning during extreme weather conditions.

NSO is developing a management plan to ensure implementation of the mitigation measures set forth above. The action alternatives would incorporate these measures by using monitoring and evaluation mechanisms to determine if the proposed ATST Project is achieving the mitigation objectives and adjust actions accordingly. This management plan would cover both phases of the proposed project, including construction and operations.

4.18.15 SUP Mitigation Measures

The following mitigation measures are discussed in each of the resource sections of Section 4.0, where they are applied to reduce adverse effects on individual resources.

Use of Park Road for Project Vehicles

Load Limits
No loads heavier than current load rating for the bridge will be allowed on the Park road. Certification of legal load limits will be required. Prior to start of work, diagrams showing vehicle configuration (axle spacings and width), weight per axle, and overall vehicle widths and lengths shall be submitted to the NPS for review for compliance with legal load requirements and conformance with load rated capacity. Additional temporary restrictions for heavy loads may be imposed by the NPS due to weather conditions.

Wide Loads
The Project will make every effort to minimize the number of wide loads*, however, the total number of wide loads will not exceed 25, including no more than 2 loads up to 10 meters (32 feet 10 inches) and no more than 23 loads up to 7 meters (23 feet 0 inches) over the course of the proposed ATST Project. The ATST Project must ensure that these wide loads will not exceed the clearances along the Park road. Every effort will be made to avoid driving wide loads on the edges of the Park road. Any damage to the Park road, road features or resources will be repaired by the ATST Project as needed. Wide loads will need to come through the Park during the night between approximately 8:00 p.m. and 4:00 a.m. to avoid impacts to the Park visitors; however, no wide loads can traverse the Park road during the night between April 20th and July 15th to avoid impacts to the nesting petrels. A minimum of 2 weeks advanced notice to NPS of wide loads is required.

*For the purposes of this mitigation measure, a *wide load* is defined as one that requires special provisions including restriction of traffic in the opposite direction to safely traverse the Park road. Loads that exceed the 9-foot legal vehicle width defined by Hawaiʻi DOT 291-34, but that can safely travel within the 12-foot lane of the Park road by implementing the legally stipulated precautions of proper signage, pilot cars, and other such measures, are not defined as wide loads with regard to this mitigation measure.

Entrance Station

The Level and Improve Shoulder option outlined in the "*HALE Entrance Station Clearance for ATST Loads"* report prepared by the ATST Project, April 2009, will be allowed to accommodate wide loads coming through the Park entrance station. This option must:

1. Assure that the septic system is adequately protected. The Park suggests the use of large, heavy gauge metal plates or material of a similar nature.
2. Assure that this option is feasible for very heavy loads.
3. Install a gate or barricade system on the temporarily improved shoulder to deter Park visitors and staff from driving on it.
4. This area contains native plants and is nēnē habitat. Native plants should be protected where possible - the Park staff will work with the ATST Project on this. The construction of the temporarily improved road shoulder would need to be completed between April and October to avoid impacts to nesting nēnē.
5. When the temporarily improved road shoulder is no longer needed for the proposed ATST Project, it will need to be fully restored and rehabilitated to natural conditions. The Park staff will need to review and approve a restoration/rehabilitation plan to accomplish this requirement.

Underground Utilities

There are a total of 4 manhole covers in the roadway, approximately 3.5 feet wide by 5.5 feet long. The following precautions will be taken by the ATST Project to ensure no damage to the covers during the haul of heavy loads to the proposed Project site:

1. Avoid direct wheel loading on the covers.
2. Replace the existing covers with heavier gauge steel
3. Large heavy gauge metal plates or similar are placed over the existing covers to adequately protect them.

Pre- and Post-Project Documentation

Prior to and after the proposed ATST Project, all historic features and other areas susceptible to potential impact along the Park road shall be photographed and documented (see FHWA report – "*Haleakala Highway, Haleakala National Park, Maui, Hawai'i, Pavement/Drainage conditions Investigation, Distress Identification and Recommendations, Report # HALA 3-2-2009, March 2, 2009* (revised April 2009)" , found in Vol. II-appendix P). This will be completed by an agreed upon qualified person funded by the ATST Project.

Traffic Controls

A general traffic plan shall be submitted for approval by the NPS prior to the start of work that addresses such items as the timing for moving large loads through the Park, staging and parking areas, prior notification for wide loads, signage, press releases, pilot cars, coordination with Park staff, etc. Specific traffic plans will be submitted by the Project to the NPS as the details of traffic control issues become known.

Biological Resources

Biological Monitor
The Project will fund an agreed upon and qualified person to conduct reasonable biological monitoring activities as outlined by the USFWS in its informal consultation. Specifically, the monitor will ensure that any changes in behavior and any petrel mortality associated with the proposed ATST Project are monitored and reported to the NPS and USFWS. The monitor will also monitor the impacts to nēnē and other biological resources. All monitoring activities shall take place during the construction phase of the proposed ATST Project and during the first three years of the operations phase.

Endangered Species Act Compliance
The construction schedule must adhere to the mitigation measures outlined in the informal Section 7 consultation with the USFWS.

Alien Invasive Species Prevention
NPS vehicle, equipment, and materials washing and inspection protocol will be followed by the ATST Project.

Programmatic Monitoring
A programmatic monitoring plan for invertebrates, flora and fauna during the project will be submitted for approval by the NPS and implemented by the Project.

Visitor Use and Experience

Travel Times Through Park
Slow moving vehicles and/or vehicles that are class 5 or larger should not travel through the Park between approximately 11:00 a.m. and 2:00 p.m. These are peak visitation hours.

Noise
To minimize impacts to the visitor experience, outside, on-site, construction activities will be limited daily to between 30 minutes after sunrise and 30 minutes prior to sunset, unless otherwise specified in other mitigation measures.

Information
The ATST Project shall provide regular updates to appropriate NPS staff during the project so NPS staff can provide information to Park visitors.

Special Use Permit Cost Recovery

A project monitor will be funded by the ATST Project to ensure that all mitigation measures and stipulations in the SUP are being followed. This person will be the NPS point-of-contact during the project. Any costs associated with damages to Park resources (e.g., Park road) resulting from the proposed ATST Project will be recovered from the Project.

Park Superintendent's Authority to Modify Mitigation Measures

The Park recognizes that situations will likely occur that may warrant reasonable deviation from the mitigation measures in the SUP. Such situations will be worked out on a case-by-case basis under the authority of the Park Superintendent.

5.0 NOTIFICATION, PUBLIC INVOLVEMENT, AND CONSULTED PARTIES

Pursuant to the National Environmental Policy Act (NEPA) and upon recommendation by the State of Hawaiʻi Dept. of Health, Office of Environmental Quality Control (OEQC), Federal and State agencies, Native Hawaiian Organizations (NHO) and individuals, other organizations and members of the public were notified, contacted, and consulted during the course of planning for the proposed Advanced Technology Solar Telescope (ATST) Project or in the course of preparing studies or submitting applications for various approvals.

Details of public and agency disclosure and involvement regarding the proposed ATST Project consisted of notification letters, agency and media announcements, document distribution lists, and descriptions of public hearings, consultations, and comment periods are detailed in the following subsections. Responses to issues and concerns raised during the public hearings, comment periods, and consultation meetings were addressed by the ATST point-of-contact.

Consultation meetings pursuant to the Section 106 process of the National Historic Preservation Act (NHPA) also took place both before and after publication of the September 2006 draft Environmental Impact Statement (DEIS). At times, the NEPA and National Historic Preservation Act (NHPA) processes were linked (as is reflected in some of the notification letters and cards), and at other times, there were additional focused Section 106 consultation meetings. This section discusses the Section 106 process, including the consultations with Native Hawaiian organizations and individuals for the proposed ATST Project. KC Environmental, Inc. (KCE), the National Science Foundation (NSF), and the archeological consultant for the proposed ATST Project initiated early and detailed consultations with the State Historic Preservation Division (SHPD) and the Advisory Council on Historic Preservation (ACHP). These consultations have continued since 2005 and are summarized in this section.

Consultation with the U.S. Fish and Wildlife Service also took place pursuant to the Endangered Species Act. A summary of that interaction and the results of consultation are provided in Section 4.3-Biological Resources and Vol. II, Appendix M-Section 7 Informal Consultation Document.

5.1. EIS PROCESS

5.1.1 Pre-Assessment Notification

Federal Process

After considering the proposed ATST Project, NSF determined that it would prepare an EIS to assess the environmental effects of the proposed ATST Project pursuant to NEPA. On June 23, 2005, the Notice of Intent (NOI) for the proposed ATST Project was published in the Federal Register. (The Federal Register is a legal newspaper published every business day by the National Archives and Records Administration (NARA). The Federal Register contains: Federal Agency Regulations, Proposed Rules and Notices, Executive Orders, Proclamations, and Other Presidential Documents. The proposed ATST Project comes under the Federal Register's organizational category of "Notices, including scheduled hearings and meetings open to the public, grant applications, and administrative orders.")

Figure 5-1 is the Notice of Intent (NOI) for the proposed ATST Project that was published in the Federal Register on Thursday, June 23, 2005 in Vol. 70, No. 120/Notices. Detailed information regarding three public scoping meetings that were held on Maui in July 2005 was also included in the NOI.

Federal Register / Vol. 70, No. 120 / Thursday, June 23, 2005 / Notices **36413**

NATIONAL SCIENCE FOUNDATION

Preparation of an Environmental Impact Statement (EIS) for the Advanced Technology Solar Telescope (ATST) at the Haleakala High Altitude Observatory (HO) Site, Mt. Haleakalā, Island of Maui, HI

AGENCY: National Science Foundation.

ACTION: Notice of intent.

SUMMARY: The National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) for the proposed Advanced Technology Solar Telescope (ATST) Project. The NSF, through an award to the National Solar Observatory (NSO), plans to fund construction of the proposed ATST at the University of Hawai'i Institute for Astronomy (IfA), Haleakalā High Altitude Observatory (HO) site, on the Island of Maui, Hawai'i. An extensive campaign of worldwide site testing has identified Haleakalā Observatory as the optimal location for this next-generation solar observing facility. The telescope enclosure and a support facility would be placed at one of two identified sites within the existing observatory boundaries. The EIS will address both of these sites and the potential environmental impacts of on-site construction, installation, and operation of this proposed new solar telescope. With its unprecedented 4.2-m (165-inch) aperture, advanced optical technology, and state-of-the-art instrumentation, the proposed ATST will be an indispensable tool for exploring and understanding physical processes on the sun that ultimately affect Earth. The EIS will address, among other things, the potential direct, indirect, and cumulative environmental impacts associated with the proposed Advanced Technology Solar Telescope project. The EIS development process for the proposed action will be conducted in accordance with the National Environmental Policy Act (NEPA).

Written comments may be forwarded to:

ADDRESSES: Dr. Craig B. Foltz, Program Officer, National Science Foundation, Division of Astronomical Sciences, 4201 Wilson Blvd., Room 1045, Washington, DC 22230. Telephone: (703) 292–4909. Fax: (703) 292–9034. E-mail: *cfoltz@nsf.gov*.

SUPPLEMENTARY INFORMATION: Proposed alternatives to be considered may include, but not be limited to, the following:

(1) Alternative 1: (Proposed Action): Undeveloped site East of Mees Observatory.

(2) Alternative 2: Former radio telescope site known as Reber Circle.

(3) Alternative 3: No-Action. The National Science Foundation will not construct the Advanced Technology Solar Telescope on Maui.

Publication of the NOI does not foreclose consideration of any courses of actions or possible decisions addressed by the National Science Foundation in its Final Environmental Impact Statement (FEIS). No final decisions will be made regarding construction of the ATST prior to completion and signature of the Record of Decision for the proposed action.

Scoping Process: Federal, State and local agencies and the public are invited to participate in the scoping process for the completion of this EIS. The scoping process will help identify potential impacts and key issues to be analyzed in the EIS.

Scoping meetings will be held at the following locations on the island of Maui, Hawai'i, with notification of the times and locations published in the local newspapers.

(1) J. Walter Cameron Center—Auditorium, 95 Mahalani Street, Wailuku, HI 96793; Tuesday, July 12, 2005, 5 p.m. to 9:30 p.m.

(2) Kula Community Center, Lower Kula Road, Kula, HI 96790; Wednesday, July 13, 2005, 6 p.m. to 10 p.m.

(3) Mayor Hannibal Tavares Community Center—Room 2, 91 Pukalani Street, Pukalani, HI 96788; Thursday, July 14, 2005 6 p.m. to 10 p.m.

Written comments identifying potential impacts to be analyzed in the EIS will be accepted within 30 days after the scoping meetings or within 30 days after publication in the Bulletin of the State of Hawaii Office of Environmental Quality Control, whichever is later. Written comments may be submitted to Dr. Craig B. Foltz at the address above.

Dated: June 6, 2005.

Craig B. Foltz,

Program Officer.

[FR Doc. 05–11970 Filed 6–22–05; 8:45 am]

BILLING CODE 7555–01–M

Figure 5-1. Federal Register Notice of Intent, June 23, 2005.

State Process

Office of Environmental Quality Control

The OEQC was established in 1970 to help stimulate, expand and coordinate efforts to maintain the optimum quality of the State's environment. The OEQC implements the Environmental Impact Statement law, Chapter 343, HRS. If the lead agency decides that a proposed project may have a significant environmental impact, a State EIS must be prepared prior to implementing the proposed project. For the proposed ATST Project, the University of Hawai‘i (UH) Institute for Astronomy (IfA), as the accepting authority for the proposed Project, decided that a State EIS must be prepared. Figure 5-2 is the Announcement for the proposed ATST Project that was published in the June 23, 2005 issue of the OEQC Bulletin. Detailed information regarding three public scoping meetings that were held on Maui in July 2005 was also included in the announcement.

Environmental Announcements

JUNE 23, 2005

Advanced Technology Solar Telescope (ATST) Project Meetings

The National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) for the proposed Advanced Technology Solar Telescope (ATST) Project. The NSF, through an award to the National Solar Observatory (NSO), plans to fund construction of the proposed ATST at the University of Hawai‘i Institute for Astronomy (IfA), Haleakala High Altitude Observatory (HO) site, on the Island of Maui, Hawai‘i. An extensive campaign of worldwide site testing has identified Haleakala Observatory as the optimal location for this next-generation solar observing facility. The telescope enclosure and a support facility would be placed at one of two identified sites within the existing observatory boundaries. The EIS will address both of these sites and the potential environmental impacts of on-site construction, installation, and operation of this proposed new solar telescope. With its unprecedented 4.2-m (165-inch) aperture, advanced optical technology, and state-of-the-art instrumentation, the proposed ATST will be an indispensable tool for exploring and understanding physical processes on the sun that ultimately affect Earth.

The NSF and NSO welcome and invite public input regarding environmental issues associated with the proposed action. Meetings will be held to provide an opportunity for concerned members of the community to comment on the appropriate scope of the EIS for this proposed project. The schedule and locations for these Public Scoping Meetings are as follows:

1) J. Walter Cameron Center – Auditorium, 95 Mahalani Street, Wailuku, HI 96793
   Tuesday, July 12, 2005, 6:30 p.m. to 9:00 p.m.

2) Kula Community Center, Lower Kula Road, Kula, HI 96790
   Wednesday, July 13, 2005, 6:30 p.m. to 9:00 p.m.

3) Mayor Hannibal Tavares Community Center – Room 2, 91 Pukalani Street, Pukalani, HI 96788
   Thursday, July 14, 2005, 6:30 p.m. to 9:00 p.m.

All meetings will begin with an informal opportunity to meet representatives from NSF and IfA during the first half-hour. The formal meeting to invite and address public comments will begin promptly thereafter. Interested parties may also submit comments or questions to Mr. Jeremy Wagner, ATST Project Manager, National Solar Observatory, 950 North Cherry Avenue, P. O. Box 26732, Tucson, AZ 85726-6732, Telephone: (520) 318-8249, Fax: (520) 318-8500, e-mail: jwagner@nso.edu .

The Environmental Notice   Office of Environmental Quality Control   Page 21

Figure 5-2. Office of Environmental Quality Control Environmental Announcement, June 23, 2005.

Formal notification letters announcing the intent of the NSF to prepare an EIS for the proposed ATST Project were sent in June 2005 to State of Hawai‘i elected officials, organizations, Federal and State agencies, and community individuals (Table 5-1). Each pre-assessment letter included a project description with the intent to publish an EIS, detailed information about the three Public Scoping Meetings, and ATST project management contact information.

Table 5-1. Pre-Assessment Notification Distribution List, June 2005.

STATE OF HAWAIʻI ELECTED OFFICIALS			
1	Congressman Ed Case	8	Senator Chris Halford
2	Congressman Neil Abercrombie	9	Senator J. Kalani English
3	Council Member Charmaine Tavares	10	Senator Kyle Yamashita
4	Council Member Mike Molina	11	Senator Mele Carroll
5	Council Member Robert Carroll	12	Senator Rosalyn Baker
6	Honorable Governor Linda Lingle	13	U.S. Senator Daniel Akaka
7	Mayor Alan Arakawa	14	U.S. Senator Daniel Inouye

AGENCIES			
	Affiliation	**Last Name**	**First Name**
1	Advisory Council on Historic Preservation, Council on Environmental Quality		
2	Air Force Maui Optical Supercomputing Site	Richert	Lt. Col. Brent
3	Boeing LTS, L&EOS Hawaiʻi Director	Zelenka	Richard
4	County of Maui, Dept. of Parks and Recreation, Director	Correa	Glenn
5	County of Maui, Dept. of Planning, Director	Foley	Mike
6	County of Maui, Police Dept. -Telecommunications	Pacheco	Walt
7	Federal Aviation Administration, Realty Contracting Officer	Young	Darice
8	Haleakalā National Park Service, Superintendent	Reeser	Donald
9	Hawaiʻi Telecom, Area Manager	Tanabe	Winslow
10	Maui County Chief of Police	Phillips	Thomas
11	Maui County Cultural Resources Commission	Sablas	Lorraine
12	Maui Economic and Development Board, Inc., Program Director High Tech Maui	Liu	Tom
13	Maui Electric Company, Inc.	Yamasaki	Craig
14	National Weather Service/NOAA, Communications Manager	Suekawa	Carl
15	Raycom Media, Inc., Director of Engineering	Aotaki	Keith
16	Raycom Media, Inc., General Manager	Fink	John
17	Sandia Laboratories, Site Manager	Vigil	Orlando
18	State Historic Preservation Division, Asst. Maui Archaeologist	Dagher	Cathleen
19	State Historic Preservation Division, Administrator	Chinen	Melanie
20	State Historic Preservation Division, Maui Archaeologist	Kirkendall	Melissa
21	State of Hawaiʻi, Department of Accounting and General Services Public Works, Information and Communications Services Division	Hlivak	Robert
23	State of Hawaiʻi, Department of Accounting and General Services Public Works, Maui Branch Engineer	Victor	David

Table 5-1. Pre-Assessment Notification Distribution List, June 2005 (cont.).

AGENCIES			
	Affiliation	**Last Name**	**First Name**
24	State of Hawaiʻi, Department of Business, Economic Development and Tourism, Office of Planning, Land Use Division	Mitsuda	Abe
25	State of Hawaiʻi, Department of Transportation, Maui Director	Ginoza	Kyle
26	State of Hawaiʻi, Department of Transportation, Director	Haraga	Rodney
27	State of Hawaiʻi, Dept. of Hawaiian Homelands Land Management Division (Non-Homestead)		
28	State of Hawaiʻi, Dept. of Land and Natural Resources, Island Burial Council	Maxwell, Sr.	Kahu Charles
29	State of Hawaiʻi, Dept. of Land and Natural Resources, Office of Conservation and Coastal Lands	Lemmo	Samuel
30	State of Hawaiʻi, Dept. of Land and Natural Resources, Division of Forestry and Wildlife, Maui Wildlife Manager	Ueoka	Meyer
31	State of Hawaiʻi, Dept. of Land and Natural Resources, Division of Forestry and Wildlife, Wildlife Biologist	Duvall, II	Dr. Fern
33	State of Hawaiʻi, Dept. of Land and Natural Resources, Land Division, Land Agent-Maui	Ornellas	Daniel
35	State of Hawaiʻi, Dept. of Land and Natural Resources, Maui Na Ala Hele Advisory Council, Trails and Access Specialist	Nohara	Torrie
36	State of Hawaiʻi, Dept. of Land and Natural Resources, Division of Forestry and Wildlife, Branch Manager	Cumming	John
38	State of Hawaiʻi, Office of Hawaiian Affairs, Chair	Apoliona	Haunani
39	State of Hawaiʻi, Office of Hawaiian Affairs, Community Resource Coordinator	Shimaoka	Thelma
40	U.S. Department of Energy	Yoshinaka	Eileen
41	U.S. Department of Interior, Fish and Wildlife Service, Acting Field Supervisor	Newman	Jeff
42	U.S. Environmental Protection Agency Pacific Islands Contact Office, Region 9	Higuchi	Dean

Table 5-1. Pre-Assessment Notification Distribution List, June 2005 (cont.).

COMMUNITY MEMBERS			
	Affiliation	**Last Name**	**First Name**
1	Hui Ala Nui O Makena	Hall	Dana
2	Kaho‘olawe Island Reserve Commission	Kahoohalahala	Sol
3	Kipahulu Community Association	Lind	Tweetie
4	Kula Community Association	Mayer	Dick
5	Maui Outdoor Circle, President	McCord	Warren
6	Na Kupuna O Maui	Nishiyama	Kupuna Patty
7	Ritz Carlton Kapalua, Cultural Specialist	Naeole	Clifford
8	Royal Order of Kamehameha I, Ku‘auhau Nui	Garcia	Ali‘i Sir William
9	Sierra Club, Maui	Holter	Lance
10	The Nature Conservancy, Natural Resources Manager	Chimera	Melissa
11		Amadeo	Kupuna Diana
12		Dutro	David
13		Hall	Issac
14		Han	Elizabeth
15		Holt-Padilla	Hokulani
16		Kuloloio	Leslie
17		Lind	John
18		Uwekoolani	Edward

During consultation with the OEQC, it was determined that an EIS Preparation Notice (EISPN) was needed to address requirements under Hawai‘i Revised Statutes (HRS) Chapter 200, Title 11, in that the proposed ATST Project may potentially meet one or more of the significance criteria for effects on Conservation District Land. The EISPN, which was a lengthy document describing the proposed ATST Project, was also prepared in accordance with HAR 13-5-31, which requires an EIS to accompany the required Conservation District Use Application (CDUA), where significant effects may be anticipated. The EISPN was published and distributed in August 2005 to the OEQC, a recommended number of elected officials, agencies and organizations, libraries, and other interested individuals. Additional copies of the EISPN were distributed during the following months as agencies or individuals requested a copy.

Agencies, groups or individuals were allocated the required 30 days from the initial publication of the Environmental Impact Statement Preparation Notice (EISPN) to submit written requests to become a consulted party or written comments regarding the issues and concerns of environmental effects of the proposed ATST Project. Responses to comments were addressed by the ATST point-of-contact. Table 5-2 is the distribution list for the EISPN. Vol. III, Appendix A-Pre-DEIS Public Comments contains the written commentary received from the 30-day public comment period as well as the responses that were addressed by the designated ATST point-of-contact.

Table 5-2. EISPN Distribution List, August 2005.

STATE OF HAWAI‘I ELECTED OFFICIALS			
1	Congressman Ed Case	8	Senator Chris Halford
2	Congressman Neil Abercrombie	9	Senator J. Kalani English
3	Council Member Charmaine Tavares	10	Senator Kyle Yamashita
4	Council Member Mike Molina	11	Senator Mele Carroll
5	Council Member Robert Carroll	12	Senator Rosalyn Baker
6	Honorable Governor Linda Lingle	13	U.S. Senator Daniel Akaka
7	Mayor Alan Arakawa	14	U.S. Senator Daniel Inouye

AGENCIES			
	Affiliation	**Last Name**	**First Name**
1	CKM Cultural Resources	Maxwell	Kahu Charles
2	County of Maui, Department of Parks and Recreation		
3	County of Maui, Department of Planning		
4	Friends of Haleakalā	Stokesberry	Mele
5	Geometrician Associates, LLC	Terry	Ron
6	Haleakalā National Park	Natividad Bailey	Cathleen
7	Hawai‘i State Library - Hana Public and School		
8	Hawai‘i State Library – Hawai‘i Document Center		
9	Hawai‘i State Library - Kahului		
10	Hawai‘i State Library – Kihei		
11	Hawai‘i State Library – Lahaina		
12	Hawai‘i State Library – Makawao		
13	Hawai‘i State Library – Wailuku		
14	Kula Community Association	Mossman	Karolyn
15	Maui Economic and Development Board, Program Director High Tech Maui	Liu	Tom
16	Maui Economic Development Board, President	Skog	Jeanne
17	Pacific Analytics	Brenner	Greg
18	Starr Environmental	Starr	Forest & Kim
19	State Historic Preservation Division, Administrator	Chinen	Melanie
20	State Historic Preservation Division, Archaeologist	Kirkendall	Melissa
21	State of Hawai‘i, Department of Accounting and General Services, Public Works and Environmental Management, Maui Branch Engineer	Victor	David
22	State of Hawai‘i, Department of Business, Economic Development and Tourism, Energy, Resources and Technology Division, Director	Liu	Ted

Table 5-2. EISPN Distribution List, August 2005 (cont.).

AGENCIES			
	Affiliation	**Last Name**	**First Name**
23	State of Hawai‘i, Department of Business, Economic Development and Tourism, Office of Planning, Land Use Division	Mistuda	Abe
24	State of Hawai‘i, Department of Environmental Health, Planning Office, Director of Health	Fukino, M.D.	Chiyome
25	State of Hawai‘i, Department of Health, Office of Environmental Quality Control, Director	Salmonson	Genevieve
26	State of Hawai‘i, Department of Health, District Health Officer	Pang, M.D.	Lorrin
27	State of Hawai‘i, Department of Land and Natural Resources, Office of Conservation and Coastal Lands	Lemmo	Samuel
28	State of Hawai‘i, Department of Land and Natural Resources, Division of Forestry and Wildlife, Branch Manager	Cumming	John
29	State of Hawai‘i, Office of Hawaiian Affairs, Chair	Apolonia	Haunani
30	State of Hawai‘i, Office of Hawaiian Affairs, Community Resource Coordinator	Shimaoka	Thelma
31	U.S. Department of Interior, Fish and Wildlife Service, Acting Field Supervisor	Newman	Jeff
32	U.S. Department of Interior, Fish and Wildlife Service, Fish and Wildlife Biologist	Freifeld	Holly
33	University of Hawai‘i Environmental Center		
34	Xamanek Researches, LLC	Fredericksen	Erik

COMMUNITY MEMBERS					
1	Evanson, Mary	5	Medeiros, Art	9	Shibuya, Warren
2	Hall, Issac	6	Miner, James	10	Smith, Bill
3	Helm, Mikahala	7	Orszula, Edmund		
4	Mayer, Dick	8	Raymond, Ki‘ope		

5.1.2 Pre-assessment Public Scoping Meetings Pursuant to NEPA and OEQC Guidance

Three pre-assessment Public Scoping Meetings to assist the lead agency in determining the scope of environmental analysis, resources involved, and potential concerns about effects were held on Maui, Hawai‘i, as follows:

1. J. Walter Cameron Center, Wailuku, HI, July 12, 2005.
2. Kula Community Center, Kula, HI, July 13, 2005.
3. Mayor Hannibal Tavares Community Center, Pukalani, HI, July 14, 2005
   (This is also known as the Pukalani Community Center).

A Public Notice was published in the Maui Weekly in the June 30 to July 6, 2005 issue (Fig. 5-3) and in the Maui News on July 7, 2005 (Fig. 5-4). Each meeting was facilitated by Mediation Services of Maui, was recorded by a transcriptionist from Iwado Court Reporters, and a Hawaiian language interpreter was available for individuals wishing to speak in Hawaiian, although no testimony was heard in the Hawaiian language at any of the scoping meetings. The attending public was invited to sign-in, view and collect information made available about the proposed ATST Project, listen to presentations given by members of the NSF, the National Solar Observatory (NSO), the National Optical Astronomy Observatory (NOAO), the IfA, and the environmental consultants. The public was given the opportunity to ask questions, comment about issues and concerns, and given 30 days to submit written commentary or a written request to be included as a consulting party to the proposed ATST Project. Although particular comment periods were determined by the OEQC and Federal regulations, all written comments were accepted for inclusion into the DEIS and made part of the NSF's Administrative Record for the proposed ATST Project. Vol. III, Appendix A-Pre-DEIS Public Comments contains written commentary received from members of the community, elected officials, agencies, and organizations, as well as the responses that were addressed by the designated ATST point-of-contact. This scoping process assisted NSF in identifying the resources involved and potential effects that the proposed ATST Project might incur.

5.1.3 Additional Public Meetings

Listed below are additional meetings that occurred either upon request from the community or at the request of ATST project members. Informal community meetings that were requested by the community were accommodated and those in attendance were given the opportunity to ask questions and comment on the proposed ATST Project. All information presented during these additional meetings was identical to the July 2005 Public Scoping meetings.

1. Mayor Hannibal Tavares Community Center, Pukalani, HI, July 12, 2005. Informal meeting requested by Friends of Haleakalā Board of Directors: Mary Evanson, Mele Stokesberry, Martha Martin, Matt Wordeman, and Advisory Board member Don Reeser, then Superintendent of Haleakalā National Park (HALE).
2. Maui Community College (MCC) Library, Kahului, HI, January 26, 2006. Informal meeting requested by community members: Don Reeser, Mary Evanson, Ki‘ope Raymond, Art Medeiros, James Miner, Mikahala Helm, Dick Mayer, and Kalei Ka‘eo.
3. Ha‘iku Community Center, Ha‘iku, HI, March 27, 2006. Informal community meeting requested by attendees at the January 26, 2006 MCC meeting. Public notification was advertised in the Maui News and the Haleakalā Times (Figs. 5-5 and 5-6).
4. Informal HO site visit/meeting held March 17, 2006, requested by community members: Reuben Dela Cruz, Mary Evanson, Jeremy Gray, Mikahala Helm, Dick Mayer, Ki‘ope Raymond.
5. Formal meeting held on March 27, 2006, at Maui Economic Development Board (MEDB) with Jeanne Skog, Leslie Wilkins, Pam Benson, and Sandy Ryan.
6. Formal meeting held on March 27, 2006, with Chancellor Clyde Sakamoto of MCC.

June 30 – July 6, 2005 • Maui Weekly • **15**

The **National Science Foundation** (NSF) intends to prepare a joint Federal and State **Environmental Impact Statement** (EIS) for the **Advanced Technology Solar Telescope** (ATST) **Project**. The NSF, through an award to the **National Solar Observatory** (NSO), plans to fund construction of the ATST at the **University of Hawai'i Institute for Astronomy** (IfA), **Haleakalā High Altitude Observatory** (HO) site, on the Island of Maui, Hawai'i.

An extensive campaign of worldwide site testing has identified Haleakalā Observatory as the optimal location for this next-generation solar observing facility. The telescope enclosure and a support facility would be placed at one of two identified sites within the existing observatory boundaries. The EIS will address both of these sites and the potential environmental impacts of on-site construction, installation, and operation of this proposed new solar telescope. With its unprecedented 4.2-m (165-inch) aperture, advanced optical technology, and state-of-the-art instrumentation, the ATST will be an indispensable tool for exploring and understanding physical processes on the sun that ultimately affect Earth.

The NSF and NSO welcome and invite public input regarding environmental issues associated with the proposed ATST. Meetings will be held to provide an opportunity for concerned members of the community to comment on the appropriate scope of the EIS for this proposed project. The schedule and locations for these Public Scoping Meetings are as follows:

J. Walter Cameron Center–Auditorium
95 Mahalani St., Wailuku, HI 96793
Tuesday, July 12, 2005, 6:30 PM to 9:00 PM

Kula Community Center – Lower Kula Road, Kula, HI 96790
Wednesday, July 13, 2005, 6:30 PM to 9:00 PM

Mayor Hannibal Tavares Community Center (Room 2)
91 Pukalani Street, Pukalani, HI 96788
Thursday, July 14, 2005, 6:30 PM to 9:00 PM

All meetings will begin with an informal opportunity to meet representatives from the project and the involved agencies during the first half-hour of the time allotted for the meeting.

The formal meeting to invite and address public comments will begin promptly thereafter.

Comments or questions may be submitted to Mr. Jeremy Wagner, ATST Project Manager, National Solar Observatory, 950 North Cherry Avenue, Tucson, Arizona 85726. Mr. Wagner may also be reached by e-mail at jwagner@nso.edu or by telephone at (520) 318-8249.

The deadline to submit public comments or questions is August 14, 2005.

Figure 5-3. Public Scoping Meetings Notification: Maui Weekly, June 30 to July 6, 2005 Issue.

C6 – Thursday, July 7, 2005 – THE MAUI NE

The National Science Foundation (NSF) intends to prepare a joint Federal and State Environmental Impact Statement (EIS) for the Advanced Technology Solar Telescope (ATST) Project. The NSF, through an award to the National Solar Observatory (NSO), plans to fund construction of the ATST at the University of Hawai'i Institute for Astronomy (IfA), Haleakala High Altitude Observatory (HO) site, on the Island of Maui, Hawai'i.

An extensive campaign of worldwide site testing has identified Haleakala Observatory as the optimal location for this next-generation solar observing facility. The telescope enclosure and a support facility would be placed at one of two identified sites within the existing observatory boundaries. The EIS will address both of these sites and the potential environmental impacts of on-site construction, installation, and operation of this proposed new solar telescope. With its unprecedented 4.2-m (165-inch) aperture, advanced optical technology, and state-of-the-art instrumentation, the ATST will be an indispensable tool for exploring and understanding physical processes on the sun that ultimately affect Earth.

The NSF and NSO welcome and invite public input regarding environmental issues associated with the proposed ATST. Meetings will be held to provide an opportunity for concerned members of the community to comment on the appropriate scope of the EIS for this proposed project. The schedule and locations for these Public Scoping Meetings are as follows:

1) J. Walter Cameron Center – Auditorium,
95 Mahalani Street, Wailuku, HI
Tuesday, July 12, 2005, 6:30 p.m. to 9:00 p.m.

2) Kula Community Center –
Lower Kula Road, Kula, HI
Wednesday, July 13, 2005,
6:30 p.m. to 9:00 p.m.

3) Mayor Hannibal Tavares Community Center (Room 2) – 91 Pukalani Street, Pukalani, HI
Thursday, July 14, 2005,
6:30 p.m. to 9:00 p.m.

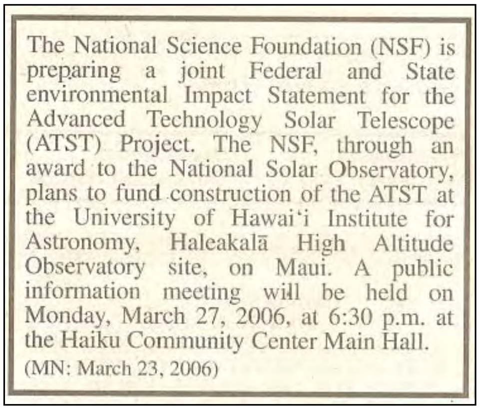
All meetings will begin with an informal opportunity to meet representatives from the project and the involved agencies during the first half-hour of the time allotted for the meeting. The formal meeting to invite and address public comments will begin promptly thereafter. Comments or questions may be submitted to Mr. Jeremy Wagner, ATST Project Manager, National Solar Observatory, 950 North Cherry Avenue, Tucson, Arizona 85726. Mr. Wagner may also be reached by email at jwagner@nso.edu or by telephone at (520) 318-8249. The deadline to submit public comments or questions is August 14, 2005.

(MN: July 7, 2005)

STATE/COUNTY GOVERNMENT NOTICES | STATE/COUNTY GOVERNMENT NOTICES

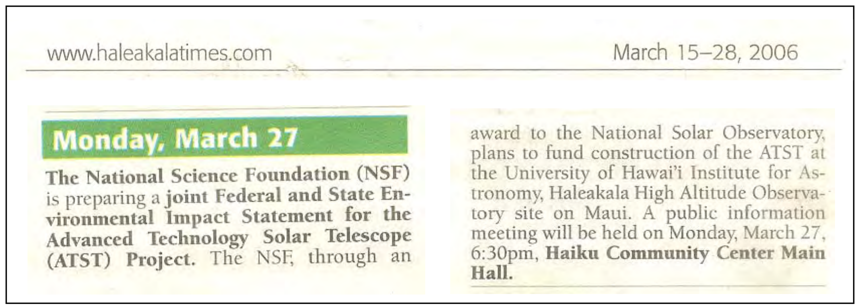
920 PUBLIC NOTICES

Figure 5-4. Public Scoping Meetings Notification: Maui News, July 7, 2005.



The National Science Foundation (NSF) is preparing a joint Federal and State environmental Impact Statement for the Advanced Technology Solar Telescope (ATST) Project. The NSF, through an award to the National Solar Observatory, plans to fund construction of the ATST at the University of Hawai'i Institute for Astronomy, Haleakalā High Altitude Observatory site, on Maui. A public information meeting will be held on Monday, March 27, 2006, at 6:30 p.m. at the Haiku Community Center Main Hall.
(MN: March 23, 2006)

Figure 5-5. Informal Community Meeting Notification: Maui News Public Notice, March 23, 2006.



www.haleakalatimes.com March 15–28, 2006

Monday, March 27

The National Science Foundation (NSF) is preparing a **joint Federal and State Environmental Impact Statement for the Advanced Technology Solar Telescope (ATST) Project.** The NSF, through an award to the National Solar Observatory, plans to fund construction of the ATST at the University of Hawai'i Institute for Astronomy, Haleakala High Altitude Observatory site on Maui. A public information meeting will be held on Monday, March 27, 6:30pm, **Haiku Community Center Main Hall.**

Figure 5-6. Informal Community Meeting Notification: Haleakalā Times Community Calendar, March 15 to 28, 2006 Issue.

5.1.4 Publication of the Draft Environmental Impact Statement

The DEIS was formally published in the Federal Register on September 6, 2006 (Figure 5-7). It was formally published in the OEQC Bulletin on September 8, 2006 (Figure 5-8), and distributed to the OEQC, an OEQC–mandatory and –approved number of State and County of Maui agencies, organizations, libraries, elected officials, and other interested individuals (Table 5-3). Additional copies of the DEIS were distributed during the following months upon request.

The public was given the required 45-day period in which to submit written on the DEIS. During this time period, the public was also invited to submit requests to become consulting parties pursuant to Section 106 of the NHPA. Responses to comments were addressed by the ATST point-of-contact. Table 5-3 is the distribution list for the DEIS. Written comments received during and after the 45-day public comment period and responses to those comments will be included in the final EIS.

Figure 5-7 is the Notice for the Draft Environmental Impact Statement (DEIS) for the proposed ATST Project that was published in the Federal Register on Wednesday, September 6, 2006 in Vol. 71, No. 172/Notices.

52586 **Federal Register** / Vol. 71, No. 172 / Wednesday, September 6, 2006 / Notices

NATIONAL SCIENCE FOUNDATION

Publication of the Draft Environmental Impact Statement (DEIS) for the Advanced Technology Solar Telescope (ATST) at the Haleakalā High Altitude Observatory (HO) Site, Haleakalā, Island of Maui, Hawai'i

AGENCY: National Science Foundation.

ACTION: Notice—Draft Environmental Impact Statement.

SUMMARY: The National Science Foundation (NSF) has prepared a Draft Environmental Impact Statement (DEIS) for the proposed Advanced Technology Solar Telescope (ATST) Project. This joint DEIS is prepared in compliance with the Federal National Environmental Policy Act (NEPA) and the State of Hawai'i Chapter 343, Hawai'i Revised Statutes (HRS). The NSF, through an award to the National Solar Observatory (NSO), plans to fund construction of the proposed ATST at the University of Hawai'i Institute for Astronomy (IfA), Haleakalā High Altitude Observatory (HO) site, on the Island of Maui, Hawai'i. An extensive campaign of worldwide site testing has identified Haleakalā Observatory as the optimal location for this next-generation solar observing facility. The telescope enclosure and a support facility would be placed at one of two identified sites within the existing observatory boundaries. The DEIS addresses the multi-year selection process of these sites and the potential environmental impacts of on-site construction, installation, and operation of this proposed new solar telescope. With its unprecedented 4.2-m (165-inch) aperture, advanced optical technology, and state-of-the-art instrumentation, the proposed ATST would be an indispensable tool for exploring and understanding physical processes on the sun that ultimately affect Earth. The DEIS addresses, among other things, the potential direct, indirect, and cumulative environmental impacts associated with the proposed Advanced Technology Solar Telescope project.

Written comments may be forwarded to:

ADDRESSES: Dr. Craig B. Foltz, Program Manager, National Science Foundation, Division of Astronomical Sciences, 4201 Wilson Blvd., Room 1045, Washington DC 22230, telephone: (703) 292–4909, fax: (730) 292–9034, e-mail: *cfoltz@nsf.gov.*

SUPPLEMENTARY INFORMATION:

Proposed alternatives to be considered include, but are not limited to the following:

(1) *Alternative 1 (Proposed Action):* Undeveloped site East of Mees Observatory.

(2) *Alternative 2:* Former radio telescope site known as Reber Circle.

(3) *Alternative 3:* No-Action. The National Science Foundation will not construct the Advanced Technology Solar Telescope on Maui.

Publication of the DEIS does not foreclose consideration of any courses of action or possible decisions addressed by the National Science Foundation in its Final Environmental Impact Statement (FEIS). No final decisions will be made regarding construction of the ATST prior to completion and signature of the Record of Decision for the Proposed Action.

Public Comment Period: The NSF welcomes and invites Federal, State, and local agencies, and the public to participate in the 45-day comment period for the completion of this EIS. The 45-day public comment period begins September 8, 2006, and ends on October 23, 2006. Public comment meetings will take place on the island of Maui, Hawai'i, with notification of the times and locations published in the local newspapers, as follows:

1. Cameron Center Auditorium, September 27, 2006, Wednesday, 6 p.m. to 10 p.m.

2. Hannibal Tavares Community Center, Multi-purpose Room, September 28, 2006, Thursday, 6 p.m. to 10 p.m.

3. Kula Community Center, September 29, 2006, Friday, 6 p.m. to 10 p.m.

Written comments may be submitted to Dr. Craig B. Foltz at the address above.

Dated: August 23, 2006.

Craig B. Foltz,

ATST Program Officer.

[FR Doc. 06–7429 Filed 9–5–06; 8:45 am]

BILLING CODE 7555–01–M

Figure 5-7. Federal Register Notice of DEIS, September 6, 2006.

Figure 5-8 is the Notice for the DEIS that was published in the September 8, 2006 issue of the OEQC Bulletin. Detailed information regarding three DEIS Public Comment Meetings that were held on Maui in September 2006 was also included in the Notice.

Maui Notices

SEPTEMBER 8, 2006

Advanced Technology Solar Telescope (ATST) (HRS 343 DEIS)

District: Makawao
TMK: (2) 2-2-007-008
Proposing Agency: National Science Foundation, Div of Astronomical Sciences, 4201 Wilson Blvd., Rm. 1045, Arlington, VA 22230
Contact: Dr. Craig Foltz (703-292-4909)
Fax: 703-292-9034, email: cfoltz@nsf.gov
Accepting Authority: University of Hawai'i Institute for Astronomy
2680 Woodlawn Dr., Honolulu, HI 96822-1897
Contact: Dr. Charlie Fein (573-1903)
Consultant: KC Environmental, Inc.
P.O. Box 1208, Makawao, HI 96768
Contact: Dr. Charlie Fein (573-1903)
Public Comment Deadline: October 23, 2006
Status: Draft environmental impact statement (DEIS) notice pending 45-day public comment. Address comments to the proposing agency with copies to the accepting authority, consultant and OEQC.
Permits Required: Conservation District Use Permit

The National Science Foundation (NSF) has prepared a Draft Environmental Impact Statement (DEIS) for the proposed Advanced Technology Solar Telescope (ATST) Project. This joint DEIS is prepared in compliance with the Federal National Environmental Policy Act (NEPA) and the State of Hawai'i Chapter 343, Hawai'i Revised Statutes (HRS).

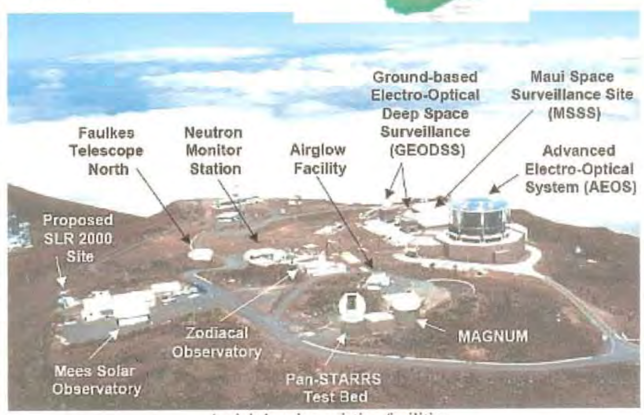
The NSF, through an award to the National Solar Observatory (NSO), plans to fund construction of the proposed ATST at the University of Hawai'i Institute for Astronomy (IfA), Haleakala High Altitude Observatory (HO) site, on the Island of Maui, Hawai'i. An extensive campaign of worldwide site testing has identified Haleakalā Observatory as the optimal location for this next-generation solar observing facility. With its unprecedented 4.2-m (165-inch) aperture, advanced optical technology, and state-of-the-art instrumentation, the proposed ATST would be an indispensable tool for exploring and understanding physical processes on the sun that ultimately affect Earth. The telescope enclosure and a support facility would be placed at one of two identified sites within the existing observatory boundaries. The DEIS addresses both of these sites and the potential environmental impacts of on-site construction, installation, and operation of this proposed new solar telescope.

Public Comment Period: The NSF welcomes and invites Federal, state, and local agencies, and the public to participate in the 45-day comment period for the completion of this EIS. The 45-day public comment period begins September 8, 2006, and ends on October 23, 2006. Public comment meetings will take place on the island of Maui, Hawai'i, with notification of the times and locations published in the local newspapers, as follows:

1. Cameron Center Auditorium
Sept. 27, 2006, Wednesday, 6:00 to 10:00 pm.

2. Hannibal Tavares Community Center, Multi-purpose Room
September 28, 2006, Thursday, 6:00 to 10:00 pm.

3. Kula Community Center
September 29, 2006, Friday, 6:00 to 10:00 pm.



Aerial showing existing facilities

The Environmental Notice — Office of Environmental Quality Control — Page 7

Figure 5-8. Office of Environmental Quality Control DEIS Notice, September 8, 2006.

Table 5-3. DEIS Distribution List, September 2006.

	Affiliation	Name	Title
1	Advisory Council on Historic Preservation	Martha Catlin	Program Analyst
2	County of Maui County Council	Robert Carroll	Council Member
3	County of Maui County Council	Dane Kane	Council Member
4	County of Maui County Council	Mike Molina	Council Member
5	County of Maui County Council	Charmaine Tavares	Council Member
6	County of Maui Police Dept., Telecommunications	Walt Pacheco	
7	County of Maui, Cultural Resources Commission	Lorraine Sablas	Chair
8	County of Maui, Department of Parks and Recreation	Glenn Correa	Director
9	County of Maui, Dept. of Planning	Michael Foley	Planning Director
10	County of Maui, Dept. of Planning, Planning Commission	Jeff Hunt	
11	County of Maui, Dept. of Public Works and Environmental Management	Milton Arakawa	Director
12	County of Maui, Dept. of Water Supply	George Tengan	Director
13	Friends of Haleakalā	Mele Stokesberry	
14	Friends of Polipoli	Brian Jenkins	President
15	Geometrician Associates, LLC	Ron Terry	
16	Hawaiian Telecom	Winslow Tanabe	Area Manager
17	Kula Community Association	Karolyn Mossman	
18	Maui Community College	Lui Hokoana	
19	Maui Community College Library		
20	Maui Economic Development Board	Jeanne Skog	President
21	Maui Electric Co.	Craig Yamasaki	Engineering Dept.
22	Maui Na Ala Hele Advisory Council	Torrie Nohara	Trails and Access Specialist
23	Na Kupuna O Maui	Kupuna Patty Nishiyama	
24	Pacific Analytics, LLC	Greg Brenner	
25	Raycom Media, Inc.	John Fink	General Manager
26	Royal Order of Kamehameha I	George Kahoʻohanhano	Aliʻi Kuʻauhau
27	Royal Order of Kamehameha I	William Garcia, Jr.	Office of the Kuʻauhau Nui
28	Royal Order of Kamehameha I	Clarence Soloman	Kahu Poʻo Iki
29	Sandia Laboratories	Orlando Vigil	Site Manager
30	Starr Environmental	Forest and Kim Starr	
31	State of Hawaiʻi, Department of Accounting and General Services, Public Works, Information and Communications Services Division	Robert Hlivak	
32	State of Hawaiʻi, Department of Accounting and General Services, Public Works	David Victor	Maui Branch Engineer
33	State of Hawaiʻi, Dept. of Agriculture		
34	State of Hawaiʻi, Dept. of Business, Economic Development and Tourism, Energy, Resources and Technology Division	Ted Liu	Director
35	State of Hawaiʻi, Dept. of Business, Economic Development and Tourism, Office of Planning, Land Use Division	Abe Mitsuda	
36	State of Hawaiʻi, Dept. of Business, Economic Development and Tourism, Planning Office and Library		
37	State of Hawaiʻi, Dept. of Hawaiian Homelands Land Management Division (Non-Homestead)		

Table 5-3. DEIS Distribution List, September 2006 (cont.).

	Affiliation	Name	Title
38	State of Hawai‘i, Dept. of Health	Dr. Lorrin Pang	District Health Officer
39	State of Hawai‘i, Dept. of Health Office of Environmental Quality Control	Genevieve Salmonson	Director
40	State of Hawai‘i, Dept. of Health, Environmental Planning Office	Dr. Chiyome Fukino	Director of Health
41	State of Hawai‘i, Dept. of Land and Natural Resources Division of Forestry and Wildlife	Dr. Fern Duvall, II	Wildlife Biologist
42	State of Hawai‘i, Dept. of Land and Natural Resources Office of Conservation and Coastal Lands	Samuel Lemmo	Administrator
43	State of Hawai‘i, Dept. of Land and Natural Resources, Division of Forestry and Wildlife	Meyer Ueoka	Maui Wildlife Manager
44	State of Hawai‘i, Dept. of Land and Natural Resources, Island Burial Council	Kahu Charles Maxwell, Sr.	
45	State of Hawai‘i, Dept. of Land and Natural Resources, Land Division	Daniel Ornellas	Land Agent-Maui
46	State of Hawai‘i, Dept. of Land and Natural Resources, Division of Forestry and Wildlife	John Cumming	Branch Manager
47	State of Hawai‘i, Dept. of Transportation	Kyle Ginoza	Maui Director
48	State of Hawai‘i, Dept. of Transportation	Rod Haraga	Director
49	State of Hawai‘i, Head Librarian, Hana Public and School Library		
50	State of Hawai‘i, Head Librarian, Hawai`i Document Center		
51	State of Hawai‘i, Head Librarian, Hilo Regional Library		
52	State of Hawai‘i, Head Librarian, Kahului Regional Library		
53	State of Hawai‘i, Head Librarian, Kaimuki Regional Library		
54	State of Hawai‘i, Head Librarian, Kaneohe Regional Library		
55	State of Hawai‘i, Head Librarian, Kihei Public Library		
56	State of Hawai‘i, Head Librarian, Lahaina Public Library		
57	State of Hawai‘i, Head Librarian, Legislative Reference Bureau Library		
58	State of Hawai‘i, Head Librarian, Lihue Regional Library		
59	State of Hawai‘i, Head Librarian, Makawao Public Library		
60	State of Hawai‘i, Head Librarian, Pearl City Regional Library		
61	State of Hawai‘i, Head Librarian, Wailuku Public Library		
62	State of Hawai‘i, Office of Hawaiian Affairs	Clyde Nāmu‘o	Administrator
63	State of Hawai‘i, Office of Hawaiian Affairs	Thelma Shimaoka	Community Resource Coordinator
64	State of Hawai‘i, State Historic Preservation Division		Branch Chief
65	State of Hawai‘i, State Historic Preservation Division	Melissa Kirkendall	Maui Archaeologist
66	The Honolulu Advertiser		Editor
67	The Honolulu Star Bulletin		Editor
68	The Maui News	David Hoff	Editor in Chief

Table 5-3. DEIS Distribution List, September 2006 (cont.).

	Affiliation	Name	Title
69	U.S. Coast Guard Civil Engineering Unit, Honolulu	R. N. Wykle	Commanding Officer
70	U S. Coast Guard Civil Engineering Unit, Honolulu	Dr. Dennis Mead	
71	U.S. Environmental Protection Agency, Region 9, CED-II	Carol Sachs	
72	U.S. Dept. of Defense		
73	U.S. Dept. of Energy	Eileen Yoshinaka	
74	U.S. Dept. of the Interior, Office of Environmental Policy and Compliance	Dr. Kenneth Havran	
75	U.S. Environmental Protection Agency, Pacific Islands Contact Office, Region 14	Dean Higuchi	
76	U.S. Federal Aviation Administration	Darice Young	Realty Contracting Officer
77	U.S. Federal Bureau of Investigation	George Hanzawa	Electronics Manager
78	U.S. Fish & Wildlife Service, Pacific Islands Fish and Wildlife Service	Holly Freifeld	
79	U.S. Fish & Wildlife Service, Pacific Islands Fish and Wildlife Service	Patrick Leonard	Field Supervisor
80	U.S. National Park Service, Haleakala National Park	Marilyn Parris	Park Superintendent
81	U.S. National Weather Service/NOAA	Carl Suekawa	Communications Manager
82	U.S. Environmental Protection Agency, Office of Federal Activities, EIS Filing Section		
83	University of California, Santa Cruz, Center for Adaptive Optics	Lisa Hunter	Associate Director
84	University of Hawai‘i Environmental Center		
85	University of Hawai‘i, Institute for Astronomy		
86	University of Hawai‘i - Manoa, Head Librarian, Hamilton Library		
87	University of Hawai‘i - Manoa, Water Resources Research Center	Dr. James Moncur	
88	Xamanek Researches, LLC	Erik Fredericksen	

Individuals			
Princess Aquino	Lorna Hazen	Richard Kinoshita	Leohu Ryder
Gordean Bailey	Mikahala & Rusty Helm	Ed & Puanani Lindsey	Nancy Shearman
Claire Barclay	Nameaaea Hoshino	Martha Martin	Warren Shibuya
Thomas Brayton	Michael Howden	Dick Mayer	Georgina Shito
Brad Breitbach	Maydeen Iao	Richard McCarty	Heather Snipes
Leslie Ann Bruce	Kaleikoa Ka‘eo	Art Medeiros	Ellen Souza Sjholom
Suzanne Burns	Roselani Kahalenu	Bill Medeiros	Kalani Tassil
Toma Craig	Walter Kanamu	Verna Nahulu	Chris Taylor
Toni Dizon –pkg returned	Jen Kane	April Pofford	Margit Tolman
Carl Eldridge	U’ilani & Jonah Kapu	Jeanne Rabold	Alexander Vilahos
Mary Evanson	Lisa Kasprzycki	Rob Ratkowski	Kathie Zwick
Isaac Hall	Kapili Keahi	Ki‘ope Raymond	
Haumea Hanakahi	Ashley Kekahuna	William Roback	

5.1.5 DEIS Public Comment Meetings

The DEIS was published on September 8, 2006, which initiated a 45-day public comment period. The DEIS addressed the multi-year site selection process by the scientific community to locate scientifically-viable sites. The DEIS also addressed the potential direct, indirect, and cumulative environmental effects of on-site construction, installation, and operation of the proposed ATST Project. Notification of the public hearings on the DEIS was published in the Maui News (Fig. 5-9), and the Haleakalā Times and Maui Weekly-South Edition, September 13 to 26, 2006 issue (Fig. 5-10).

Three DEIS public hearings were held, as follows:

1. September 27, 2006, Cameron Center Auditorium, Wailuku, Maui, HI.
2. September 28, 2006, Mayor Hannibal Tavares Community Center, Pukalani, Maui, HI.
3. September 29, 2006, Kula Community Center, Kula, Maui, HI.

Public Notice

The National Science Foundation (NSF) has prepared a Draft Environmental Impact Statement (DEIS) for the proposed Advanced Technology Solar Telescope (ATST) Project This joint DEIS is prepared in compliance with the Federal National Environmental Policy Act and the State of Hawai'i Chapter 343, Hawai'i Revised Statutes. The NSF, through an award to the National Solar Observatory, plans to fund construction of the proposed ATST at the University of Hawai'i Institute for Astronomy (IfA), Haleakalā High Altitude Observatory site, on the Island of Maui, Hawai'i. The DEIS is available at all Maui public libraries and on the Internet at: http://atst.nso.edu/.

Public Comment Period: The NSF welcomes and invites Federal, state, and local agencies, and the public to participate in the 45-day comment period beginning September 8, 2006, and ending on October 23, 2006. Public comment meetings will take place, as follows:

1. Cameron Center Auditorium – September 27, 2006, Wednesday, 6:00 to 10:00 pm.
2. Hannibal Tavares Community Center, Multi-purpose Room (pool room) September 28, 2006, Thursday, 6:00 to 10:00 pm.
3. Kula Community Center – September 29, 2006, Friday, 6:00 to 10:00 pm.

ORIGINAL comments should be sent to the applicant:

Dr. Craig Foltz, ATST Program Manager
National Science Foundation, Division of Astronomical Sciences
4201 Wilson Boulevard, Room 1045,
Arlington, VA 22230
Telephone: 703-292-4909, Fax: 703-292-9034,
email: cfoltz@nsf.gov

COPIES of comments should also be sent to:

1. Dept. of Health, Office of Environmental Quality Control, REF: ATST
   235 South Beretania Street, Room 702,
   Honolulu, HI 96813
   Fax: 808-586-4186
2. Mr. Mike Maberry, Associate Director
   University of Hawai'i Institute for Astronomy
   P. O. Box 209, Kula, HI 96790-0209,
   Fax: 808-876-7603
3. Dr. Charlie Fein, KC Environmental, Inc.
   P. O. Box 1208, Makawao, HI 96768
   Telephone: 808-573-1903,
   Fax: 808-573-7837,
   email: charlie@kcenv.com

Your comments must be received or postmarked by October 23, 2006.

Section 106 – National Historic Preservation Act (NHPA): During NSF's trip to Maui, pre-scheduled meetings will also be held on September 27th to 29th with interested individuals and groups who submit resolution proposals that seek to minimize or mitigate adverse affects by virtue of a Memorandum of Agreement as contemplated by the NHPA. Please submit resolution proposals to KC Environmental. In addition, Section 106 consultations will also be part of the discussion during the public comments to the DEIS and all proposals can be further submitted at those meetings.

(MN: Sept. 8, 2006)

PUBLIC NOTICE

ATST Draft EIS Public Meetings Time Change – Due to scheduling conflicts, the time has changed for the public comment meetings for the Draft Environmental Impact Statement (DEIS) for the proposed Advanced Technology Solar Telescope (ATST) Project, as follows:

1. Cameron Center Auditorium – September 27, 2006, Wednesday, **7:00 to 10:00 pm.**
2. Hannibal Tavares Community Center, Multi-purpose Room – September 28, 2006, Thursday, **7:00 to 10:00 pm.**
3. Kula Community Center – September 29, 2006, Friday, **7:00 to 10:00 pm.**

(MN: Sept. 22, 24, 2006)

Figure 5-9. DEIS Public Comment Meetings Notifications: Maui News Public Notice, March 23, 2006.

PUBLIC NOTICE

The National Science Foundation (NSF) has prepared a Draft Environmental Impact Statement (DEIS) for the proposed Advanced Technology Solar Telescope (ATST) Project. This joint DEIS is prepared in compliance with the Federal National Environmental Policy Act and the State of Hawai'i Chapter 343, Hawai'i Revised Statutes. The NSF, through an award to the National Solar Observatory, plans to fund construction of the proposed ATST at the University of Hawai'i Institute for Astronomy, Haleakala High Altitude Observatory site, on the Island of Maui, Hawai'i. The DEIS is available at all Maui public libraries and on the Internet at: http://atst.nso.edu/

Public Comment Period: The NSF welcomes and invites Federal, state, and local agencies, and the public to participate in the 45-day comment period beginning September 8, 2006, and ending on October 23, 2006. Please note that due to scheduling conflicts, the time for these meetings has changed from previously distributed info:

1. Cameron Center Auditorium - Sept. 27, 2006, Wednesday, 7:00 to 10:00 pm.
2. Hannibal Tavares Community Center, Multi-purpose Room, September 28, 2006, Thursday, 7:00 to 10:00 pm.
3. Kula Community Center - September 29, 2006, Friday, 7:00 to 10:00 pm.

ORIGINAL comments should be sent to the applicant:
Dr. Craig Foltz, ATST Program Manager
National Science Foundation, Division of Astronomical Sciences
4201 Wilson Boulevard, Room 1045, Arlington, VA 22230
Telephone: 703-292-4909,Fax: 703-292-9034, email: cfoltz@nsf.gov

COPIES of comments should also be sent to:

1. Dept. of Health, Office of Environmental Quality Control, REF: ATST
   235 South Beretania Street, Room 702, Honolulu, HI 96813
   Fax: 808-586-4186
2. Mr. Mike Maberry, Associate Director
   University of Hawai'i Institute for Astronomy
   P. O. Box 209, Kula, HI 96790-0209, Fax: 808-876-7603
3. Dr. Charlie Fein, KC Environmental, Inc.
   P. O. Box 1208, Makawao, HI 96768
   Telephone: 808-573-1903, Fax: 808-573-7837, email: charlie@kcenv.com

Your comments must be received or postmarked by October 23, 2006.

Section 106 – National Historic Preservation Act (NHPA): During NSF's trip to Maui, pre-scheduled meetings will also be held on September 27th to 29th with interested individuals and groups who submit resolution proposals that seek to minimize or mitigate adverse affects by virtue of a Memorandum of Agreement as contemplated by the NHPA. Please submit resolution proposals to KC Environmental. In addition, Section 106 consultations will also be part of the discussion during the public comments to the DEIS and all proposals can be further submitted at those meetings.

Figure 5-10.
DEIS Public Comment Meetings Notification:
Haleakalā Times and Maui Weekly-South Edition, September 13 to 26, 2006 Issue.

The 45-day public comment period began on September 8, 2006, and ended on October 23, 2006; however, public comments were accepted beyond the deadline and will be included in the final EIS.

The format for each meeting was identical. Mediation Services of Maui facilitated all meetings and, at the onset of each meeting, set courtesy rules for comment and/or response interaction, notified participants that a court stenographer was in attendance to record the meeting, notified participants that those who signed up to give oral comments would be called upon to speak, and encouraged participants to submit comments before the comment deadline. The environmental consultant made additional opening statements by announcing the purpose of the meeting and introducing key members of the DEIS team. Meeting participants were also informed that staff from the news media and a videographer were in the audience and were independent of the proposed ATST Project.

During each meeting, the public was repeatedly encouraged to provide comments either by oral testimony, via mail, facsimile, or e-mail. The public was informed that all comments would be addressed in the final EIS, either individually or collectively, depending on the nature of the comment. Display material, comment forms with submittal information, and a comment drop box were provided at each meeting. A stenographer from Iwado Court Reporters recorded each meeting.

Table 5-4 is a summary of participants who registered at each meeting and the number of speakers who signed up to participate in oral testimony. Registered participants are based on the number of individuals who signed an attendance sheet upon arriving at a meeting. Total attendance was higher than those registering.

Table 5-4. Summary of DEIS Meeting Participants.

Meeting Location	Registered Participants	Number of Speakers
Cameron Center Auditorium	35	20
Mayor Hannibal Tavares Community Center	23	9
Kula Community Center	15	10

5.1.6 Public Comments and Responses

Public input was solicited on the DEIS via oral testimony, e-mail, fax, and letter. Comments submitted before publication of the DEIS and responses to substantive comments are included in Vol. III, Appendix A-Pre-DEIS Public Comments. Comments submitted after the DEIS and SDEIS were published and responses thereto will be included in the Final Environmental Impact Statement (FEIS). Although NEPA regulations governed the public comment period, all comments received after deadlines were accepted. Preparation of this SDEIS is largely a result of and response to the comments received before and after the DEIS was published.

All comments received thus far were carefully evaluated during the preparation of this SDEIS and, where appropriate, they were incorporated into the document. Full consideration was given to the concerns, suggestions, information, and documentation provided by the commenting individuals, groups, and agencies.

Publication of this SDEIS will prompt the start of another 45-day public comment period. Public comments received on this SDEIS during this public comment period and responses thereto will be included in the FEIS.

5.2 THE SECTION 106 CONSULTATION PROCESS PURSUANT TO THE NATIONAL HISTORIC PRESERVATION ACT

As stated in 36 CFR Part 800, "*Section 106 of the National Historic Preservation Act requires Federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings. The procedures in this part define how Federal agencies meet these statutory responsibilities. The Section 106 process seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties, planning. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess its effects and seek ways to avoid, minimize or mitigate any adverse effects on historic properties.*"

As stated in Section Subpart A, Section 800.2 (2) (ii) "*Consultation on historic properties of significance to Indian tribes and Native Hawaiian organizations. Section 101(d)(6)(B) of the act requires the agency official to consult with any Indian tribe or Native Hawaiian organization that attaches religious and cultural significance to historic properties that may be affected by an undertaking. This requirement* *applies regardless of the location of the historic property. Such Indian tribe or Native Hawaiian organization shall be a consulting party."*

In compliance with Section 106, NSF invited participation in this process to organizations and individuals who may attach religious and cultural significance to a historic property that may be affected by a proposed undertaking. Table 5-5 briefly lists the Historic/Cultural Resource Preservation Consultation Events.

At the time the DEIS was published, NSF continued its outreach efforts to identify relevant Native Hawaiian organizations that might have an interest in participating in the Section 106 consultation process. To that end, assistance was requested from the Office of Hawaiian Affairs (OHA) and the Native Hawaiian community prior to each consultation meeting to identify relevant Native Hawaiian organizations to invite.

In September of 2007, the Office of Hawaiian Relations published in the Federal Register, Vol. 72, No. 186, a Notice regarding the development criteria for establishment of a NHO Notification List. The intent of the NHO list is to make available to other Federal agency officials this mechanism to assist with reasonable and good faith efforts to identify NHOs that are to be notified or consulted with when required by statute or when desired. Although the NHO list was not published prior to the publication of the DEIS, NSF did review the NHO list prior to conducting its August 2008 consultation meetings and invited the participation of all organizations appearing on the NHO list that had not previously been identified.

Table 5-5. Historic/Cultural Resource Preservation Consultation.

Date	Consultation Description
June 20, 2005	Pre-notification letter of intent to prepare EIS sent to ACHP.
	Pre-notification letter of intent to prepare EIS sent to: SHPD: Melanie Chinen, Administrator, Melissa Kirkendall, Maui Archaeologist, Cathleen Dagher, Asst. Maui Archaeologist.
August 22, 2005	Environmental Impact Statement Preparation Notice (EISPN) sent to SHPD: Melanie Chinen, Melissa Kirkendall, Cathleen Dagher.
January 12, 2006	SHPD Melissa Kirkendall notified of informal Section 106 meeting held on January 24, 2006.
January 24, 2006	Informal consultation meeting with Kahu Charles Maxwell and Hokulani Padilla Holt to discuss the proposed ATST Project and explain Section 106 process. Meeting minutes documented with copies to SHPD-David Brown and Melissa Kirkendall.
February 22, 2006	Invitation to David Brown, SHPD Branch Chief, and Melissa Kirkendall to 1st formal Section 106 meeting held on March 28, 2006, at Pukalani Community Center with copies of all invite letters sent to the community.
March 28, 2006	1st formal public Section 106 consultation meeting held at Pukalani Community Center.
March 28, 2006	Formal consultation with Boyd Mossman, OHA Trustee. Boyd Mossman provides NSF with Native Hawaiian Organizations (NHO) list to use for invitations to participate in Section 106 consultation.
March 31, 2006	Mail-out letters to OHA list of NHOs with update on project and process to date and invitation to participate.
April 3, 2006	David Brown and Melissa Kirkendall copied on all invitation letters to OHA-recommended consultation list inviting participation.
April 17, 2006	David Brown and Melissa Kirkendall copied on the distribution list for all postcard invitations to 2nd formal public consultation meeting at Paukūkalo Community Center on May 1, 2006.

Table 5-5. Historic/Cultural Resource Preservation Consultation (cont).

Date	Consultation Description ***The following entries were included after publication of the DEIS.***
April 25, 2006	Charisse Carney-Nunes, NSF Assistant General Counsel, e-mail to David Brown acknowledging conversation about Section 106 process for the proposed ATST project and informing him of the May 1st public consultation meeting. Record of Contact documented by Charisse Carney-Nunes, 2006.
April 26, 2006	David Brown e-mail to Charisse Carney-Nunes acknowledging conversation of previous day and forwarding contact info for Melissa Kirkendall.
May 1, 2006	2nd formal Section 106 consultation meeting held at Paukūkalo Community Center. Attended by approximately 50 individuals.
June 5, 2006	Postcard sent to consulting parties encouraging submission of resolution proposals that would assist NSF in directing appropriate consideration to Native Hawaiian cultural and historic interests in connection with this project. Reminder of DEIS publication and NSF scheduling potential meetings with interested parties who submit resolution proposals.
June 13, 2006	KC Environmental, Inc. (KCE) letter sent to Melissa Kirkendall requesting written concurrence of adverse effect finding, copy to SHPD-Branch Chief David Brown, NSF, Archeologist Erik Fredericksen-Xamanek Researches.
July 6, 2006	Notification letter from Bijan Gilanshah, NSF Assistant General Counsel, to Mr. Donald Klima, Director, Office of Federal Agency Programs, ACHP, advising of finding of adverse effect regarding a proposed federal undertaking and updating as to the Section 106 consultations to date.
August 1, 2006	Martha Catlin, ACHP Program Analyst, to NSF-Bijan Gilanshah requesting additional, specific information on proposed project.
August 23, 2006	E-mail from NSF-Bijan Gilanshah to SHPD-Melissa Kirkendall asking about June 13, 2006 request for written concurrence letter.
	Response e-mail from SHPD-M. Kirkendall to NSF-B. Gilanshah requesting DEIS and will respond in writing upon review of DEIS. DEIS sent to SHPD-Kirkendall and David Brown September 2006.
August 25, 2006	Fax from Bijan Gilanshah to Martha Catlin following telecon and acknowledging regrets that she cannot attend public meetings. Follow-up of ACHPs request to participate in consultation meetings, providing dates of three DEIS public comment meetings on Maui, suggesting that perhaps someone else from Native American Program might be able to participate.
September 8, 2006	DEIS became public.
September 12, 2006	Formal meeting requested by Maui County Cultural Resources Commission in Wailuku, HI. Attended by Commission members and chaired by Sam Kalalau. ATST project represented by Mike Maberry, UH IfA and KC Environmental, Inc.
September 19, 2006	E-mail from ACHP-Martha Catlin to NSF-Bijan Gilanshah regarding not being able to attend three September meetings and Valerie Hauser from the Native American Program also had a conflict with attending, so do not count on ACHP representation at these particular meetings.
September 27, 2006	Formal consultation with Clyde Nāmu‘o, OHA Administrator and ATST Project.
September 27, 28, 29, 2006	DEIS Public Comment Meetings held on Maui.
November 21, 2006	Letter from ACHP-Charlene Dwin Vaugh to Bijan Gilanshah acknowledging receipt of additional documentation, acceptance of invitation participate in consultation, and copy of letter to NSF Director. (In ACHP March 21, 2007 letter, ACHP also provided copies of notification letter to 17 individuals and organizations.) Letter to NSF-Honorable Arden Bement, dated November 21, 2006, from, ACHP-Executive Director John Fowler notifying NSF of ACHPs decision to participate in consultation and will consult with NSF, Hawai’i SHPD, and others to resolve potential adverse effects of proposed undertaking.

Table 5-5. Historic/Cultural Resource Preservation Consultation (cont).

Date	Consultation Description ***The following entries were included after publication of the DEIS.***
March 19, 2007	UH President David McClain, UH Chief of Staff Sam Callejo, IfA Director Rolf-Peter Kudritzki, IfA Assistant Director Mike Maberry, IfA Associate Director Bob McLaren, IfA Associate Director for the Haleakalā Division Jeff Kuhn met with Office of Hawaiian Affairs (OHA) Administrator Clyde Nāmuʻo and OHA Trustee Judge Walter Meheula Heen. A PowerPoint presentation was given that provided an overview of the NSF's Draft Response to OHA's October 2, 2006, comments to the DEIS for the ATST. While OHA was not happy with the tone of the Draft Response, they were comfortable with its merit. Considering the project is undertaking an EIS and Section 106, OHA will not be inclined to provide funding to challenge the project.
March 21, 2007	Letter from ACHP-Charlene Dwin Vaugh to Bijan Gilanshah notifying NSF that ACHP received copies of letters from National Park Service, the Dept. of the Interior, and the Environmental Protection Agency regarding the proposed ATST. ACHP requests copies of referenced letters and other documentation to Section 106 consulting parties for ACHP review and a schedule for conducting the Section 106 process.
May 4, 2007	Informal site visit and meeting requested by Haumea Hanakahi with Mike Maberry, UH IfA, held at HO. Meeting requested based on comments provided by Haumea at a public meeting.
May 25, 2007	Final Supplemental Cultural Impact Assessment (SCIA) Report
July 2, 2007	Letter from Bijan Gilanshah to Martha Catlin with update on current status of consultations, enclosed copy of Supplemental Cultural Impact Assessment (SCIA) for the proposed ATST. KC Environmental, Inc. sent copy of NSF letter and SCIA to consulting parties.
July 31, 2007	ATST Project team and HALE meet to discuss project and HALE concerns as Section 106 consulting party.
August 28, 2007	NSF Section 106 consultation regarding mitigation proposal with Chancellor Clyde Sakamoto and Kalei Kaʻeo of Maui Community College.
October 22, 2007	Letter from DOI-J. Jarvis to NSF-C. Foltz regarding July 31, 2007 meeting, road concerns in HALE, alternatives analysis, viewshed study, and Section 106 process with Native Hawaiian community.
November 8, 2007	NSF-Caroline Blanco letter to ACHP-Martha Catlin regarding NSF's positions on avoidance, minimization, and mitigation of adverse affects and request for guidance on how Section 106 compliance can best be accomplished. Attached mitigation proposal from Maui Community College. ACHP letter and MCC mitigation proposal also sent to Section 106 consultants.
December 26, 2007	NSF-Craig Foltz to HALE-Marilyn Parris, Superintendent. Clarifying that HALE received a copy of the 11/08/07 letter from NSF-C. Blanco to the ACHP expressing NSFs desire to move the Section 106 process forward
January 17, 2008	Letter from ACHP-Charlene Dwin Vaugh to NSF-Caroline Blanco acknowledging NSF November 8, 2007 letter, understands HALE is providing comments to NSF and perhaps other parties in coming weeks, working with SHPD on their views before advising on Section 106 matters, and advise NSF to refer to October 1, 2008 letter for AHCPs view on how best to proceed.

Table 5-5. Historic/Cultural Resource Preservation Consultation (cont).

Date	Consultation Description ***The following entries were included after publication of the DEIS.***
February 11, 2008	Letter from DOI-J. Jarvis to NSF-C. Foltz regarding special use permit.
February 11, 2008	HALE-Marilyn Parris, Superintendent to NSF-Craig Foltz. Requests for all information/questions/etc related to the ATST project come through Superintendent's office, letter with concerns forthcoming. Requests additional meeting with all parties.
February 18, 2008	DLNR-SHPD-Laura Theilen and SHPD-Nancy McMahon to NSF. Request need to address the Area of Potential Effect (APE), additional alternative, and mitigation.
April 8, 2008	MCC Chancellor Clyde Sakamoto appoints Sol Kahoohalahala to focus on identifying and responding to Native Hawaiian community concerns related to the development of ATST atop Haleakalā.
May 6, 2008	NSF-Craig Foltz to SHPD-Laura Theilen and SHPD-Nancy McMahon. Clarification of communication efforts, APE, alternatives, and mitigation through previous correspondence.
May 8, 2008	NSF invitation to HALE-Marilyn Parris, Superintendent requesting a June meeting to discuss Section 106 and HALE issues for mitigation.
May 12, 2008	Letter from NSF-C. Blanco to ACHP-M. Catlin response to ACHP-Dwin Vaughn letter of 01-17-08. Clarification of communication efforts with ACHP and HALE, APE, alternatives, and mitigation through previous correspondence. Invitation to Section 106 meeting on Maui in June.
May 12, 2008	Letter from NSF to consulting parties inviting to June Section 106 meetings at UH IfA to discuss and begin preparation of a Memorandum of Agreement (MOA), brief overview of position on adverse effects, and encourage submittal of mitigation proposals prior to June Section 106 meetings.
May 13, 2008	NSF-Craig Foltz to HALE-Marilyn Parris, Superintendent. RE: Invitation to meet with NSF, suggest telecon before June, need for mitigation discussions and process to move forward between Federal agencies.
May 13, 2008	HALE-Marilyn Parris, Superintendent to NSF-Craig Foltz. Re: Invitation to meet with NSF, HALE is not available in June. Suggest meeting in August.
May 15, 2008	Letter from Historic Hawaiʻi Foundation-Kiersten Faulkner, Executive Director request for HHF to be a consulting party.
May 19, 2008	Email from Kiʻope Raymond, President of Kilakila o Haleakalā to NSF requesting his organization to be a consulting party.
June 4, 2008	Letter from SHPD-P. Aiu, Administrator and N. McMahon-Deputy SHPD/State Archaeologist to NSF-C. Foltz needs discussion of site alternatives.
June 5, 2008	Email to HHF-Kiersten Faulkner accepting HHF as a consulting party with understanding this is late in the process and NSFs desire to keep the process organized and moving forward and invitation to June meetings.
June 5, 2008	Correspondence between NSF and HALE confirming meeting on August 22, 2008 to resolve outstanding issues.
June 9, 2008	Email from NSF-C. Foltz to Kiʻope Raymond, Kilakila o Haleakalā extending same invitation to be a consulting party as HHF.
June 9, 2008	Letter to consulting parties with formal invitation to June 16 and 17, 2008 Section 106 meetings to be held on Maui.
June 10, 2008	Letter from OHA regarding invitation to participate in June meetings, reiterates Native Hawaiian community position on project, concerns about mitigation proposals as "community benefits package".

Table 5-5. Historic/Cultural Resource Preservation Consultation (cont).

Date	Consultation Description ***The following entries were included after publication of the DEIS.***
June 12, 2008	Letter from ACHP-C. Dwin Vaughn to NSF-C. Foltz, ACHP unable to attend June meetings, overview of understanding of correspondence received regarding Section 106 process, HALE concerns, consulting parties, and Native Hawaiian historic properties.
June 12, 2008	Email from Kiope Raymond to NSF-C. Foltz regarding Kilakila o Haleakalā as consulting party.
June 16 and 17, 2008	Formal Section 106 meetings held at UH IfA Maikalani Facility to discuss ways in which to address adverse effects to historic properties associated with the proposed ATST Project.
June 17, 2008	Letter from NSF-C. Blanco to National Trust for Historic Preservation-Betsy Merritt with copies of Section 106 correspondence letters since June 2005.
July 10, 2008	Email to ACHP, follow-up on meeting with ACHP on 7-10-08 regarding NSFs Section 106 process to date, attached correspondence responding to ACHPs questions during meeting.
July 16, 2008	Email to ACHP, informing of forthcoming letter to consulting parties about August 27 and 28, 2008 Section 106 meetings and asking ACHP for additional input to letters.
July 17, 2008	Letter from ACHP-Dwin Vaughn to NSF-C. Blanco regarding follow up of July 10, 2008 meeting and additional questions and concerns.
July 21 to 28, 2008	Emails between NSF and HALE confirming August 22nd meeting and requesting additional HALE consulting parties contact information. HALE responds that consulting parties should be SHPD and OHA. NSF responds that SHPD and OHA have indeed been consulting parties since 2006 and consultation with these agencies is ongoing.
July 22, 2008	Emails between NSF, ACHP regarding additional information as requested by ACHP in 07-17-08 letter and HALE-M. Parris and G. Lind confirming August 22nd meeting and requesting additional HALE consulting parties contact information.
July 24, 2008	NSF sends invitation to participate in upcoming August 27th and 28th, 2008 Section 106 consultation meetings. Letter sent to consulting parties and list of Potentially Interested Parties. Meeting was scheduled as a result of a suggestion made by the Hawaiʻi State Historic Preservation Officer during the June 16, 2008 consultation meeting and was consistent with guidance provided by the ACHP.
August 15, 2008	NSF sends 2nd invitation to participate in upcoming August 27th and 28th, 2008 Section 106 consultation meetings. Letter sent to consulting parties and list of Potentially Interested Parties. Attachments included an Agenda, a Q&A sheet, and a list of the documents posted to the ATST Section 106 website.
August 22, 2008	NSF consultation with the National Park Service to discuss issues relating to HALE.
August 27, 2008	At the request of t Hawaiʻi State Historic Preservation Officer during the June 16, 2008 consultation meeting and consistent with guidance provided by the ACHP, this meeting was held to provide additional opportunities for consulting parties to meet with NSF to discuss ways in which to address adverse effects to historic properties associated with the proposed ATST Project.
August 28, 2008	Meeting with HALE, SHPD, ACHP, and ATST Project regarding next steps as a result of August 27th Section 106 consultation meeting. Attending agencies to collaborate on “Consultation Summary” on Section 106 process.

5.2.1 Section 106 Consultation Chronology

Advisory Council on Historic Preservation

The Advisory Council on Historic Preservation (ACHP) was sent a formal notification letter in June 2005 announcing the intent of NSF to prepare an EIS for the proposed ATST Project. This pre-assessment letter included a project description with the intent to publish an EIS, detailed information about the three

Public Scoping Meetings, and ATST project management contact information. On July 6, 2006, a letter was sent to the ACHP, pursuant to 36 CFR § 800.6(a)(1)(iii), informing the ACHP of NSF's finding of adverse effect regarding the proposed undertaking. The letter also included a list of organizations and individuals the NSF has been in consultation with throughout the Section 106 process, a copy of CKM Cultural Resources' evaluation for the proposed Project, and a copy of a letter that was sent to Melissa Kirkendall, Maui archeologist, SHPD, requesting concurrence of the agency's adverse effect finding (ACHP, 2006). Additional information pursuant to Section 800.11(e) of the ACHP regulations was submitted to the Council for their review and determination of whether their participation in this matter is warranted. Ultimately, the ACHP decided to become a consulting party to NSF's Section 106 process. Significant interactions with the ACHP regarding NSF's consultation efforts have taken place since issuance of the DEIS. Those interactions are discussed further in Section 5.2.1-Section 106 Consultation Chronology.

State Historic Preservation Division

The SHPD is the responsible State of Hawaii entity with which NSF is required, pursuant to the NHPA, to engage in Section 106 consultations regarding the proposed ATST Project. A letter dated June 20, 2005 was sent to the SHPD (Melanie Chinen, Administrator; Melissa Kirkendall, Maui Archeologist; and Cathleen Dagher, Assistant Maui Archeologist) to notify them of NSF's intent to prepare an EIS. NSF directly, and through KCE, corresponded with the SHPD regarding formal and informal consultation meetings (Table 5-4). Since the publication of the DEIS, NSF and the SHPD have engaged in consultations regarding NSF's Section 106 process and ways in which adverse effects need to be addressed. NSF continues to consult with the SHPD as part of its Section 106 process and is currently discussing the possibility of developing a Memorandum of Agreement/Programmatic Agreement designed to address adverse effects associated with the proposed ATST Project.

Public Invitation to Participate – February 15, 2006

On June 23, 2005, notification of the proposed ATST Project was published in both the Federal Register and the State of Hawaiʻi Department of Health's OEQC Bulletin. During that same week, notification was also sent to Federal, State, and County offices, and members of Maui's community. In September 2005, on behalf of the NSF, KCE initiated consultation in accordance with Section 106 of the NHPA through numerous communications between Melissa Kirkendall, Maui Archaeologist of the Hawaiʻi SHPD and Archaeologist Erik Fredericksen of Xamanek Researches, LLC.

On January 24, 2006, informal consultation was initiated with Kahu Charles K. Maxwell, Sr. and Dane Maxwell of CKM Cultural Resources and Kumu Hula Hokulani Holt-Padilla of the Maui Arts and Cultural Center, all of whom are knowledgeable about the traditional, cultural, and spiritual significance of Haleakalā. A copy of CKM Cultural Resources Evaluation (Vol. II, Appendix F) for the proposed project, "Cultural Resource Evaluation and Traditional Practices Report, January 2006", was made available on the ATST web site (http://atst.nso.edu/library/EIS.shtml, link to "E Mālama Mau Ka Laʻa: Preserve the Sacredness"). A copy of this evaluation was also made available in all Maui public libraries.

During consultations with HALE in January 2006, the HALE Superintendent expressed concerns about potential effects from construction of the proposed ATST Project on the historic Park road. Specifically, the Superintendent commented that the historic roadway has been evaluated by the National Park Service (NPS) and Historic American Engineering Record (HAER) as eligible for listing in the National Register of Historic Places under Criterion A (for its development of the National Park System, the development of early NPS landscape architectural design styles, and the craftsmanship of the Civilian Conservation Corps (CCC) and Criterion C (for its association with rustic park design that characterized early NPS development during the 1930s). Historic features of this roadway include: 1 bridge, 11 box culverts, and original culverts with mortared stone headwalls.

A letter from NSF dated February 15, 2006, and a copy of CKM Cultural Resources' evaluation was sent to agencies and members of the community who submitted written requests to be a consulted party to the proposed ATST Project (Table 5-6). The letter briefly summarized the proposed ATST Project as it relates to the Section 106 process, a status of consultation meetings with Melissa Kirkendall of SHPD and archaeologist Erik Fredericksen of Xamanek Researches, LLC, the January 24, 2006 informal consultation with CKM Cultural Resources and Hokulani Holt-Padilla, and an invitation to participate in a formal Section 106 consultation meeting that was being planned for March 28, 2006. A link to Section 106 information was posted to the ATST website and was also included in the invitation letter (http://atst.nso.edu/library/EIS.shtml).

Table 5-6. Section 106, Invitation to Participate Distribution List, February 15, 2006.

	Affiliation	Last Name	First Name
1	Dept. of Land and Natural Resources, Island Burial Council		
2	Friends of Polipoli, President	Jenkins	Brian
3	Hana Public and School Library, Head Librarian		
4	Hawaiʻi State Library, Hawaiʻi Document Center		
5	Kahului Public Library, Head Librarian		
6	Kihei Public Library, Head Librarian		
7	Lahaina Public Library, Head Librarian		
8	Makawao Public Library, Head Librarian		
9	Hana Public and School Library, Head Librarian		
10	Hawaiʻi State Library, Hawaiʻi Document Center		
11	Kula Community Association	Mossman	Karolyn
12	Maui Arts and Cultural Center, Cultural Programs Director	Holt-Padilla	Hokulani
13	Maui Community College and Central Maui Hawaiian Civic Club	Hokoana	Lui
14	Maui Economic Development Board, President	Skog	Jeanne
15	Na Kupuna O Maui	Nishiyama	Patty
16	Office of Hawaiian Affairs, Administrator	Nāmuʻo	Clyde
17	Office of Hawaiian Affairs, Community Resource Coordinator	Shimaoka	Thelma
18	Royal Order of Kamehameha I, Kahu Poʻo Iki	Solomon	Clarence
19	Royal Order of Kamehameha I, Office of the Kuʻauhau Nui	Garcia, Jr.	William
20	State Historic Preservation Division, Branch Chief	Brown	David
21	State Historic Preservation Division, Maui Archaeologist	Kirkendall	Melissa
22		Evanson	Mary
23		Hall	Isaac
24		Helm	Mikahala
25		Kaʻeo	Kalei
26		Maxwell, Sr.	Charles
27		Mayer	Dick
28		Medeiros	Art
29		Miner	James
30		Orzula	Edmond
31		Raymond	Kiʻope
32		Reeser	Don
33		Smith	Bill

Formal Consultation Meeting – March 28, 2006

A letter inviting participation in a formal Section 106 consultation was sent by KCE on behalf of the NSF on February 22, 2006. This letter was sent to elected officials, agencies, organizations, and members of the community who submitted written requests to be a consulting party to the proposed ATST Project (Table 5-7). A copy of the letter and mailing distribution list was also sent to the SHPD and OHA. Identical public notices were published in the Maui News on March 1 and 23, 2006 (Fig. 5-11), the Haleakalā Times in the March 15 to 28, 2006 issue and the Maui Weekly-South in the March 16 to 22, 2006 issue (Fig. 5-12).

Formal consultation meetings were held on March 28, 2006, at Mayor Hannibal Tavares Community Center and on May 1, 2006, at the Paukūkalo Community Center. The intent of both meetings was to introduce the Section 106 process to the public, discuss avoidance, mitigation and minimization proposals, answer questions and listen to testimony, request assistance in providing NSF with contact information for other Native Hawaiian organizations and individuals who may want to participate in this process, and to encourage discussion on identifying and resolving adverse effects. Proposals arising from these interactions were received from Mr. Warren Shibuya (March 28, 2006 and August 28, 2008), Mr. Charles K. Maxwell, (March 28, 2006), and Chancellor Clyde Sakamoto, Maui Community College (May 14, 2007). A stenographer from Iwado Court Reporters was employed to record the proceedings of the meeting for the administrative and public record.

Table 5-7. Formal Section 106 Meeting Notification Distribution List, March 28, 2006.

	Affiliation	Last Name	First Name
1	Congressman	Abercrombie	Neil
2	Congressman	Case	Ed
3	Dept. of Land and Natural Resources, Island Burial Council		
4	Friends of Polipoli, President	Jenkins	Brian
5	Kula Community Association	Mossman	Karolyn
6	Maui Community College and Hawaiian Civic Club	Hokoana	Lui
7	Maui Economic Development Board, President	Skog	Jeanne
8	Na Kupuna O Maui	Nishiyama	Patty
9	Office of Hawaiian Affairs	Nāmuʻo	Clyde
10	Office of Hawaiian Affairs, Community Resource Coordinator	Shimaoka	Thelma
11	Royal Order of Kamehameha I, Kahu Poʻo Iki	Solomon	Clarence
12	Royal Order of Kamehameha I, Office of the Kuʻauhau Nui	Garcia, Jr.	William
13	Senator	Akaka	Daniel
14	Senator	Inouye	Daniel
15	State Historic Preservation Division, Branch Chief	Brown	David
16		Evanson	Mary
17		Hall	Isaac
18		Helm	Mikahala
19		Holt-Padilla	Hokulani
20		Kaʻeo	Kalei
21		Maxwell, Sr.	Charles
22		Mayer	Dick
23		Medeiros	Art
24		Miner	James
25		Orzula	Edmond
26		Raymond	Kiʻope
27		Reeser	Don
28		Smith	Bill

PUBLIC NOTICE

36 CFR Part 800 – Protection of Historic PropertiesAdvanced Technology Solar Telescope(ATST) Project

The National Science Foundation (NSF) is undertaking a review pursuant to the National Historic Preservation Act (NHPA) and the National Environment Policy Act (NEPA) for the proposed Advanced Technology Solar Telescope (ATST) Project. The proposed ATST is a project of the National Solar Observatory (NSO) that is being considered for construction funding by the NSF. NSF would serve as the lead federal agency for the NHPA/NEPA review. As the University of Hawai'i Institute for Astronomy (IfA) is one of several partners collaborating on this project, they would also cooperate in this process as well as a parallel state process.

Two of the alternatives that NSF and NSO are considering in this review would entail the planning and construction of the proposed ATST project was published in both the Federal Register and the State of Hawai'i Department of Health's Office of Environmental Quality Control (OEQC) Bulletin. During that same week, notification was also sent to Federal, State, and County offices, and members of Maui's community. In September 2005, on behalf of the NSF, KC Environmental, Inc. caused consultation to be initiated under Section 106 of the NHPA through numerous communications between the Maui Archaeologist of the Hawai'i State Historic Preservation Division (SHPD) and the Archaeologist of Xamanek Researches, LLC. A Cultural Resources Evaluation for the proposed project, *Cultural Resource Evaluation and Traditional Practices Report, January 2006*, is available now in all Maui public libraries and on the Internet at: http://atst.nso.edu/library/EIS.shtml.

NSF hereby invites your participation in this process as an individual who may attach religious and cultural significance to a historic property that may be affected by a proposed undertaking. **Specifically, we hereby invite your written comments on the above Cultural Resource Evaluation to address any Native Hawaiian concerns you may have about the proposed project; and we hope you will accept our invitation to participate in a formal Section 106 consultation meeting that will be held at:**

Mayor Hannibal Tavares Community Center,Multi-purpose Room (next to the pool),Tuesday, March 28, 2006, 6:00 p.m.

The deadline to submit comments or questions on the Cultural Resource Evaluation is March 20, 2006.

While NSF closely oversees this process and will be legally responsible for making all required findings and determinations under Section 106 of the NHPA, we have authorized our local consultant, KC Environmental Inc., to represent us in this matter. KCEs contact information is: Dr. Charlie Fein, Vice-President, KC Environmental, Inc., P.O. Box 1208, Makawao, HI 96768, ph: (808) 573-1903, Fax: (808) 573-7837, charlie@kcenv.com. In the event that you have questions you would like to address to a federal representative, please contact Assistant General Counsel Chrisse Carney-Nunes at (703) 293-8060 or Dr. Craig Foltz, the NSF ATST Program Director at (703) 292-4909.

(MN: Mar. 1, 23, 2006)

Figure 5-11. Section 106 Meeting Notification: Maui News Public Notice, March 1 and 23, 2006.

36 CFR Part 800 – Protection of Historic Properties
Advanced Technology Solar Telescope (ATST) Project

The National Science Foundation (NSF) is undertaking a review pursuant to the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA) for the proposed Advanced Technology Solar Telescope (ATST) Project. The proposed ATST is a project of the National Solar Observatory (NSO) that is being considered for construction funding by the NSF. NSF would serve as the lead federal agency for the NHPA/NEPA review. As the University of Hawai'i Institute for Astronomy (IfA) is one of several partners collaborating on this project, they would also cooperate in this process as well as a parallel state process.

Two of the alternatives that NSF and NSO are considering in this review would entail the planning and construction of the proposed ATST project within the Haleakala High Altitude Observatories (HO) site on Maui. On June 23, 2005, notification of the proposed project was published in both the Federal Register and the State of Hawai'i Department of Health's Office of Environmental Quality Control (OEQC) Bulletin. During that same week, notification was also sent to Federal, State, and County offices, and members of Maui's community. In September 2005, on behalf of the NSF, KC Environmental, Inc. caused consultation to be initiated under Section 106 of the NHPA through numerous communications between the Maui Archaeologist of the Hawai'i State Historic Preservation Division (SHPD) and the Archaeologist of Xamanek Researches, LLC. A Cultural Resources Evaluation for the proposed project, Cultural Resource Evaluation and Traditional Practices Report, January 2006, is available now in all Maui public libraries and on the Internet at: http://atst.nso.edu/library/EIS.shtml.

NSF hereby invites your participation in this process as an individual who may attach religious and cultural significance to a historic property that may be affected by a proposed undertaking. **Specifically, we hereby invite your written comments on the above Cultural Resource Evaluation to address any Native Hawaiian concerns you may have about the proposed project; and we hope you will accept our invitation to participate in a formal Section 106 consultation meeting that will be held at:**

Mayor Hannibal Tavares Community Center, Multi-purpose Room (next to the pool), Tuesday, March 28, 2006, 6:00 p.m.

The deadline to submit comments or questions on the Cultural Resource Evaluation is March 20, 2006.

While NSF closely oversees this process and will be legally responsible for making all required findings and determinations under Section 106 of the NHPA, we have authorized our local consultant, KC Environmental Inc., to represent us in this matter. KCEs contact information is: Dr. Charlie Fein, Vice-President, KC Environmental, Inc., P. O. Box 1208, Makawao, HI 96768, ph: (808) 573-1903, Fax: (808) 573-7837, charlie@kcenv.com. In the event that you have questions you would like to address to a federal representative, please contact Assistant General Counsel Charisse Carney-Nunes at (703) 292-8060 or Dr. Craig Foltz, the NSF ATST Program Director at (703) 292-4909.

Figure 5-12. Section 106 Meeting Notification: Haleakalā Times, March 15 to 28, 2006 Issue and Maui Weekly-South Edition, March 16 to 22, 2005 Issue.

OHA-Recommended Consultation – March 28, 2006

Consultation was held on March 28, 2006, with Retired Judge Boyd Mossman, Maui Trustee of OHA. NSF was given a list of additional Native Hawaiian groups that Judge Mossman recommended be invited to participate in the Section 106 process. Invitation letters dated March 31, 2006 were distributed (Table 5-8) and included a brief summary of the proposed ATST Project as it relates to the Section 106 process, including:

1. A status of consultation meetings to date,
2. An invitation to participate in the Section 106 process,
3. A web link to information posted to the ATST website,
4. A copy of the cultural evaluation; and,
5. NSF contact information.

Table 5-8. OHA-Recommended List of Those Invited to Participate.

	Affiliation	Last Name	First Name
1	Aʻo Aʻo O Na Loko Iʻa O Maui	Ople	Sheila
2	Alu Like, Inc.	Duey	Rose Marie
3	Dept. of Hawaiian Homelands	Medeiros	Vanessa
4	Dept. of Hawaiian Homelands, Grants Review Advisory Committee	Libed	Clifford
5	Fishpond Ohana	Ryan	Patrick
6	Friends of Mokuʻula, Executive Director	Akana	Akoni
7	Hawaiian Community Assets, Inc.	Wagele	Jim
8	Hawaiian Homes Waiehu Kou 1	Ishizaka	Kekealani
9	Hui Kakoʻo ʻAina Hoʻopulapula and Na Poʻe Kokua	Feiteira	Blossom
10	Hui No Ke Ola Pono	Chang	Mei-Ling
11	Hui of Hawaiians	Filimoe'atu	Kehaulani
12	Ka Imi Naʻauao ʻO Hawaiʻi Nei	Bailey	Roselle
13	Kamehameha Schools Alumni	Takahashi	Dancine
14	Kamehameha Schools, Headmaster	Chamberlain	Dr. Rod
15	Keokea Hawaiian Homes	Newhouse	Robin
16	Lokahi Pacific	Ridao	Joann
17	Maui Community College – Kuʻina Program		
18	Maui Community College, Cooperative Education Program Coordinator	Pelegrino	Wallette
19	Na Leo Pulama	Ishikawa	Lei
20	Na Pua Noʻeau	Morando	Ohua
21	Native Hawaiian Educational Council	Keala	David
22	Paukukalo Hawaiian Homestead Community Association	Mariano	Velma
23	Punana Leo O Maui	Namauu	Kili
24	Queen Liliʻuokalani Children's Center	Mountcastle	Iris

Formal Consultation Meeting – May 1, 2006

Notification postcards were sent to agencies, organizations, and members of the community announcing a second formal consultation meeting (Table 5-9). This meeting was held on May 1, 2006 at the Paukūkalo Community Center. A copy of the postcard announcement and mailing distribution list was sent to SHPD and OHA.

Identical public notice advertisements were placed in the Maui News on April 21, 2006 (Fig. 5-13), the Haleakalā Times in the April 26 to May 9, 2006 issue, the Maui Weekly-South in the April 27 to May 3, 2006 issue (Fig. 5-14), and posted to the ATST web site.

At the meeting, the public was invited to participate in the Section 106 process, public testimony was heard, written testimony was accepted, and questions were answered. During public testimony, specific concern was heard about which organizations and individuals were contacted, the IfA's LRDP, and the

NSF's role in educational outreach specifically for women and Native Hawaiians. Documentation addressing all of these concerns was posted to the ATST web site within the week following the meeting. A stenographer from Iwado Court Reporters was employed to record the proceedings of the meeting for inclusion in the Administrative Record.

Table 5-9. Formal Section 106 Meeting Notification Distribution List, May 1, 2006.

	Affiliation	Last Name	First Name
1	Friends of Moku‘ula, Executive Director	Akana	Akoni
2	State Historic Preservation Division, Branch Chief	Brown	David
3	Alu Like, Inc.	Duey	Rose Marie
4	A‘o A‘o O Na Loko I‘a O Maui	Ople	Sheila
5	Dept. of Hawaiian Homelands	Medeiros	Vanessa
6	Dept. of Land and Natural Resources, Island Burial Council		
7	Fishpond Ohana	Ryan	Patrick
8	Hawaiian Community Assets, Inc.	Wagele	Jim
9	Hawaiian Homes Waiehu Kou 1	Ishizaka	Kekealani
10	Hui Kako‘o ‘Aina Ho‘opulapula and Na Po‘e Kokua	Feiteira	Blossom
11	Hui No Ke Ola Pono	Chang	Mei-Ling
12	Hui of Hawaiians	Filimoe‘atu	Kehaulani
13	Ka Imi Na‘auao ‘O Hawai‘i Nei	Bailey	Roselle
14	Kamehameha Schools Alumni	Takahashi	Dancine
15	Kamehameha Schools, Headmaster	Chamberlain	Rod
16	Keokea Hawaiian homes	Newhouse	Robin
17	Lokahi Pacific	Ridao	Joann
18	Maui Community College – Ku‘ina Program		
19	Maui Community College and Hawaiian Civic Club	Hokoana	Lui
20	Maui Community College, Cooperative Education Program Coordinator	Pelegrino	Wallette
21	Na Kupuna O Maui	Nishiyama	Patty
22	Na Leo Pulama	Ishikawa	Lei
23	Na Pua No‘eau	Morando	Ohua
24	Native Hawaiian Educational Council	Keala	David
25	Office of Hawaiian Affairs, Administrator	Namu'o	Clyde
26	Office of Hawaiian Affairs, Community Resource Coordinator	Shimaoka	Thelma
27	Paukūkalo Hawaiian Homestead Community Association	Mariano	Velma
28	Punana Leo O Maui	Nāmauu	Kili
29	Queen Lili‘uokalani Children's Center	Mountcastle	Iris
30	Royal Order of Kamehameha I, Kahu Po‘o Iki	Solomon	Clarence
31	Royal Order of Kamehameha I, Office of the Ku‘auhau Nui	Garcia, Jr. CK	William
32	State Historic Preservation Division, Maui Archaeologist	Kirkendall	Melissa
33		Barros	Jake
34		Bustamente	Keahi
35		Helm	Mikahala
36		Holt-Padilla	Hokulani
37		Kaeo	Kalei
38		Kahoohanohano	George
39		Kaohu	Kathy
40		Lindsey	Ed
41		Maxwell	Charles
42		Raymond	Ki‘ope

PUBLIC NOTICE

The National Science Foundation (NSF) is undertaking a review pursuant to the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA) for the proposed Advanced Technology Solar Telescope (ATST) Project. The next NHPA 106 consultation meeting will be:

Monday, May 1, 2006, 7:00 to 10:00 p.m.
Paukūkalo Community Center
655 Kaumuali'i Street, Paukūkalo

You are encouraged to submit resolution proposals by April 24th to KC Environmental Inc, P. O. Box 1208, Makawao, HI 96768. You may also bring them to the meeting where you can provide comments or testimony that would assist NSF in directing appropriate consideration to Native Hawaiian interests in connection with this project. All proposals, comments, and testimony will be fully considered as part of the NSF, NEPA, and NHPA review process.

Please visit the ATST website for additional information about the Section 106 process for this project: http://atst.nso.edu/library/EIS.shtml

(MN: April 21, 2006)

Figure 5-13. Section 106 Meeting Notification: Maui News Public Notice, April 21, 2006.

The National Science Foundation (NSF) is undertaking a review pursuant to the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA) for the proposed Advanced Technology Solar Telescope (ATST) Project. The next NHPA 106 consultation meeting will be:

Monday, May 1, 2006, 7:00 to 10:00 p.m.
Paukukalo Community Center
655 Kaumuali'i Street, Paukukalo

You are encouraged to submit resolution proposals to KC Environmental Inc, P. O. Box 1208, Makawao, HI 96768. You may also bring them to the meeting where you can provide comments or testimony that would assist NSF in directing appropriate consideration to Native Hawaiian interests in connection with this project. All proposals, comments, and testimony will be fully considered as part of the NSF, NEPA, and NHPA review process.

Please visit the ATST website for additional information about the Section 106 process for this project: http://atst.nso.edu/library/EIS.shtml

Figure 5-14. Section 106 Meeting Notification: Haleakalā Times, April 26 to May 9, 2006 Issue and Maui Weekly-South Edition, April 27 to May 3, 2006 Issue.

DEIS Notification and Section 106 Resolution Proposals Status Update – June 5, 2006

On behalf of the NSF, KC Environmental, Inc. (KCE) sent information postcards (Fig. 5-15) to agencies, organizations, and members of the community (Table 5-10) with information announcing the anticipated publication of the DEIS and the subsequent public meetings to comment on the DEIS. It also announced that scheduled meetings with interested individuals and groups who submit resolution proposals for the Section 106 process would be held during the week of the DEIS public meetings. A copy of the postcard and mailing distribution list was sent to SHPD and OHA.

The information on the postcard was also published in the Maui News on April 21, 2006, the Haleakalā Times in the April 26 to May 9, 2006 issue, the Maui Weekly-South in the April 27 to May 3, 2006 issue, and posted to the ATST web site.

The National Science Foundation (NSF) is continuing to accept resolution proposals pursuant to the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA) for the proposed Advanced Technology Solar Telescope (ATST) Project.

You are encouraged to submit resolution proposals to
KC Environmental Inc., PO Box 1208, Makawao, HI 96768
that would assist NSF in directing appropriate consideration to
Native Hawaiian cultural and historic interests in connection with this project.

It is anticipated that a Draft Environmental Impact Statement (DEIS) will be published this summer, after which time, NSF and the University of Hawaiʻi will hold public meetings to receive comments on the DEIS.

During NSF's trip to Maui, scheduled meetings will also be held with interested individuals and groups who submit resolution proposals for the Section 106 process. All resolution proposals will be fully considered. The deadline for submitting Section 106 resolution proposals will be announced with public notification of the DEIS release and in the ATST historic properties web site: http://atst.nso.edu/library/EIS.shtml.

June 5, 2006

Figure 5-15. Section 106 Resolution Proposals Status Update Postcard, June 5, 2006.

Table 5-10. DEIS and Resolution Proposals Status Update Distribution List, June 5, 2006.

	Affiliation	Last Name	First Name
1	Aʻo Aʻo O Na Loko Iʻa O Maui	Ople	Sheila
2	Alu Like, Inc.	Duey	Rose Marie
3	Dept. of Hawaiian Homelands	Medeiros	Vanessa
4	Dept. of Land and Natural Resources, Island Burial Council		
5	Fishpond Ohana	Ryan	Patrick
6	Friends of Mokuʻula, Executive Director	Akana	Akoni
7	Hawaiian Community Assets, Inc.	Wagele	Jim
8	Hawaiian Homes Waiehu Kou 1	Ishizaka	Kekealani
9	Hui Kakoʻo ʻAina Hoʻopulapula and Na Poʻe Kokua	Feiteira	Blossom
10	Hui No Ke Ola Pono	Chang	Mei-Ling
11	Hui of Hawaiians	Filimoeʻatu	Kehaulani
12	Ka Imi Naʻauao ʻO Hawaiʻi Nei	Bailey	Roselle
13	Kamehameha Schools	Chamberlain	Rod
14	Kamehameha Schools Alumni	Takahashi	Dancine
15	Keokea Hawaiian Homes	Newhouse	Robin
16	Lokahi Pacific	Ridao	Joann
17	Maui Community College	Hokoana	Lui
18	Maui Community College – Kuʻina Program		
19	Maui Community College, Cooperative Education Program Coordinator	Pelegrino	Wallette
20	Na Kupuna O Maui	Nishiyama	Patty
21	Na Leo Pulama	Ishikawa	Lei

Table 5-10. DEIS and Resolution Proposals Status Update Distribution List, June 5, 2006 (cont.).

	Affiliation	Last Name	First Name
22	Na Pua No‘eau	Morando	Ohua
23	Native Hawaiian Educational Council	Keala	David
24	Office of Hawaiian Affairs, Administrator	Nāmu‘o	Clyde
25	Office of Hawaiian Affairs, Community Resource Coordinator	Shimaoka	Thelma
26	Paukūkalo Hawaiian Homestead Community Association	Mariano	Velma
27	Punana Leo O Maui	Namauu	Kili
28	Queen Lilioukalani Children's Center	Mountcastle	Iris
29	Royal Order of Kamehameha I, Kahu Po‘o Iki	Solomon	Clarence
30	Royal Order of Kamehameha I, Office of the Ku‘auhau Nui	Garcia, Jr.	William
31	State Historic Preservation Division, Branch Chief	Brown	David
32	State Historic Preservation Division, Maui Archaeologist	Kirkendall	Melissa
33		Awana	Nadine, Chanelle
34		Bailey	Timmy
35		Barros	Jake
36		Burns (e-mail)	Suzanne
37		Bustamente	Keahi
38		Dias	Pohai
39		Dizon	Toni
40		Eldredge	Carl
41		Garcia	Don
42		Helm	Mikahala, Rusty
43		Hoffman	Mark
44		Holt-Padilla	Hokulani
45		Kaeo	Kalei
46		Kahoohanohano	George
47		Kamai	David
48		Kanamu	Walter
49		Kaohu	Kathy
50		Kekahuna	Ashley
51		Kong	Leinoa
52		Kuailani	Kapena
53		Lehuanani	Princess
54		Lindsey	Ed, Puanani
55		Maxwell	Charles
56		McLean	Luke
57		Medeiros	Bill
58		Park	Pua‘ ōlena
59		Raymond	Ki‘ope
60		Roback	Billy
61		Shito	Georgina
62		Souza	Keoki
63		Tassill	Kalani
64		Tomoso	John

OHA Formal Consultation Meeting – September 27, 2006

On September 27, 2006, NSF met again with OHA following issuance of the DEIS. That meeting took place in Honolulu with OHA Administrator, Clyde Nāmu’o. At that meeting, Mr. Nāmu’o said he was glad NSF engaged OHA early on in its Section 106 process, and he indicated that NSF was taking the right steps and engaging the right people.

Supplemental Cultural Impact Assessment Distribution – July 4, 2007

Extensive comments were received on the DEIS and during the Section 106 consultations concerning effects on historic and cultural resources. In view of these comments, NSF decided that it would be necessary to have a supplemental cultural impact evaluation prepared to assist in both its NEPA process and its ongoing Section 106 consultations. The Supplemental Cultural Impact Assessment (SCIA) provided by Cultural Surveys Hawaiʻi, Inc. substantially addressed the comments received on the DEIS and reflects additional consultative interactions requested in those comments. It is also exhaustive in its review and often-verbatim recitation of the numerous comments, consultations, and proposals that have occurred. This report can be found in Vol. II, Appendix F(2)-Supplemental Cultural Impact Assessment. The SCIA was sent to the ACHP as well as the Section 106 consulting parties (Table 5-11) and posted to the ATST website.

ACHP Letter and Maui Community College Mitigation Proposal – November 8, 2007

The November 8, 2007, consultation letter from NSF to ACHP summarized the current Section 106 process, including consultations with interested parties. The November 8th letter also expressed NSF's desire to hold a meeting with the consulting parties to discuss all mitigation proposals submitted to date and allow for submission of additional proposals. Finally, the letter notified ACHP of the receipt of a Mitigation Proposal from MCC, and requested a meeting with the ACHP to discuss a path forward in the consultation process. A copy of both the November 8, 2007 ACHP letter and the MCC Mitigation Proposal were sent to the consulting parties (Table 5-11).

Table 5-11. SCIA (July 4, 2007) and MCC Mitigation Proposal (November 8, 2007) Distribution List.

	Affiliation	Last Name	First Name
1	County of Maui, Dept. of Planning Cultural Resource Commission, AICP, Staff Planner	Hunt	Jeff
2	Dept. of Land and Natural Resources, Island Burial Council	Maxwell	Charles
3	Dept. of Land and Natural Resources, SHPD Officer	Smith	Allan
4	Haleakalā National Park, Superintendent	Parris	Marilyn
5	Na Kupuna O Maui	Nishiyama	Patty
6	Office of Hawaiian Affairs, Administrator	Nāmuʻo	Clyde
7	Office of Hawaiian Affairs, Community Resource Coordinator	Shimaoka	Thelma
8	Royal Order of Kamehameha I, Aliʻi Kuʻauhau	Kaho'ohanhano	George
9	Royal Order of Kamehameha I, Kahu Poʻo Iki	Solomon	Clarence
10	Royal Order of Kamehameha I, Office of the Kuʻauhau Nui	Garcia, Jr. CK	William
12	State Historic Preservation Division, Administrator	Chinen	Melanie
11	State Historic Preservation Division, Maui Archaeologist	Pickett	Jenny
13	U.S. Dept. of the Interior, Office of the Secretary Office of Environmental Policy and Compliance Pacific West Region, Regional Environmental Officer	Sanderson Port	Patricia
14		Helm	Mikahala
15		Maxwell	Charles
16		Nahulu	Verna
17		Raymond	Kiʻope
18		Shibuya	Warren

Formal Consultation Meeting – June 16 and 17, 2008

An invitation to attend formal Section 106 consultation meetings on June 16 and 17, 2008, was sent to all consulting parties. Those meetings were held at the University of Hawaiʻi Institute for Astronomy Maikalani Facility. A meeting facilitator was present as well as a court reporter.

While several consulting parties who attended the June 2008 meetings expressed concerns about and objections to the location of the proposed ATST Project, other consulting parties provided creative suggestions for mitigation provisions that could be included in a Memorandum of Agreement. Some of these suggestions included providing educational programs for Native Hawaiians, at both the University and K through 12 levels; placing a "Hawaiian Star Compass" on the summit in recognition of the role navigation has played in Native Hawaiian culture; having the Native Hawaiian community identify a person with appropriate kuleana who could serve in a capacity similar to that of a Konohiki to work with the University of Hawaiʻi to facilitate traditional cultural practices at the Haleakalā High Altitude Observatory Site and to provide interpretation of the summit; removing the concrete remnants of the Reber Circle and cleaning up other areas on the summit; and putting a 50 year limit on the life of the proposed ATST Project. All of these suggestions and other comments by the consulting parties in attendance are set forth in the transcripts of both meetings; those transcripts, the notes of the facilitator, and other important information containing NSF's Section 106 compliance efforts to date were posted on the ATST project website.

During the June 2008 meetings, one of the consulting parties expressed a concern that there were people/entities previously interested in participating in the Section 106 process, but who did not appear on the then-current list of consulting parties. After the meetings, the records were reviewed and individuals and entities were identified who initially expressed an interest in participating in the ATST Section 106 process, but were ultimately not included in the list of consulting parties due to inactivity or a subsequent apparent lack of interest. At the June 2008, meetings, the SHPD also recommended that NSF host two additional consultation meetings. NSF agreed to do so.

<u>Follow-up from June 16 and 17, 2008 Consultation Meetings</u>

Following the June, 2008 consultation meetings, NSF engaged in extensive conversations with the ACHP, the SHPD, HALE, and the Dept. of Interior (DOI) regarding an appropriate path to move forward in its Section 106 consultation process. Concerns were expressed by the ACHP, the SHPD, and HALE regarding the outreach efforts NSF had made to include members from the Native Hawaiian Community.

The ACHP wrote a letter to NSF on July 17, 2008, requesting further information regarding NSF's outreach efforts. In response to specific questions raised by the ACHP, NSF responded:

> "In your July 17th letter, you raise a concern about NSF's outreach efforts to involve Native Hawaiian Organizations ("NHOs"). Specifically, you ask whether NSF looked beyond Maui to identify NHOs. You also asked whether NSF invited the Office of Hawaiian Affairs ("OHA") to participate in our Section 106 process. As reflected in several letters recently sent to all consulting parties, including the ACHP, it is clear that several consulting parties are located outside of Maui. With regard to NSF's outreach efforts with OHA, NSF indeed reached out to OHA early on in its process. In September of 2005, NSF contacted OHA, and received a letter in return setting forth the authorities requiring the respectful treatment of the ceded lands of the summit, and requesting that part of the proposed ATST Project, if it goes forward, "include a guarantee of training and education for Hawaiians . . . to allow them the opportunity to gain jobs at the Haleakalā High Altitude Observatories site." *See* DEIS at pp. 3-7 to 3-8. NSF invited OHA to be a consulting party in this process, and that invitation was accepted. (Please note that OHA's consulting party status is reflected on all of the correspondence addressed to consulting parties.)
>
> In addition, as I explained to you [and other ACHP personnel] during our telecon last week -- and as set forth on page 5-16 of the DEIS -- NSF met with Retired Judge Boyd Mossman of OHA on March 28, 2006,

> to discuss NSF's Section 106 process. During that meeting, NSF was given a list of additional NHOs that OHA recommended be invited to participate in our Section 106 process. The meeting and the OHA-recommended list are documented in the DEIS on pages 5-16 and 5-17. Letters were sent to those on the OHA-recommended list on March 31, 2006 inviting them to participate in the process. Copies of those letters can be located on the website setting forth NSF's Section 106 compliance efforts to date: http://atst.nso.edu/library/36CFR800. On September 27, 2006, NSF met again with OHA following issuance of the DEIS. That meeting took place in Honolulu with OHA Administrator, Clyde Nāmu'o. At that meeting, Mr. Nāmu'o said he was glad NSF engaged OHA early on in its Section 106 process, and he indicated that NSF was taking the right steps and engaging the right people.
>
> Further involvement of NHOs is reflected in the testimony on behalf of the Association of Hawaiian Civic Clubs, which was received during NSF's formal Section 106 meeting for the proposed ATST Project on May 1, 2006. Mr. Lui Hokoana, president of the Central Maui Hawaiian Civic Club, testified on behalf of his civic club, the Lahaina Hawaiian Civic Club, and the Hoolehua Hawaiian Civic Club in conjunction with the Association of the Hawaiian Civic Clubs, which represents 51 clubs from throughout Hawai'i and seven mainland states. Mr. Hokoana's testimony strongly urged that the telescope not be built on Haleakalā. In addition, a letter dated May 1, 2006, containing the written testimony of Antoinette L. Lee, President of the Association of Hawaiian Civic Clubs, was also submitted. This written testimony can be found in Appendix K to the DEIS at page 116."

NSF further discussed its outreach efforts through the date of issuance of the DEIS, as outlined in this section. Specifically, NSF explained:

> "These efforts include public hearings, formal and informal consultation meetings, media outreach to inform the public of the proposed ATST Project, ensuring that the DEIS was provided to all public libraries in the State of Hawai'i, and Federal Register notices published to notify the public of opportunities to participate in the NEPA and Section 106 processes. In fact, a total of 23 consultation meetings, both formal and informal, have taken place since July of 2005. [The outreach efforts for the proposed ATST Project have indeed been taken very seriously by NSF, which is evidenced by the fact that the current list of consulting parties includes 29 individuals and entities]. Moreover, on July 24, 2008, NSF sent out a letter to all consulting parties inviting them to the upcoming consultation meetings scheduled for next month (on August 27th and 28th). That invitation letter was also sent to an additional 87 individuals/entities who NSF considers to be potentially interested parties. These parties expressed an interest in participating in the Section 106 process at some point over the past three years, but were ultimately not included in the list of consulting parties due to inactivity and/or an apparent lack of interest. Nevertheless, NSF decided to reach out to them to provide them with one more opportunity to participate in the process."
>
> Discussions also ensued regarding expanding the Area of Potential Effects to include the Park road corridor. NSF agreed to do so. NSF continued to work closely, primarily with the ACHP, to structure the format for additional consultation meetings scheduled for August 27 and 28, 2008. In structuring the August meetings, NSF also consulted closely with HALE and reached out to the SHPD.

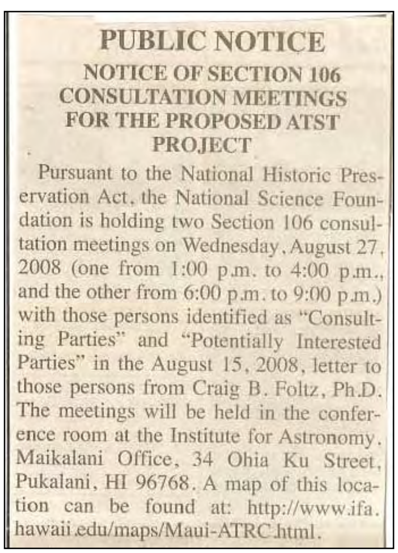
Formal Consultation Meetings – August 27, 2008

An invitation letter announcing the next consultation meetings, which took place on August 27, 2008 at the University of Hawaiʻi Institute for Astronomy Maikalani Facility – was sent to all persons listed as consulting parties and those from the NHO list that had not previously been included in the process. In addition, an invitation letter was sent to those persons/entities who previously expressed an interest in NSF's Section 106 process, but who became inactive and/or demonstrated an apparent lack of interest in participating further in the process. A Public Notice announcing the August 27, 2008 consultation meetings was published in the Maui News, the Honolulu Advertiser, and the Honolulu Star Bulletin on August 24, 2008 (Fig. 5- 16). A meeting facilitator and a court reporter were present at the meeting on August 27, 2008. The transcript of both meetings and the notes of the facilitator were posted on the ATST Project website.

Both meetings on August 27, 2008, were intended to provide opportunities for consulting parties to meet with NSF to discuss ways in which to address adverse effects to historic properties associated with the proposed ATST Project through avoidance, minimization, and mitigation. At the meetings, there were no suggestions provided by the consulting parties regarding ways in which to minimize or mitigate any adverse effects associated with the proposed ATST Project; most of the people present stated that they were against the proposed ATST Project and that they were in favor of avoiding the effects. NSF explained that, due to the scientific criteria required to build the proposed ATST Project, adverse effects resulting from the color, size, and location of the proposed Project could not be avoided unless NSF were to select the no-action alternative and issue a decision to not fund the proposed Project's construction.

An additional meeting was held on August 28, 2008, attended only by representatives of NSF, the ATST project team, the ACHP, HALE, and the SHPD, to discuss next steps in the process. It was agreed upon that NSF would host another consultation meeting to address potential effects to the Park road corridor once a road condition survey was completed. (As noted earlier, that survey was completed in January, 2009, by the FHWA, and the final report was issued on March 4, 2009.) Due to the very small attendance of consulting parties at both the June and August 2008 consultation meetings, the NSF, ACHP, HALE, SHPD and ATST project team representatives discussed, again, ways in which to improve outreach efforts to include more participation by Native Hawaiians. That discussion is ongoing and NSF and HALE are working to find ways to increase participation by consulting parties in the next consultation meetings, scheduled for the week of May 4, 2009. NSF is also working with NSF, the ACHP, HALE, and the SHPD to develop a Memorandum of Agreement/Programmatic Agreement to address adverse effects anticipated from the proposed ATST Project.

As a cumulative result of the response to all Section 106 consultation meetings, a new consulting party list was formulated at the end of the August 27, 2008 consultation meeting (Table 5-12).



PUBLIC NOTICE

NOTICE OF SECTION 106 CONSULTATION MEETINGS FOR THE PROPOSED ATST PROJECT

Pursuant to the National Historic Preservation Act, the National Science Foundation is holding two Section 106 consultation meetings on Wednesday, August 27, 2008 (one from 1:00 p.m. to 4:00 p.m., and the other from 6:00 p.m. to 9:00 p.m.) with those persons identified as "Consulting Parties" and "Potentially Interested Parties" in the August 15, 2008, letter to those persons from Craig B. Foltz, Ph.D. The meetings will be held in the conference room at the Institute for Astronomy, Maikalani Office, 34 Ohia Ku Street, Pukalani, HI 96768. A map of this location can be found at: http://www.ifa.hawaii.edu/maps/Maui-ATRC.html.

Figure 5-16. Section 106 Meeting Notification, Public Notice: Maui News, Honolulu Advertiser, Honolulu Star Bulletin, August 24, 2008.

Table 5-12. Section 106 Consultation List as of August 27, 2008.

	Last Name	First Name	Affiliation
1	Garcia, Jr., CK	Aliʻi Sir William	Office of the Kuʻauhau Nui, Royal Order of Kamehameha I
2	Jenkins	Brian	President, Friends of Polipoli
3	Sakamoto	Clyde	Chancellor, Maui Community College
4	Apana	Clare	Individual
5	Nāmuʻo	Clyde	Administrator, Office of Hawaiian Affairs
6	Kanahele	Dan	Individual
7	Merritt	Elizabeth S.	Deputy General Counsel, National Trust for Historic Preservation
8	Kahoohanohano	George	Royal Order of Kamehameha I
9	Rodrigues	Hinano	Cultural Historian, State Historic Preservation Division
10	Fernandez	Jamie	Individual
11	Hunt	Jeff	Director, County of Maui, Dept. of Planning, Cultural Resources Commission
12	Costa	Joyclynn	Individual
13	Mancini	Judy	Individual
14	Maxwell	Kahu Charles	State Historic Preservation Division, Island Burial Council
15	Maxwell	Kahu Charles	Individual
16	Solomon	Kahu Poʻo Iki Clarence	Royal Order of Kamehameha I
17	Kaʻeo	Kaleikoa	Maui Community College
18	Kaohu	Kathy	Individual
19	Raymond	Kiʻope	Kilakila o Haleakalā
20	Raymond	Kiʻope	Individual
21	Faulkner	Kiersten	AICP, Executive Director, Historic Hawai'i Foundation
22	Thielen	Laura	Officer, State Historic Preservation Division Department of Land and Natural Resources
23	Ryder	Leiohu	Individual
24	Horovitz	Liana	Individual
25	Parris	Marilyn	(Former) Superintendent, Haleakalā National Park
26	Catlin	Martha	Program Analyst, Advisory Council on Historic Preservation Office of Federal Agency Programs
27	Prince	Melissa	Individual
28	Maberry	Michael	Assistant Director, University of Hawaiʼi, Institute for Astronomy
29	Helm	Mikihala	Individual
30	Pickett	Jenny	Asst. Maui Archaeologist, State Historic Preservation Division
31	McMahon	Nancy	Acting Archaeology Branch Chief, State Historic Preservation Division
32	Morando	Ohua	Individual
33	Sanderson Port	Patricia	Regional Environmental Officer, Office of the Secretary, U.S. Dept. of the Interior, Office of Environmental Policy and Compliance
34	Nishiyama	Patty	Na Kupuna O Maui
35	Aiu	Pua	Administrator, State Historic Preservation Division
36	Creachbaum	Sarah	(Current) Superintendent, Haleakalā National Park
37	Kane	Shad	Individual
38	Kahoohalahala	Sol	Maui Community College
39	Keil, Ph.D.	Steve	Director and ATST Project Director, National Solar Observatory
40	Shimaoka	Thelma	Community Resource Coordinator, Office of Hawaiian Affairs
41	Nahulu	Verna	Individual
42	Shibuya	Warren	Individual

Table 5-12. Section 106 Consultation List as of August 27, 2008 (cont.).

POTENTIALLY INTERESTED PARTIES			
	Last Name	**First Name**	**Affiliation**
43	Agalerai	Melinda	Individual
44	Ahue	Cliff Pali	Individual
45	Ampong	Paulette"Leihua"	Individual
46	Bailey	Gordean	Individual
47	Baker	Chris	Individual
48	Barnard Ki`inani o`Kalani	Christy	Individual
49	Bass	Ron	Individual
50	Boteilho	Rose	Individual
51	Bulawan	Mary Frances M.	Individual
52	Bulawan, Sr.	Bernard	Individual
53	Chock	April	Individual
54	Delapinia	Kaulana	Individual
55	Edwards	Dylan	Individual
56	Escobar, Jr.	Sharon and Fausto	Individual
57	Gerard	Sheila	Individual
58	Gibson	Lehua	Individual
59	Heintz	Heather	Individual
60	Hokoana	Lui	Individual
61	Ishikawa	Lei	Individual
62	Ka`auwai	Kristen	Individual
63	Kaina	DeAnn	Individual
64	Kanoa	Beverly-Ann	Individual
65	Kapu	Uilani	Individual
66	Karratti	Margaret	Individual
67	Kneubuhl	Alesa, Buzzy, and Robyn	Individual
68	Lee	Gordon	Individual
69	Makanani	Attwood M.	Individual
70	Miller	Ane	Individual
71	Miller	Chuck and Terry	Individual
72	Mirkovich	Sincerity	Individual
73	Murray	Heather Ku`ulei Makamae	Individual
74	Orme	Maile	Individual
75	Pulama-Collier	Wanda S.	Individual
76	Rabold	Jeanne	Individual
77	Rasmussen	Lena	Individual
78	Sampson	Rina	Individual
79	Subiono	David Kea	Individual
80	Thongtrakul	Leimomi	Individual
81	Thyne	Jacquelynn	Individual
82	Whittle-Wagner	Jamie Moanikeala	Individual
83	Wong	Annette	Individual
84	Wong	Kerry	Individual
85	Wong	Newton and Jodean	Individual

Table 5-12. Section 106 Consultation List as of August 27, 2008 (cont.).

POTENTIALLY INTERESTED PARTIES			
	Last Name	**First Name**	**Affiliation**
86	Ople	Sheila	A‘o A‘o O Na Loko I‘a O Maui
87	Duey	Rose Marie	Alu Like, Inc.
88	Pelegrino	Wallette	Cooperative Education Program Coordinator, Maui Community College
89			Council for Native Hawaiian Advancement
90			Dept. of Hawaiian Homelands
91	Libed	Clifford	Dept. of Hawaiian Homelands Grants Review Advisory Committee
92	Akana	Akoni	Executive Director, Friends of Moku'ula
93	Ryan	Patrick	Fishpond Ohana
94	Hoke	Arthur	Hawaiian Civic Club of Hilo
95	Wagele	Jim	Hawaiian Community Assets, Inc.
96	Ishizaka	Kekealani	Hawaiian Homes Waiehu Kou 1
97	DeLima	Lee Ann	Headmaster, Kamehameha Schools
98			Hui Kako‘o ‘Aina Ho‘opulapula Hawai‘i Maoli
99	Feiteira	Blossom	Hui Kako'o 'Aina Ho'opulapula and Na Po'e Kokua
100	Filimoe'atu	Kehaulani	Hui of Hawaiians
101	Bailey	Roselle	Ka Imi Na'auao 'O Hawai'i Nei
102	Takahashi	Dancine	Kamehameha Schools Alumni
103	Wise	Taffi	Kanu o ke ‘Aina Learning ‘Ohana
104	Shirai, Jr.	Thomas T.	Kawaihapai Ohana
105	Newhouse	Robin	Keokea Hawaiian Homes
106	Ridao	Joann	Lokahi Pacific
107	Swinney	Shirley S.	Malu‘ohai Residents Association
108			Maui Community College – Ku‘ina Program
109			Na Ku‘auhau‘o Kahiwakaneikopolei
110	Ishikawa	Lei	Na Leo Pulama
111	Keala	David	Native Hawaiian Educational Council
112			Papa Ola Lokahi
113	Mariano	Velma	Paukukalo Hawaiian Homestead Community Association
114	Namauu	Kili	Punana Leo O Maui
115	Mountcastl	Iris	Queen Lilioukalani Children's Center
116			Royal Hawaiian Academy of Traditional Arts
117	de lba Chu	Kippen	The Friends Of ‘Iolani Palace
118			The I Mua Group

5.2.2 Addressing Adverse Effects

Mitigation for resolving adverse effects is described in Section 4.18.2-Cultural, Historic, and Archeological Resources. Minimization and mitigation proposals from all interested groups and individuals are incorporated into this SDEIS. Three written proposals for mitigating adverse effects were submitted during the consultation process. Figure 5-17 is both an abbreviated and detailed proposal submitted by Kahu Charles Maxwell, Sr. on March 28, 2006. Figure 5-18 are two proposals submitted by Mr. Warren Shibuya on March 27, 2006 and August 28, 2008. Figure 5-19 is a proposal submitted by Chancellor Clyde Sakamoto on behalf of Maui Community College.

The Maui Community College proposal appears to be consistent with proposed mitigation received in September 2005 from OHA (OHA, 2005). Specifically, a letter was received from Mr. Clyde Nāmuʻo, OHA Administrator, which acknowledges that the HO "may be used for educational purposes and for the betterment of Hawaiians" and states, in pertinent part,

> "OHA therefore requests that should the proposed project go forward, part of the project include a guarantee of training and education for Hawaiians, perhaps through the Maui Community College, University of Hawaiʻi Institute of Astronomy, to allow them the opportunity to gain jobs at the Haleakalā High Altitude Observatories site."

These mitigation proposals and all other suggestions for addressing adverse effects are currently under consideration by NSF. In advance of the next Section 106 consultation meetings, to occur during the public comment period for this SDEIS, NSF intends to prepare a draft Memorandum of Agreement/Programmatic Agreement designed to reflect the ideas generated during the Section 106 consultation meetings held thus far. This draft will be available for review and consideration by the consulting parties and serve as a part of the discussion during NSF's next Section 106 consultation meetings in May 2009.

5.2.3 Public Comments and Responses

The public was encouraged to comment on the proposed ATST Project during all stages of the EIS process via oral testimony, e-mail, fax, or letter. Comments submitted before publication of the DEIS and responses to comments can be found in Vol. III, Appendix A-Pre-DEIS Public Comments. Although NEPA regulations governed the public comment period, all comments received after deadlines were accepted. Preparation of this SDEIS was in part due to comments received on the DEIS. Responses to all comments to the DEIS published on September 2006 and this SDEIS will be addressed in the FEIS.

On several occasions, the public requested that the transcripts from formal meetings be made available. To accommodate these requests, transcripts were sent to requesters and verbatim transcripts for the Public Scoping Meetings, the DEIS Public Comment Meetings, and formal Section 106 meetings are provided in Vol. III, Appendices B through D-Meeting Transcripts. The proceedings of each meeting were taken by machine shorthand and thereafter reduced to print by means of computer-assisted transcription. The transcriptions represent, to the best of each stenographer's ability, a true and correct transcript of the proceedings.

Hālau ʻImi ʻIke Hōkū

Center for Traditional Hawaiian Navigation and Astronomy

Proposal for creation:

Hālau ʻImi ʻIke Hōkū: Center for Traditional Hawaiian Navigation and Astronomy will be a collaboration of community and cultural resources to provide a venue to, *e ʻimi ʻike no nā hōkū* or to search or gather knowledge about the bright stars above. The Center's purposes will be to:

1. To create, produce, collaborate and administer curriculum for students from Kindergarten through Secondary and post secondary collaborations, which focus on traditional and modern astronomy and traditional Hawaiian navigation. This product would be for public and private school uses.
2. Promote edification of traditional Hawaiian techniques in astronomy and navigation and to integrate these concepts with scientific knowledge and produce traditional interpretations of the universe and the understanding of the native Hawaiian relationship to the surrounding areas and World.
3. Prepare students of all ages with traditional knowledge and modern scientific techniques that would cause future interest in astronomy and establish native Hawaiian expertise in the subject.
4. Create and manage a scholarship fund for individuals seeking a post high education on the island of Maui.
5. Create a planetarium with celestial bodies of the solar system that duplicate "traditional methods" used by Hawaiians to travel thousands of miles throughout the Pacific in double hulled canoes, using the knowledge of their natural elements and the traditional and native instincts as their guide.
6. Finally, this center for Traditional Hawaiian Navigation and Astronomy should be built at the time funding is approved for ATST by Congrass. Ideas like this tend to get "lost" in the shuffle of progress. The completion date could be worked on by the parties involved at that time.

In presenting this idea to Master Navigator Nainoa Thompson of the Polynesian voyaging canoe Hōkūleʻa, who sailed thousands of miles throughout the pacific using traditional navigational methods, he felt that this method is the missing component in teaching the youth of Hawaiʻi about the brilliance and resilience of their ancestors and the enormous feats they accomplished thousands of years ago. He has committed his support and that of the Polynesian Voyaging Society to make this happen.

The potential outreach of this Center could be enormous, but the more compelling reason is because it is right. A center of this magnitude possibly will produce world class Hawaiʻi/Maui-based scientists in this subject matter. Because of the training in these two worlds (Polynesian discovery and modern science), these future scientists and astronomers could bridge the past to the present and beyond. E ʻimi ʻike hōkū!

Submitted by:
KAHU CHARLES KAULUWEHI MAXWELL SR.

Figure 5-17. <u>Abbreviated</u> Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr.

Hālau ʻImi ʻIke Hōkū Project Proposal

A Quest for the Stars

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ʻO Wākea noho iā Papahānaumoku
Wākea procreates with Papahānaumoku
Hānau o Hoʻohōkūkalani, he wahine
Born is Hoʻohōkūkalani, a female
Hānau o Hawaiʻi, he moku
Born is Hawaiʻi, an Island
Hānau o Maui, he moku
Born is Maui, an Island
ʻO Wākea noho iā Hoʻohōkūkalani
Wākea takes to Hoʻohōkūkalani
Hānau o Molokaʻi, he moku
Born is Molokaʻi, an Island
Hānau o Lānaʻi ka ula, he moku
Born is Lānaʻi, sacred, an Island
Lili o pu punalua iā Hoʻohōkūkalani, hoʻi hou o Papa noho iā Wākea
Jealousy of Hoʻohōkukalani's relationship with Wākea, he returns to Papa
Hānau o Oʻahu, he moku
Born is Oʻahu, an Island
Hānau o Kauaʻi, he moku
Born is Kauaʻi, an Island
Hānau o Niʻihau, he moku,
Born is Niʻihau, an island
He ula a o Kahoʻolawe.
Sacred is Kahoʻolawe
ʻO Wākea noho iā Hoʻohōkūkalani
Wākea returns to Hoʻohōkūkalani
Hānau o Hāloa-Naka, he ʻeʻepa
Born is Hāloa-Naka, a shivering fetus
Kanu ʻia i ka ʻāina, ola ka mea ʻaina, he kalo
Interred in the land, sustenance sprouts forth, a taro plant
ʻO Wākea noho hou iā Hoʻohōkūkalani
Wākea returns to Hoʻohōkūkalani, yet again
Hānau o Hāloa, he kanaka.
Born is Hāloa, the first Man

Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr.

Introduction

In any venue, the natural elements, the physical elements, the human elements and all that remains as counterparts we recognize as the pulse of life. We further recognize what has brought us thus far and the generations of shoulders we stand upon, which give us power and strength. This proposal lends a voice to the generations of knowledge that have come before; we recognize it and remain committed to it.

The aforementioned genealogy chant of Papahānaumoku (Papa who births islands) and Wākea (Sky Father) generates relativity to our existence as native Hawaiians, our existence as *kalai ʻāina* or caretakers of the land and our undying responsibility to those whom shall make this home for generations to come. It is of utmost importance to recognize this particular genealogy to the relativity of this proposal.

"Hawaiian genealogies are the histories of our people. Through them we learn of the exploits and identities of our ancestors – their great deeds and their follies, their loves and their accomplishments, and their errors and defeats."[1]

To bring further relevance of the abovementioned genealogical recitation to this proposal, let its general concept be explained. Papahānaumoku and Wākea create a daughter, her given name is Hoʻohōkūkalani, meaning "to place stars in the heavens." It is a traditional belief that Hoʻohōkūkalani's responsibility was to decorate the night's sky with instruments to guide and navigate vessels. With these individuals there comes a human relationship, kinship and connection. Wākea and Hoʻohōkūkalani creates the sustenance and the first man through Hāloa-Naka and Hāloa, respectively.

This is where we find our responsibility and our commitment!

The fountain and foundation of Hālau ʻImi ʻIke Hōkū's concept is born from years of development amongst sacred landscapes that have come to be recognized as vessels of ancestral knowledge and power. Years passed before native Hawaiians grew their trembling concerns in to a powerful voice to mandate respect and compliance with cultural standards and protocols.

This concept is deep-rooted in these powerful voices that have found strength in ancestral ʻike or *knowledge*.

- Continue -

[1] Kameʻeleihiwa, Ph.D., Lilikalā. 1994 and 2003. *Native Land and Foreign Desires – Pehea Lā E Pono Ai?* Honolulu, Hawaiʻi: Bishop Museum Press

While there have been tremendous scientific developments while utilizing these sacred landscapes, no attention was honored to those whose ways, standards and protocols recognized these natural edifices as already existing observatories, without compromising the surrounding natural elements. It is arguably a well known fact that the ancestral knowledge that guided these islands, its ecology and people for hundreds of years, spoke to details that modern day science has yet to uncover.

This proposal seeks to establish a Center for Traditional Hawaiian Navigation and Astronomy (Center). The following proposal brings life and above all potential to the possibilities of traditional Hawaiian navigation and astronomy exploration.

We seek to validate our ancestral knowledge; a center of this sort would without doubt bring parity to our cultural and ancestral knowledge and voice.

We remain committed.

No nā hōkū!

Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr. (cont.).

Project Proposal

Hālau ʻImi ʻIke Hōkū: Center for Traditional Hawaiian Navigation and Astronomy

Proposal for Creation:

Hālau ʻImi ʻIke Hōkū: Center for Traditional Hawaiian Navigation and Astronomy be a collaboration of community and cultural resources to provide a venue to, *e ʻimi ʻike no nā hōkū* or to search or gather knowledge about the bright stars above. The Center's purposes will be to:

1. To create, produce, collaborate and administer curriculum for students from Kindergarten through Secondary and post secondary collaborations, which focus on traditional and modern astronomy and traditional Hawaiian navigation. This product would be for public and private uses.
2. Promote edification of traditional Hawaiian techniques in astronomy and navigation and to integrate these concepts with scientific knowledge and produce traditional interpretations of the universe and the understanding of the native Hawaiian relationship to the surrounding areas and World.
3. Prepare students of all ages with traditional knowledge and modern scientific techniques that would cause future interest in astronomy and establish native Hawaiian expertise in the subject.
4. Create and manage a scholarship fund for individuals seeking a post high education on the Island of Maui.
5. Create a planetarium with celestial bodies of the solar system that duplicate "traditional methods used by Hawaiians to travel thousands of miles throughout the pacific in double hulled canoes, using the knowledge of their natural elements and the traditional and native instincts as their guide.
6. The Center should be built at the time funding is approved for ATST by Congress. Proposals of this nature tend to be placed with non-priority issues. The completion date could be worked on by all parties involved.

In presenting this idea to Master Navigator Nainoa Thompson of the Polynesian voyaging canoe Hōkūleʻa, who sailed thousands of miles throughout the Pacific using traditional navigational methods, he felt that this method is the missing component in teaching the youth of Hawaiʻi about the brilliance and resilience of their ancestors and the enormous feats they accomplished thousands of years ago. He has committed his support and that of the Polynesian Voyaging Society to bring validation to this effort.

Hālau ʻImi ʻIke Hōkū: A Quest for the Stars 5

The potential of this Center could be enormous, but the more compelling reason is because it is right. A center of this magnitude possibly will produce world class Hawaiʻi/Maui-based scientists in this subject matter. Because of the training in these two worlds (Polynesian discovery and modern science), these future scientists and astronomers could bridge the past to the present and beyond. E ʻimi ʻike hōkū!

SUBMITTED MATERIALS TO ATST COMMUNITY MEETING

ORIGINALLY SUBMITTED BY:

Kahu Charles Kauluwehi Maxwell, Sr.

Hālau ʻImi ʻIke Hōkū: A Quest for the Stars 6

Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr. (cont.).

Concept Formulation

Purpose

The purpose of such facilities and programs is to reconnect threads of knowledge to weave into useful and applicable methods. These methods would compose an entire department to create, produce, collaborate and administer curriculum for students from Kindergarten through Secondary and create opportunities of partnership with post high institutions.

These opportunities are boundless, yet provide enough collaboration to provide a codified venue for serious cultural and intellectual discussions to occur.

Furthermore, through these facilities and programs, a valid concept, a voice perhaps, would grow from the ability to produce through research, ancestral knowledge of the universe and the understanding of the native Hawaiian relationship to the surrounding areas and World. These abilities may break ground to codifying standards for cultural protocol in sufficiently sacred areas.

This project is well over due and its fruition should not depend on the acceptance for federal funds that are tied to a controversial telescope. Native Hawaiians have had tremendous cultural resources eradicated on Haleakalā and other mountain tops we deem spiritual, because of the former and continual development of these sacred areas. A project of this sort would bring parity to our voice and allow us to address these damages through our educational components.

A portion of the facilities' operating budget would include funds to distribute to students seeking post high endeavors through out the Island of Maui.

Within the facilities a primary goal will be to build a world class planetarium with celestial bodies of the solar system that duplicate ancestral and traditional concepts and methods used by native Hawaiians to travel thousands of miles in the vast Pacific Ocean. This planetarium would further validate the voice of ancestral knowledge.

Through this entire movement, our overall purpose is to create, develop and nurture our *keiki* or children and providing a spark to their interest in traditional Hawaiian navigation and astronomy.

Target (Projected Partnerships):

In compiling such a proposal, the immediate question is, "To whom shall the applicability of such programs benefit?" To this end, our belief is that this shall benefit all who are interested in traditional navigation and this proposal's ultimate goal of heightening academic understanding of traditional Hawaiian astronomy and providing a codified venue for the Hawaiian voice. Additionally, to add to the target scope of our reach, this provides a venue for students from young to tenured professors to collaborate, envelop and produce quality materials.

The broader outlook of such a Center must be diverse in its dealings and partnerships. The following community sectors will be key in developing both the Center's outreach and venues.

United State Department of Education (USDOE)
We will bridge a partnership with the USDOE. This partnership will guide our ability to create sound curriculum that meets and/or exceeds the USDOE's guidelines on curriculum education. Further, the Center will seek to engage the USDOE in seeking standards for indigenous pedagogies, and for the first time codify a venue of this sort for an indigenous voice.

Hawai'i Department of Education (DOE)
Our partnership with the DOE will be crucial to making the Center an open and viable place of learning for all of the learning institutions under the DOE's purview. The focus of the Center's primary mission and outlook are these islands, therefore the commitment and the responsibility of our work is due in part to the DOE.

University of Hawai'i (University)
An absolutely crucial step in this process will be to create and sustain a relationship with the University. Many departments within the University's purview will become partners in many of the Center's goals and projects. An internship program in various departments in the University will be beneficial to both the center as well as the University.

University of Hawai'i – Institute for Astronomy (IFA)
IFA will be one of the most important partnerships created for this Center. IFA's new Kula office will be near the Center's proposed site. The relationship that will be established between the two institutions will provide a myriad of opportunities for students, staff and the international world of astronomy science. This will also be a chief method of distributing our findings on indigenous methodologies of navigation and astronomy.

Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr. (cont.).

County of Maui (County)
The County will be a necessary partner in moving forward. Our partnership will be necessary to accept government approval for permitting purposes as well as to recognize the Center as a qualified organization.

Association of Private Schools (Association)
Much like the DOE, the Association is an integral part of the Center's focused outreach. Some of Hawai'i's best and brightest attend private educational institutions. We would not want to miss the opportunity to extend our education outreach to these schools.

Private Sector
The private sector is also an important component to the overall vision of this Center. The private sector will allow the Center's business and community aspect to grow roots and bring in services that the private sector offers. In Hawai'i, we honor relationships, it is in this spirit that the private sector will become as important as any other component listed thus far. The Kamehameha Schools Maui campus is a neighbor to the Center's proposed site – the building of bridges are endless.

Polynesian Voyaging Society (PVS)
Being the only organization in Hawai'i for the last thirty years to create and implement sound education activities that encompass the traditional skill of navigation, wins them PVS the ability to boast. This is not the case, however. PVS recognizes its responsibility as a cultural organization, to bridge the understanding of their ancestors with the strength of the future to move forward. PVS has made a commitment to partner with the Center.

Target Area:

This proposal has benefits that would be applied State wide.

In the more immediate venue for targets, the facilities would be located on Maui, on the slopes of Kula. The proximity of the center to Maui's highest peak would be beneficial to the overall goal of the Center and its mission. The land that is available by Hui 'Ai Pōhaku, Inc. could be in no better location. The Center would be positioned perfectly at midpoint to Haleakalā, making the center an easy and accessible tourist attraction.

A recommendation of this proposal seeks to establish scholarships for individuals seeking post high financial assistance on the island of Maui. This financial assistance program will be beneficial to all who partake in such an award program.

The publications created by this organization will have great affect through the academic scheme to promote and codify ancestral knowledge and traditions. While Maui maybe home base for this organization, through our partnerships, the curriculum and publications created will have wide spread dissemination.

Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr. (cont.).

Target Range (Time Frame):

We propose the following time frames for various phases of this project:

Entity Creation *Present 2006 – March 2007*
During this time period, after all approvals and beginning of funding, all documents will be filed with respective sectors of government to create the necessary entities.

1. Draft organizational structure.
2. Implement organizational design.

Development Planning and Permitting: *January 2007 – January 2008*
This phase of the project encompasses a multifaceted approach to the onset of the facilities opening. In this period of time, the logistical matters of compiling a project of this magnitude will be completed such as:

1. Filing the necessary Federal, State and County documents and permits needed to acquire/lease the land for the facilities and to design and construct the site.
2. Create administrative positions.
3. Find individuals to fill administrative positions.
4. Bid for necessary architecture and construction services.
5. Build and bridge partnerships with State and private institutions.

Development of Strategic Educational Outreach *January 2007 – January 2009*
The strategic phase will coincide with the process to develop strategic partnerships. Some of our educational outreach will be dependent on strategic partnerships established in our communities.

1. Create administrative positions.
2. Conduct strategic planning phase for educational outreach.

Development of Strategic Partnerships *January 2007 – January 2009*
This period of work is essential in creating lasting partnerships that will provide an overall network of supporting organizations to carry through the Center's purpose and mission. These relationships will help to build and add to the character of the Center, its staff members, its publications and all arms and projects of the Center.

1. Create administrative positions.
2. Build strategic relationships in all sectors:
   a. Educational Institutions
   b. Government Branches
   c. Private Sector
   d. Various demographics

Construction of Facilities *January 2008 – January 2009*
This phase will ultimately be a culmination of all previous phases. The construction will give impetus to the work that must be done. The facilities will be located in Kula, Maui, Hawai'i. More information is described in the Facilities Proposal, further along in this proposal.

Entity Proposal

Overview

The entity structure of this center will be two fold. The overall entity will be incorporated in the State of Hawai'i as a limited liability for profit corporation. The latter portion and bulk of most intended enterprises will be a not-for-profit corporation administered by the limited liability company.

For-Profit Entity

The for-profit entity incorporated as a limited liability company (LLC) within the State of Hawai'i is envisioned to have the following responsibilities:

1. Manage and conduct all business of the entity and non-profit entity.
2. Forge business relationships to increase revenue to entity and Center.
3. Manage and conduct all employee management necessities as applicable by law.
4. Own through title all property, liquid assets, intellectual properties and remaining assets deemed fit by the organization.
5. Create a consultation division for cultural matters on Haleakalā.
6. Conduct any other business permissible by the Hawai'i Revised Statutes to a for-profit organization.

Additional methods to increase visibility of this entity will be to apply for Small Business Administration (SBA) Status 8(A) and SBA Status Super 8(A), should the organizational structure support the requirements of such statuses.

Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr. (cont.).

Non-Profit Entity

The non-profit entity incorporated within the State of Hawai'i and chartered as a 501(c)(3) tax exempt status organization by the Internal Revenue Service is envisioned to be the charitable foundation of the limited liability company (LLC) and to have the following responsibilities:

1. Create, conduct and manage all educational services of the LLC.
2. Manage, grant and award scholarship funds for individuals interested in post-high educational opportunities.
3. Bridge and create relationships with other non-profits throughout the nation with similar missions and visions.
4. Conduct any other business permissible to an IRS sanctioned not-for-profit organization.
5. Board members of the Non profit will be an array of individuals to community leaders to other business and non profit leaders in Hawai'i and Maui County.

Additional methods to increase visibility of this entity will be to apply for Small Business Administration (SBA) Status 8(A) and SBA Status Super 8(A), should the organizational structure support the requirements of such statuses.

Facilities Proposal

Overview

There will be two primary facilities. The main facility to house, conduct and implement majority of the services shall be known as the Center. The Center shall be built and operated on the island of Maui in the district of Kula.

There shall also be established an office center on the island of O'ahu. This office shall be primarily used to conduct all business for strategic relationships. Due to the amount of professional services offered on the island of O'ahu, this office shall remain an integral part of forging new relationships and sustaining those built.

Included in this facilities proposal will be estimated figures for construction, land management and facilities purchase and/or lease. The figures for up keep and maintenance will be addressed in the following section.

Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr. (cont.).

Maui Facility (The Center)

The Center will be a multi use facility. In proposing, designing and constructing the Center, its use by the public and various institutions will be kept at the forefront through these stages.

The following are estimate figures of current market prices. It must be considered that because we are dealing with volatile land prices, these figures could certainly change from month to month and no doubt from year to year.

Land: There is a commitment from an IRS 501 (c)(3) charted not-for-profit organization, Hui ʻAi Pōhaku, Inc., to lease their 5 acres of prime real estate in Kula, Maui. This potential site is near the University of Hawaiʻi's Institution for Astronomy's new center in the Kulamalu District.

Facility: The facility will consist of the following amenities:

1. A state-of-the-art planetarium
2. A museum-like display for educational institutions/visitors
3. A café/restaurant
4. Cultural facilities: *Pā Hula, Kuahu, Ahu ʻAumākua*
5. State-of-the-art Office/Conference Center
6. State-of-the-art research center
7. Grounds to host all native Hawaiian plants of the area

Costs:

Subject	*Cost*	*Terms*	*Notes*
	Land Fees		
Land	$ 500,000.00	Per year	5 acre parcel in Kula, Maui. The parcel is not developed and has the specified certifications required for a center of this sort.
Land Adjustments	$ 1,500,000.00	To build	The current property offered by Hui ʻAi Pōhaku, Inc. is 5 acres which sits on a 45 degree slope. To make the best use of the

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Subject	*Cost*	*Terms*	*Notes*
			land, some portions would require grading in order to make the space provided effective enough to conduct business.
	Facilities Breakdown		
Planetarium	$ 7,500,000.00	To build	The planetarium will be a state-of-the-art center. It would boast the most accurate interpretations of western and traditional astronomy information.
Center's Exhibit and Displays Arena	$ 5,000,000.00	To build	The Center's Exhibit and Display area will host all that the public and visitors should know about Hwn Navigation and Astronomy.
Café/Restaurant	$ 2,000,000.00	To build	The Café/Restaurant will add a unique venue to this center. This venue will make the center more approachable. When business hours are done, the area could be rented for special events.
Cultural Facilities: *Pā Hula* – Hula Mound *Kuahu* – Alter in honor of the surrounding area *Ahu ʻAumākua* – Alter to honor the area's deities.	$ 1,500,000.00	To build	The Cultural Facilities will give the center an even more unique venue. We envision the cultural facilities to be used by area cultural practitioners and organizations.
Office, conference and research center	$ 7,500,000.00	To build	These resources will house the "power house" and purpose for such a center. The nice exhibits and planetarium is great to have in this center, but to expand the concept

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Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr. (cont.).

			of traditional Hawaiian navigation & astronomy, an office, conference and research center of this caliber must exist.
Grounds to reflect native fauna of the area	$ 750,000.00	To plant	To increase the concept of the work place and the visitor center, it would be fitting to surround the grounds with the native plants of the area.
Overhead Costs	$ 5,000,000.00		These costs included that for drafting services, advisory and administrative services.

Oʻahu Office (Office)

The Office that will be established in Honolulu will be used for strategic relationship building. This is crucial to the Center's existence. In order to grow as an organization and institution, the Center will need continually harness new relationships.

The office will also act as a liaison with many of the preconceived partnership. Many of the institutions, organizations and/or branches of government listed as strategic partners, house their own headquarters on the Island of Oʻahu. To make our relationships more productive we must be able to be in close contact with them.

Therefore, this office will serve its purpose on the Island of Oʻahu.

Options

Leased Facility: A leased facility may offer much in its ability to change venues, keep start up costs low.

Purchased Facility: A purchased facility may also offer much in the long run. A facility of this sort will keep overhead costs lower in the long run.

Subject	*Cost*	*Terms*	*Notes*
Leased Facility	$ 50,000.00	In the onset	A facility of this sort may keep cost low in the front end.
Purchased Facility	$ 3,000,000.00	Purchase	The office could become the property of the LLC and used in anyway deemed fit by the LLC. This could make our ability to expand easier.
Total Projected Construction Costs	**$ 32,250,000.00**		This is the request for funding of the construction of the facilities.

Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr. (cont.).

Projected Annual Operating Budget

Overview

This portion of the proposal will encompass a projected budget for staff salaries, overhead, upkeep and maintenance of the facilities, the scholarship, and as well other incidentals.

Maintenance Budget

Item	Cost	Cycle	Terms/Total
Land Lease	$43,402.92	Per month	$520,835.00
Electricity Costs	$2.88/kwh @ 35,000 hours	Per year	$ 100,800.00
Water Costs	$2.40/gallon @ 50,000	Per year	$ 120,000.00
General upkeep and supplies	$175,000.00	Per year	$ 175,000.00
O'ahu Office Lease plus expenses	$15,000.00	Per month	$ 180,000.00
O'ahu Office Expense	$ 6,000.00	Per month	$ 72,000.00
	TOTAL		$ 1,168,635.00

Staff Budget

Color Reference: Administration | Support Staff | Maintenance Staff

Position No.	Item	Cost	Cycle	Terms/Total
01A	President and CEO (LLC)	$ 150,000.00	Per year	$ 150,000.00
-	CEO Expenses	$ 15,000.00	Per year	$ 15,000.00
02A	Exec VP & Executive Director of the Non Profit	$ 125,000.00	Per year	$ 125,000.00
	EVP/ED Expenses	$ 10,000.00	Per year	$ 10,000.00
03A	VP of Business Development	$ 100,000.00	Per year	$ 100,000.00
04A	VP of Government Relations	$ 100,000.00	Per year	$ 100,000.00
05A	VP of Strategic Relationships	$ 100,000.00	Per year	$ 100,000.00
06A	VP of Educational Services LLC and Non-Profit	$ 100,000.00	Per year	$ 100,000.00
07A	VP of Cultural Relations and Protocol	$ 100,000.00	Per year	$ 100,000.00
08A	Controller	$ 90,000.00	Per year	$ 90,000.00
09A	Director of Operations	$ 90,000.00	Per year	$ 90,000.00
10A	Human Resources Director	$ 90,000.00	Per year	$ 90,000.00
11A	Research Director	$ 90,000.00	Per year	$ 90,000.00
12A	Information Technologies Director	$ 80,000.00	Per year	$ 80,000.00
13A	Head Chef	$ 70,000.00	Per year	$ 70,000.00
14A	Facilities Manager	$ 60,000.00	Per year	$ 60,000.00
15A	Planetarium Facilities Manager	$ 60,000.00	Per year	$ 60,000.00

Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr. (cont.).

16A	Café/Restaurant Manager	$ 50,000.00	Per year	$ 50,000.00
17A	Facilities Safety Director	$ 50,000.00	Per year	$ 50,000.00
18A	Exhibits Education Director	$ 50,000.00	Per year	$ 50,000.00
01S	Assistant to the President & CEO	$ 55,000.00	Per year	$ 55,000.00
02S	Assistant to the Executive VP/ED	$ 55,000.00	Per year	$ 55,000.00
03S	Administrative Chief of Staff Assistant to the Vice Presidents	$ 55,000.00	Per year	$ 55,000.00
04S	Office Administrator O'ahu Island	$ 55,000.00	Per year	$ 55,000.00
05S.1 05S.2 05S.3 05S.4	Research Assistants	$ 50,000.00	4 per year	$ 200,000.00
06S.1 06S.2	Exhibits Technicians	$ 50,000.00	2 per year	$ 100,000.00
07S.1 07S.2	Information Technologies Technician	$ 50,000.00	2 per year	$ 100,000.00
08S	Administrative Assistant Non Profit	$ 30,000.00	Per year	$ 30,000.00
09S	Administrative Assistant LLC	$ 30,000.00	Per year	$ 30,000.00
10S	Human Resources Assistant	$ 30,000.00	Per year	$ 30,000.00
11S	Facilities Safety Assistant	$ 30,000.00	Per year	$ 30,000.00
12S	Planetarium Assistant	$ 45,000.00	Per year	$ 45,000.00
13S	Facilities Assistant	$ 30,000.00	Per year	$ 30,000.00
14S.1 14S.2	Cultural Staff Full Time	$ 32,000.00	2 per year	$ 64,000.00

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15S.1 15S.2 15S.3 15S.4 15S.5	Education Staff - Full Time	$ 32,000.00	5 per year	$ 160,000.00
16SP.1 16SP.2 16SP.3 16SP.4 16SP.5	Education Staff - Part Time	$ 16,000.00	5 per year	$ 80,000.00
01M	Janitorial Supervisor	$ 40,000.00	Per year	$ 40,000.00
02M.1 02M.2 02M.3 02M.4	Janitorial Staff	$ 25,000.00	4 per year	$ 100,000.00
03M	Maintenance Supervisor	$ 40,000.00	Per year	$ 40,000.00
04M.1 04M.2 04M.3 04M.4	Maintenance Staff	$ 30,000.00	4 per year	$ 120,000.00
05M.1 05M.2 05M.3 05M.4	Facilities Safety Staff	$ 30,000.00	4 per year	$ 120,000.00
06M.1 06M.2 06M.3 06M.4	Café/Restaurant Staff Full Time	$ 25,000.00	4 per year	$ 100,000.00
07MP.1 07MP.2 07MP.3 07MP.4 07MP.5 07MP.6	Café/Restaurant Staff Part Time	$ 11,000.00	6 per year	$ 66,000.00
		TOTAL		$ 3,285,000.00

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Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr. (cont.).

Department Budgets

Administrative	$ 200,000.00	Per year	$ 200,000.00
Business Development	$ 250,000.00	Per year	$ 250,000.00
Government Relations (LLC)	$ 100,000.00	Per year	$ 100,000.00
Strategic Relations	$ 250,000.00	Per year	$ 250,000.00
Educational Services (LLC)	$ 250,000.00	Per year	$ 250,000.00
Educational Services (Non-Profit)	$ 500,000.00	Per year	$ 500,000.00
Cultural Relations and Protocol	$ 100,000.00	Per year	$ 100,000.00
Marketing & Public Relations	$ 200,000.00	Per year	$ 200,000.00
Scholarship Fund	$ 1,000,000.00	Per year	$ 1,000,000.00
University of Hawai'i Cultural Relationships	$ 2,000,000.00	Per year	$ 2,000,000.00
		TOTAL	$ 4,850,000.00

Budget Analysis

# of Admin Positions	18
# of Support Positions	30
# of Maintenance Positions	24
Total # of Positions	72
Average Salary	$ 45,625.00

Projected Annual Operating Budget

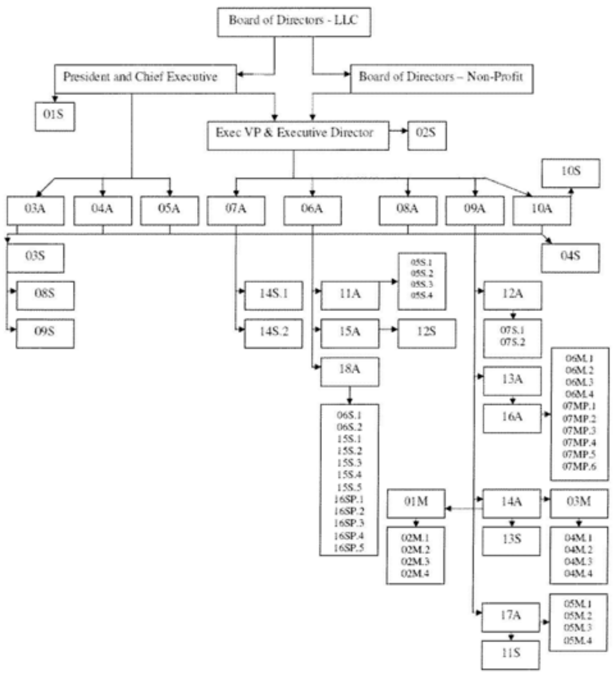
Budget Type	Subtotal
Maintenance Budget	$ 1,168,635.00
Staff Budget	$ 3,285,000.00
Department Budget	$ 4,850,000.00
TOTAL OPERATING BUDGET	**$ 9,303,635.00**

Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr. (cont.).

Organizational Chart

Overview

The following is an organizational flow chart. The position titles are referenced in the previous section. A chart of this sort is important in the long term vision, this helps to establish order and a sound cadence to responsibilities.



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Conclusion

Overview

A voice that knows this land better than the rest; is the same voice that has been used to summon the Sun atop Hawaiʻi's highest peaks; is the voice that has perpetuated the history of these islands; it is this chorus of voices that remind us to care for these islands, to respect the area in where we live and in turn will treat us the same.

This is the voice that needs a larger audience, this is our native voice that must be heard and understood.

This proposal seeks to establish a Center for Traditional Hawaiian Navigation and Astronomy (Center). The following proposal brings life and above all potential to the possibilities of traditional Hawaiian navigation and astronomy exploration.

We thank you for the opportunity to entertain this vision, this compilation of knowledge, this necessity to hear our voice.

We remain committed!

Contacts:

Kahu Charles Kauluwehi Maxwell, Sr.
157 ʻAleʻa Place
Makawao, HI 96768
808.572.8038
http://www.moolelo.com
kale@moolelo.com

Adrian Kamalaniikekai Kamaliʻi
1050 Kīnaʻu Street, STE 706
Honolulu, HI 96814
808.599.8705
http://www.paeaina.com
adrian@paeaina.com

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Figure 5-17. Detailed Proposal Submitted by Kahu Charles Kauluwehi Maxwell, Sr. (cont.).

Testimony on Advance Technology Solar Telescope proposed to be housed on UH Institute of Astromony, Haleakala High Altitude Observatories, Haleakala, Maui.

Good evening members of this panel and audience. I am Warren Shibuya. I am a returning Maui resident after retiring from the Space & Missile Systems Center in El Segundo, California. Mahalo for allowing me to present my testimony.

I support basic and applied research and proposed housing of Advanced Technology Solar Telescope (ATST) systems, a project within the 18.166-acre University of Hawaii Institute for Astronomy (IfA), Haleakala High Altitude Observatories (HO) site at the summit of Mt. Haleakala, Maui, Hawaii.

I ask you and all project members to behave respectfully and malama mau ka lá a, preserve the sacredness of Haleakala, specifically the summit area. Proper cultural respect should be demonstrated by ATST project and other projects housed at Haleakala High Altitude Observatories site, especially while sharing very sacred summit grounds.

As you well know, Haleakala is home to all 40,000 Hawaiian gods and goddesses. Haleakala is spiritual power and home of inspired Hawaiian beliefs, besides being physically inspiring. Haleakala's summit, or Kolekole, is near wao akua, a level of earth stratosphere where gods and goddesses are believed to reside and culturally guide everyday living. Ala Hea Ka La, "the path to calling the sun," presents basic rhythms of night and day and establishes the sun being source of life for Kanaka Maoli, Hawaiians, and citizens of Maui and Hawaii.

In ancient days, Kolekole was site where Kahuna Pó o, High Priests, consulted with gods and goddesses to answer difficult questions and delve tough issues. Astronomy, aerospace and solar study efforts at Kolekole should be respectful of wao akua, sacred area above the summit and lava, the essence of Goddess Pele, despite her current home at Kilauea caldera. Special care should be exercised in digging, saving lava and restoring earlier pù u, hills and wahi pana, and minimizing invading airspace, all Sacred places.

To demonstrate proper respect, let us all do it right, as kapó e kahiko, or ancient people respected and admired Kolekole. Recommend Institute for Astronomy immediately remove intrusive, unused or excess facilities, poles, antenna, lines, signs and roads; immediately begin respectfully restoring Kolekole to it's ancient topology and it's historic

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Figure 5-18. Proposal Submitted by Warren Shibuya, March 27, 2006.

Testimony on Advance Technology Solar Telescope proposed to be housed on UH Institute of Astromony, Haleakala High Altitude Observatories, Haleakala, Maui.

and highly sacred configuration. Further, rename summit roadways to more appropriate kapó e kahiko names, thus demonstrating sacred wahi pana, respect of Kolekole.

Today, ATST nobly seeks to observe and carefully study turbulent forces of our Sun, which affects life on Earth from a sacred site. As mentioned, Kolekole wahi pana was used by Kahuna Pó o, High Priests, who consulted with gods and goddesses to answer difficult questions, delve and resolve tough issues. Today, inaddition to consulting gods and goddesses and accommodating visitors, the scientific community is permitted to seek answers to heavenly questions through use of high technology telescopes and systems, computerized instruments, all housed in large structures. As Kahuna Pó o shared gained insights with Maui residents, I ask ATST technology and other Haleakala IfA investigations and gained knowledge be regularly shared with host Maui and Hawaii State's people, to include keiki, kapuna, Kamaaina and malama aina groups.

Shared knowledge and expressions of appreciation be given to Mauians, such as support for Hawaiian education, culture, arts, soveign rights and law, language programs and scholarships to pursue learning at higher institutes, centers and universities. Of course, Mauians should be employed with all projects on Haleakala.

I remind you and other agencies operating in sacred wahi pana of Demi God Maui and other gods and goddesses, that your viewing or looking through Wao Akua, where gods reside, is invasive and not polite etiquette or behavior of a guest. Peeping through a neighbor's home is privacy-invasive and by our laws could be a misdemeanor crime.

Western culture dictates, "It is most proper for a guest visiting a home, to express appreciation to the host with fists filled with gifts." In no case should guests visit with closed fists, especially when visiting the sacred "House of the Sun." I am embarrassed to remind you of proper etiquette. I truly trust you know and will do the right things to demonstrate your most honored respect of the host's customs and beliefs. Maui kanaka maoli and kamaaina should not need to tell terms to you more succinctly and emphatically.

I am no expert on Hawaii's culture, but simple analogies mentioned should be more than adequate for respectful understanding and behavior of Hawaiian and visiting non-Hawaiian members. Hawaiian culture is founded on love and respect for each other,

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Figure 5-18. Proposal Submitted by Warren Shibuya, March 27, 2006.

Testimony on Advance Technology Solar Telescope proposed to be housed on UH Institute of Astromony, Haleakala High Altitude Observatories, Haleakala, Maui.

family ohana, the aina which provides life sustenance, the importance of the sun and the deep felt reverence for wao akua.

Mahalo for allowing me to express my support for scientific pursuits for knowledge, expressing my thoughts and trust you and other visiting agencies will demonstrate your appreciation to Maui's citizens.

Figure 5-18. Proposal Submitted by Warren Shibuya, March 27, 2006.

TESTIMONY: Advanced Technology Solar Telescope Project for Haleakala Summit, 27 August 2008.

Aloha members of National Science Foundation, National Solar Observatory, University of Hawaii Institute for Astronomy, KC Environmental, Inc., and fellow Maui residents.

Mahalo for this opportunity to testify on the Advanced Technology Solar Telescope (ATST) project proposed for sighting on the summit of Haleakala Mt, Maui. I am Warren Shibuya, a retired employee of the Space & Missile Systems Center.

I listened carefully to numerous testimonies and testified on the sacred grounds and worked with representatives of the National Science Foundation (NSF), National Solar Observatories (NSO), UH Institute for Astronomy (UH IfA), Maui Community College, KC Environmental, Inc. and various groups to reach a workable arrangement amongst various very valid community interests and concerns, as reflected in ATST EIS.

I am encouraged to believe a working agreement can be attained, based on mutual respect and trust. I do not represent any interest group or agency. I am a Maui resident who worked in leading edge technology for most of my 32 working and learning years. I want Maui and Hawaii residents having a similar window of opportunity to invest and develop their lives in a new industry in Hawaii; knowledge-based on studies of science, technologies, engineering, math, English, law and Man's cultures.

The sacredness of Haleakala summit can be respected and shared for a while. Kahuna Po'o, High Priests consult with gods and goddesses seeking answers on difficult and tough issues at Kolekole, so should solar scientists seeking answers on an important heavenly body, our sun. Basic knowledge on our sun, obtained by scientists will be shared openly with residents, visitors and the world!

Further, if ATST project permitted to study and share information at Haleakala, the ATST project will be for four sun-cycles. At conclusion of study, all ATST facilities and structures removed and Pu'u restored. This is a landmark project contract, first to be initiated anywhere on Earth! This is an awesome precedence, demonstrating significant project respect and working together, sharing and maintaining sacred Kolekole, together seeking answers on difficult issues and understanding our life-giving sun.

Remember today, everyone, including Kahuna Po'o and Kanaka Maoli, residents and visitors visit Haleakala Summit, except for set-aside areas. Each respectfully observing in their caring way Ala Hea Ka La, "the path to calling the sun."

Other features in proposed ATST project include the following agencies NSF, NSO, UH IfA, State, Maui Community College contributing to workforce development programs on Maui developing workers to work with the ATST project. This workforce development program exceeds OJT (on-job-training) to include funds supporting studies of mathematics, physical and gaseous sciences, solar physics, thermo and plasma dynamics, engineering, and Hawaiian Culture. I want MCC establishing a 4-year University of Hawaii College of Sciences, Technology and Engineering on Maui, emphasizing the close partnership with ATST project, NSF, NSO and UH IfA. This is a rare opportunity to mentor and bootstrap interested and talented students into solar sciences and engineering.

Figure 5-18. Proposal Submitted by Warren Shibuya, August 28, 2008, Page 1.

TESTIMONY: Advanced Technology Solar Telescope Project for Haleakala Summit, 27 August 2008.

Unfortunately, current state-of-the-art technology limits studies of our sun from Earth-bound or a ground observatory. Perhaps, through ATST project's four sun-cycle studies, advanced developments in engineering and space technology could lead to a space-based solar observing platform. NSF and NSO thoroughly researched world sites and Haleakala is the best site to support such an expensive and 'glass breaking' research project. I feel solar breakthrough knowledge will result from proposed ATST project!

As initially suggested by Uncle Charlie K. Maxwell, I support ATST project helping establish a Maui Solar and Hawaiian Culture Center, featuring staff, multimedia facilities and systems to share information, educate and ignite passions and encourage Maui students getting needed skills and seek ATST employment. This cultural center informs Hawaiian Polynesian Culture through programs. This Center would display and explain on-line solar images and solar disturbances and relate associated impacts on Earth and satellite communications, our Earth environment and even Astronauts in space. The Center would present customized curriculum or presentations for residents, students, educators and visitors. Maui Solar and Cultural Center would proudly integrate ancient Polynesian navigational skills, share Ohana concept, and Malama Aina skills, accomplishments and beliefs.

ATST project adopting in written contract, a "Sunset" for all ATST structures and program at Kolekole is respectful. This precedent setting "Sunset clause" directs removal of ATST structures and restoring used summit grounds to original Sacred configuration. This respectful concept is resulting in UH Institute for Astronomy discussing plans to remove historical radio telescope structure, used in early 1950's by UH Professor Dr. Grote Reber and working toward renaming service roadways and facilities with Hawaiian designations or names currently posted at the Haleakala Summit.

From 2005, I continue supporting implementing the Advanced Technology Solar Telescope project at the Haleakala Summit and ATST concluding following four sun-cycles. I support this rare opportunity for Maui residents learning first-hand and gaining knowledge while growing with this leading edge, basic scientific and engineering research project. I look forward getting more knowledge on our sun for our following generations!

Mahalo for your patience, understanding and support!

Mahalo nui loa.

Warren S. Shibuya
35 Kulamanu Circle, Kula Maui, HI 96790-8273

Figure 5-18. Proposal Submitted by Warren Shibuya, August 28, 2008, Page 2.

University of Hawai'i

MAUI COMMUNITY COLLEGE

Office of the Chancellor

May 14, 2007

Dr. Charlie Fein
P.O. Box 1208
Makawao, HI 96768

Dear Dr. Fein:

In the interest of the possibility of the Advanced Technology Solar Telescope materializing, we are submitting a mitigation proposal on behalf of the interest of the future of Native Hawaiians. The proposal addresses their historical and continuing relationship with Haleakala and the substantial career development opportunities that will integrate and fully appreciate the potential positive outcomes between science and culture.

Should you have any questions please feel free to contact me on behalf of the Native Hawaiian interest in fulfilling careers in science and technology that may be connected to Haleakala.

Sincerely,

Clyde M. Sakamoto
Chancellor

310 W. Ka'ahumanu Avenue, Kahului, HI 96732-1617
Telephone: (808) 984-3636, Facsimile: (808) 984-3546, http://mauicc.hawaii.edu
An Equal Opportunity/Affirmative Action Institution

Figure 5-19. Proposal Submitted by Maui Community College, Page 1.

AKEAKAMAI I KA LĀ HIKI OLA

Scientific Exploration Beneath The Life-Bringing Sun

MITIGATION PROPOSAL

ADVANCED TECHNOLOGY SOLAR TELESCOPE
HALEAKALĀ, MAUI

MAUI COMMUNITY COLLEGE

Figure 5-19. Proposal Submitted by Maui Community College, Page 2.

PROJECT OVERVIEW

Maui Community College (MCC), in Kahului, Hawaiʻi, is presenting a mitigation proposal in response to the National Science Foundation's (NFS) application to erect the Advanced Technology Solar Telescope (ATST) upon the summit of Haleakalā. With the submission of this draft plan, MCC offers to mitigate the hurtful and harmful impacts troubling the Native Hawaiian community in respect to the NSF's request to construct and manage the ATST.

We propose to request funding to establish *Akeakamai I Ka Lā Hiki Ola* (AIK) as a mitigation initiative. The main goal of AIK will be to improve the achievement success of Native Hawaiians in math and science. Thus, the outcome will be an improvement in the social and economic well being of Native Hawaiians. In essence, AIK will endeavor to raise the academic success of Native Hawaiians in Science, Technology, Engineering, and Math (STEM) whereby growing workforce advancement and job opportunities for Native Hawaiians in high-technology trades and industry.

AIK will enhance the institutional, instructional, and curriculum effectiveness in serving the Native Hawaiian Community via the integration of the most up-to-date technology, pedagogy, and research into classrooms. In addition to the curriculum, STEM teachers will be offered the chance to receive proper training to implement this dynamic and innovative teaching initiative.

Another facet of this program will be to offer culturally responsive student cohorts—model to complement the Native Hawaiian students' values and responsibilities—as a means to elevate the retention and achievement rates of Native Hawaiians in STEM programs at MCC. Additionally, AIK will strive to strengthen MCC's existing partnerships with the Native Hawaiian Community, Private Industry, and the Public Sector in teaming up with students to assist them in increasing their workforce potential and job placement.

To advance the feasibility of this collaboration, more resources than may be available from one or another source may be required. A ten-year period would be the time within which a generation of young Native Hawaiians would have experienced the full cycle of the proposed development. In addition to a National Science Foundation leadership investment, other public and private resources would be collaboratively approached. The intent of this exploration is

Figure 5-19. Proposal Submitted by Maui Community College, Page 3.

to characterize the overall architecture of a future that must be cooperatively designed.

<u>BACKGROUND</u>

The intention of this mitigation proposal is to explore the potential for mitigating the impact of the proposed ATST on Haleakalā. As the history and record of testimony of Haleakalā as a holy site and a *wahi pana,* or celebrated, noted, or legendary place, of the Native Hawaiian people are recognized and can be further detailed in a subsequent submission, this exploration attempts to present an opportunity to uncover support for a new relationship between the celestial, solar, astrophysical and other scientific and technological fields of knowledge and the depths of the Native Hawaiian cultural, spiritual, and historical resources to restore a more appropriate balance between science and the host Native Hawaiian culture.

This overture recognizes the reality of Haleakalā having been historically ignored as a significant and cherished spiritual icon in Hawaii. It additionally acknowledges that while there have been initiatives correct this desecration, the opportunity to elevate the contribution and importance of the Hawaiian culture and people in forging a constructive and leadership role in pursuing the cultural and scientific knowledge afforded by the Haleakalā site has never before materialized, been supported or seriously considered. The basis for this attempt acknowledges the limitations of past discussions and experiences. This exploration seeks to understand the authenticity of a response to mitigate the impact of a physical and scientific presence atop the Haleakalā summit that would further compromise the spiritual integrity of the site.

This proposal stems from an underlying assumption of the value of the sun as a primary source of energy and life itself ... a recognition shared by our *kūpuna* and scientist alike. Some of the principles offered for mutual consideration include:

- That the future impact of Haleakalā as a spiritual place will be irretrievably and irreversibly affected by a significant and obtrusive structure;
- That the further physical and spiritual intrusion on the summit could possibly diminish the relationship between science and the Hawaiian culture;

Figure 5-19. Proposal Submitted by Maui Community College, Page 4.

- That the promise of a potential initiative related to the Haleakala Summit that must accept the co—responsible roles of culture and science and prospect of significant contributions from each realm;
- That the balance between the place of the Hawaiian culture and science must be righted by the appropriate elevation of Native Hawaiians to leadership roles in the education, research, and interpretation roles of the future of Haleakala;
- That the process of preparing the next generation of Native Hawaiians must begin at all levels simultaneously but especially to build and restore the confidence and performance of Native Hawaiian elementary students in math and science through affording access to mentors who can provide meaningful contexts and curricula in math and science related to the work atop Haleakala;
- That the continuation of a strong foundation leverage the Hawaiian communities, schools, and college programs in the community to enlist all who may be committed and willing to support a vital cultural and scientific leadership role for Native Hawaiians and eventually other minorities as well who would adopt the principles, education and research that would sustain this initiative;
- That middle, high school, college bridge programs, internships, associate/bachelor/graduate degrees must be part of a long-term investment strategy that will require many partners, employers, political leaders, and all sectors of government and educational leadership;
- That existing partnerships among the UH Institute for Astronomy, Center for Adaptive Optics at UCSC, the Maui District Department of Education; Hawaii, Kauai, and Leeward Community Colleges; the Women in Technology Program; and the Polynesian Voyaging Society;
- That out of profound respect and appreciation for Kahu Charles Maxwell's leadership, that the education, training and research programs would seek to utilize his proposed facilities and expertise;
- That the value of the constructive inter-relationship between the Hawaiian culture and astronomy, astrophysics, adaptive optics/photonics and other sciences will return sustainable careers for the considerable investment and launch a more broadly supported important sector of the Maui Economy;
- That as UH-Maui Community College represents, at the moment, the largest adult and higher education facility on Maui; and that although all may not agree with this initiative, there is a sufficient cross-section among faculty, staff and administration who support the exploration of a project that may place Native Hawaiian students, faculty, staff, and ultimately

Figure 5-19. Proposal Submitted by Maui Community College, Page 5.

technicians and scientists at the forefront of leaders who would research and apply the findings of the ATST for the local, national and global benefit;

- That as the education, training, research, analysis, and interpretation related to Haleakala materialize with Native Hawaiian involvement and leadership that other scientific and technological alternatives (health, alternative energy, waste management, etc.) will emerge to offer Native Hawaiians and others in our community with opportunities and exemplary paths for success;
- That the complement of a science and technologically based curricula grounded in the context of a Hawaiian culture would be a teacher preparation initiative offering added career paths and addressing a local, statewide, and national need for science educators;
- That the prominence of the Native Hawaiian cultural influence on science will have a positive impact on other fields including the arts, social sciences, etc. to suggest other creative solutions that connect culture and discipline content with new possibilities and solutions;
- That this document is offered as a draft to invite insights and principles that would further strengthen the future for Native Hawaiians;
- And that finally, more than resources, a spirit of collaboration at higher level and a commitment to a broader purpose that will make a sustainable difference for Native Hawaiians and for the science of solar astronomy are the essence of this exploration.

GOALS

Goal 1. - Grow the capacity and number of Native Hawaiians majoring in Science, Technology, Engineering, and Math

Goal 2. - Increase the proficiency and skills of pre-college and post-secondary Native Hawaiian students in Science, Technology, Engineering, and Math

Goal 3. - Cultivate and reinforce the intersection of Hawaiian culture and knowledge with Science, Technology, Engineering, and Math courses, programs, certifications, and degrees.

Goal 4. - Expand the job opportunities of Native Hawaiians for employment in Science, Technology, Engineering, and Math related careers

Figure 5-19. Proposal Submitted by Maui Community College, Page 6.

METHODS

Activity I - Develop and implement an innovative Math and Science curriculum and program based on Hawaiian cultural knowledge and worldview.

A team of MCC instructors, educational specialists, scientists, engineers, and technical staff will collaborate to frame a specialized curriculum using the framework of Hawaii's distinctive physical environment, technological assets, and cultural heritage. An intersection of Hawaiian Studies, Science, and Math in the curriculum will promote academic success for Native Hawaiian students.

The activity will target the development of a pioneering Algebra I and Introduction to Physical Science. All curriculums will be bi-lingual—Hawaiian and English—and meeting the Hawaii Content Standards. Classroom testing and Teacher training workshops will be included.

Curriculum will be accessible to all via Internet. It will be multi-media based, disseminating from the AIK Website; text, PowerPoint, streaming, DVD, video, pod casting, and Poly COM video-conferencing.

Activity II - Build up relevant coursework and dedicated programs at Maui Community College

This activity will support the role that MCC plays to increase the success of Native Hawaiian students by establishing and expanding the offering of relevant STEM coursework and job opportunities.

AIK will expand MCC programs to increase specialized training, certification, & training opportunities. In addition, AIK will strive to improve MCC's A.A.S. STEM programs and its community and industry relationships. Also, AIK will expand academic opportunities for Native Hawaiians to earn B.S degrees in STEM and related career pathways at MCC.

AIK will labor to increase STEM majors and interest by offering for credit STEM courses in high schools. These courses will articulate for credit at MCC and hence attempt to increase the matriculation number of Native Hawaiians into STEM programs.

Figure 5-19. Proposal Submitted by Maui Community College, Page 7.

This activity will concentrate on building bridges into STEM careers by integrating Hawaiian Studies, Science, and Math. Programs may focus on; Cultural and Natural Resource Management, Biology, Environmental Restoration, Adaptive Optics, Engineering, and Astronomy.

Activity III – Significantly increase the number and retention of Native Hawaiian students in STEM courses and programs at Maui Community College

This activity will develop and administer cultural based student support services that will include the coordination and support for Native Hawaiian STEM student cohorts at MCC. This activity will endeavor to improve the achievement and retention rates of Native Hawaiian students in STEM programs at MCC.

Cohorts:

- High School Cohort
    - 40 Native Hawaiian students
    - Bridge Programs
- STEM Internships
    - 40 Native Hawaiian students
    - MCC/4-year/Advanced degrees
- STEM Cohort
    - 40 Native Hawaiian students
    - MCC/4-year/Advanced degrees
- Teacher Cohort
    - 40 awards
    - Teachers/instructors/professors

AIK will put together and manage a Hawaiian Science Lab to offer computer access, technology training, tutorial services, workshops, and to serve as the academic hub to supply meaningful academic support services to Native Hawaiian students.

Activity IV- Cultivate and develop an experienced, highly skilled, and well-favored Native Hawaiian workforce for STEM related industries and careers.

This activity will focus on directing student internships, training, and skills so that they will successfully find employment in the high-technology industry on Maui. AIK will manage an internship program that will provide necessary

Figure 5-19. Proposal Submitted by Maui Community College, Page 8.

certification, training, and experience in order for students to gain field experience, job requirement, and skills to land highly desired internships.

AIK will establish and strengthen partnerships with high-tech industries in the public and private sector to open opportunities for internships, workforce practicum, and job placement.

BUDGET

	SUMMARY OF CATEGORIES	Budget Request
1	SALARIES	$650,000.00
2	FRINGE BENEFITS	$226,100.00
3	EQUIPMENT	$165,000.00
4	TRAVEL	$116,000.00
5	CONSUMABLE SUPPLIES	$48,000.00
6	CONTRACTUAL SERVICE	$225,000.00
7	OTHER DIRECT EXPENSES	$87,500.00
8	TOTAL, DIRECT COSTS (1-7)	$1,517,600.00
9	TOTAL, INDIRECT COSTS	$414,305.00
10	PARTICIPANTS SUPPORT COSTS	$560,000.00
	TOTAL: Fed. Funds Requested (8+9+10)	**$2,491,905.00**

PERSONNEL

- Project Director
- Administration and Fiscal Support
- Academic Specialist
- Program Support Specialist
- Cohort Support Specialist
- Cohort Counselor

Figure 5-19. Proposal Submitted by Maui Community College, Page 9.

- Curriculum Specialist
- Hawaiian Studies Instructor
- Math Instructor
- Science Instructor
- Hawaiian Science Lab Coordinator

FUNDING

In order to successfully mitigate the ATST project, MCC proposes that **ten percent (10%) of all funds allocated and utilized in the construction and for the operation of the ATST** be set aside to generate an endowment to administer AIK at MCC. As such, we anticipate that a sum of $ 250 million will be spent to construct and run the ATST. Using that figure, we propose that an estimated $25 million should be allocated to MCC for the next 10 years. Thus, MCC is putting forward a budget of $2.5 million for the initial year of the project.

PROPOSED PARTNERS

- Hui ʻAi Pōhaku (HʻAP)
- The Poʻokela Project (PP)
- The Hoʻokahua Project (HP)
- Leeward Haleakala Watershed Partnership (LHWP)
- University of Hawaii, Center for Hawaiian Studies (CHS)
- University of Hawaii, Hawaiian & Indo-Pacific Languages and Literatures (HPILL)
- University of Hawaii, Institute for Astronomy (IFA)
- University of California, Santa Cruz, Center for Adaptive Optics (CfAO)
- Maui Economic Development Board (MEDB)
- Department of Education, Maui District (DOE)
- Office of Hawaiian Affairs (OHA)
- County of Maui (CM)

Figure 5-19. Proposal Submitted by Maui Community College, Page 10.

	SUMMARY OF CATEGORIES	**Budget Request**		
1	SALARIES	$650,000.00	**Project Name:**	**NFS Mitigation Proposal for Na Lau A Hoohokukalani**
2	FRINGE BENEFITS	$226,100.00	**Organization:**	**Maui Community College**
3	EQUIPMENT	$165,000.00	**Date:**	**04/02/07**
4	TRAVEL	$116,000.00	**Program Year:**	
5	CONSUMABLE SUPPLIES	$48,000.00		
6	CONTRACTUAL SERVICE	$225,000.00		
7	OTHER DIRECT EXPENSES	$87,500.00		
8	TOTAL, DIRECT COSTS (1-7)	$1,517,600.00		
9	TOTAL, INDIRECT COSTS	$414,305.00		
10	PARTICIPANTS SUPPORT COSTS	$560,000.00		
	TOTAL: Fed. Funds Requested (8+9+10)	**$2,491,905.00**		
	BUDGET DETAILS		**COMPUTATION**	**JUSTIFICATION**
1	**SALARIES: Total**	**$650,000.00**		
	Project Director	$75,000.00	1.0 FTE Instructor	Coordinate Program: to develop courses at MCC and in high schools with emphasis on HWST, Math, and Science. Develop Bi-lingual curriculum for MCC and high schools. Internship program for MCC and high school Native Hawaiian students. Hawaiian Studies Lab and support services; recruitment and retention of Native Hawaiian students.
	Administration and Fiscal Support	$55,000.00	1.0 FTE APT	Fiscal mangement and record maintenance
	Academic Specialist	$55,000.00	1.0 FTE Instructor	Coordinate academic and tutorial Programs
	Program Support Specialist	$55,000.00	1.0 FTE Counselor	Supports Project Director
	Cohort Support Specialist	$55,000.00	1.0 FTE Counselor	Recruitment and Retention and cohort coordinator
	Cohort Counselor	$60,000.00	1.0 FTE Counselor	Provide academic and career conseling to cohort participants
	Curriculum Specialist	$60,000.00	1.0 FTE Instructor	Development of MCC courses and High School Bridges, Articulate MCC courses and curriculum to DOE standards
	Hawaiian Studies Instructor	$60,000.00	1.0 FTE Instructor	To provide instruction: 1 course HWST (Ethno-astronomy/Malama Aina), Curriculum Development, High School Bridge
	Math Instructor	$60,000.00	1.0 FTE Instructor	To provide instruction: 1 course MATH (IMP), Curriculum Development, High School Bridge
	Science Instructor	$60,000.00	1.0 FTE Instructor	To provide instruction: 1 course Science (____), Curriculum Development, High School Bridge
	Hawaiian Science Lab Coordinator	$55,000.00	1.0 FTE Instructor	Coordinates activities, workshops, trainings and management of Hawaiian Science Lab
2	**FRINGE BENEFITS: Total**	**$226,100.00**		
	Program Coordinator	$28,500.00	$75,000 X 38%	Fringe Benefits per UH
	Administration and Fiscal Support	$20,900.00	$55,000 X 38%	
	Program Support Specialist	$20,900.00	$55,000 X 38%	
	Cohort Support Specialist	$20,900.00	$55,000 X 38%	
	Cohort Counselor	$22,800.00	$60,000 X 38%	
	Curriculum Specialist	$22,800.00	$60,000 X 38%	
	Hawaiian Studies Instructor	$22,800.00	$60,000 X 38%	
	Math Instructor	$22,800.00	$60,000 X 38%	
	Science Instructor	$22,800.00	$60,000 X 38%	
	Hawaiian Science Lab Coordinator	$20,900.00	$55,000 X 38%	

Figure 5-19. Proposal Submitted by Maui Community College, Page 11.

3	**EQUIPMENT > 5,000: Total**	**$165,000.00**		
	Hawaiian Science Lab Equipment	$75,000.00		Computers, notebooks, computer programs
	Cohort(s) Equipment	$20,000.00		Computers, notebooks, computer programs
	Instructional Equipment	$20,000.00		Computers, notebooks, computer programs
	Curriculum Development Equipment	$20,000.00		Computers, notebooks, computer programs
	Video Conferencing Equipment	$30,000.00	$5,000 X 6 systems	Distance Education support
4	**TRAVEL: Total**	**$116,000.00**		
	Out of state airfare	$40,000.00	$1,000 x 25 trips	
	Inter island airfare	$40,000.00	$250 x 100 trips	
	Per diem	$16,000.00	$80 x 200	
	Lodging	$15,000.00	$150 x 100	
	Transportation	$5,000.00	$50 x 100	
5	**CONSUMABLE SUPPLIES: Total**	**$48,000.00**		
	Administrative Supplies	$7,200.00	$600 per month X 12 months	Paper, Printer Cartridges, Desk Supplies, File Folders, Binders, Reproducing Costs, MCC Media Center
	Instructional Supplies	$7,200.00	$600 per month X 12 months	Internship Cohort: reproducing costs, computer supplies, portfolio supplies
		$7,200.00	$600 per month X 12 months	High School Internship Program
		$7,200.00	$600 per month X 12 months	Curriculum Development
		$7,200.00	$600 per month X 12 months	Instructor Support
		$12,000.00	$1000 per month X 12 months	Hawaiian Science Lab Support
6	**CONTRACTUAL SERVICES: Total**	**$225,000.00**		
	Curriculum & Education Development and Dessemination	$100,000.00		Consultants, translators, editors, web design and maintenance
	Internship and Workforce Development	$50,000.00		Internships, job-placment, training, certifications
	Data Collection and Research	$25,000.00		
	Professional development	$25,000.00		Training and workshops for teachers, faculty, staff, and students
	Student Development	$25,000.00		
7	**OTHER: Operating Expenses: Total**	**$87,500.00**		
	Postage	$1,800.00	$150 per month X 12 months	Cost for office, cohort and summer bridge mail outs
	Phone	$1,200.00	$100 per month X 12 months	Long distance costs for office and administrative purposes
	Inter Island Van Rental	$7,200.00	$120/day X 60	
	Inter Island Bus Fare	$4,800.00	$200/day X 24	
	Printing and Publication Fees	$12,500.00		Brochure Design and Printing Cost
	Conference Fees	$25,000.00	$500 X 50	Attend and participate in Conferences
	Training workshops and camps	$25,000.00		
	Facility Rentals	$10,000.00		
8	**TOTAL: DIRECT Costs**	**$1,517,600.00**		
9	**INDIRECT COSTS (if applicable):**	**$414,305.00**	Direct Costs X 27.3%	
10	**PARTICIPANTS SUPPORT COSTS**	**$560,000.00**		
	Stipends (STEM Internships)	$240,000.00	3,000 X 40 students X 2 semesters	Stipends to STEM students for completing internship requirements
	Stipends (MCC/4-year/Graduate STEM Cohort)	$240,000.00	$3,000 X 40 students X 2 semesters	Stipends to students for completing STEM cohort requirements
	Stipends (High School Bridges Cohort)	$40,000.00	$1,000 X 40 awards	Stipends to students for completing high school cohort requirements
	Stipends (Teacher Cohort)	$40,000.00	$1,000 X 40 awards	Stipends to participants of teacher training workshops
11	**TOTAL: Budget Requested**	**$2,491,905.00**		

Figure 5-19. Proposal Submitted by Maui Community College, Page 12.

5.3 Consultation Under the Endangered Species Act

In July 2005, NSF began its consultation with the U.S. Fish & Wildlife Service (USFWS), and a site visit to the preferred and alternate sites for the proposed ATST Project was arranged for September 2005. On-site discussions with an avian biologist from the USFWS included representatives from HALE, NSO/NOAO, IfA, and KCE. At that time, the USFWS and HALE biologists suggested that pre-construction video monitoring of the ‘u‘au (Hawaiian petrel) burrow colony adjacent to the preferred site would be a useful tool to characterize the behavior of the ‘u‘au prior to the proposed ATST Project, so that potential effects during construction, if any, could be recognized. They also suggested that monitoring of a “control” ‘u‘au colony in HALE during construction would provide a better understanding of potential effects, if any, during construction, by comparing the behavior of ‘u‘au much further away from construction activities.

In response to that suggestion, NSF initiated a day/night, motion activated, video monitoring program of 30 ‘u‘au burrows at HO in February 2006, with video data collected during the entire nesting season. In addition, video monitoring was established for correlating activities in and around HO. The data was shared with HALE personnel via the internet throughout the nesting season. The video monitoring system has operated throughout each nesting season subsequent to 2006, to build a database of ‘u‘au behavior during non-construction years.

On June 15th, 2006, NSF requested initiation of formal consultation for the construction and use of the proposed ATST Project, pursuant to Section 7 of the Federal Endangered Species Act of 1973, as amended (16 USC, 1531, et seq.). At that time, NSF determined that the construction of ATST could adversely affect the endangered ‘u‘au. NSF also determined that the construction would not adversely affect the nēnē (Hawaiian goose), ‘ope‘ape‘a (Hawaiian Hoary bat), or ‘ahinahina (Haleakalā silversword). During the pre-consultation and formal consultation process, NSF and USFWS worked cooperatively to develop avoidance and minimization measures to reduce effects to listed species, specifically for the ‘u‘au occupying burrows in the vicinity of the proposed ATST Project.

In a February 2007 conference call between USFWS and NSF, the USFWS concurred with the NSF determination “...that the inclusion of avoidance and minimization measures had reduced project effects to the level of insignificance” (Vol. II, Appendix M-USFWS, Informal Consultation Document). Although not anticipated, it was agreed that if a nēnē or ‘u‘au was harmed or killed as a result of ATST construction activities, work action would cease and formal consultations would be initiated with USFWS at that time.

USFWS further considered the potential effects on the ‘u‘au in March 2007, e.g., the unlikely prospect of “incidental take” of ‘u‘au during construction, and ultimately issued an Informal Section 7 Consultation document rather than a Formal Biological Opinion. The Informal Consultation Document concurred that the proposed ATST Project is not likely to adversely affect the endangered species in question. It also circumscribed the Action Area not likely to be adversely affected by the proposed ATST Project to include the HALE summit area and Park road corridor (Fig. 3-5).

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6.0 UNRESOLVED ISSUES

At this juncture, there are three issues that remain unresolved, but are in a significant stage of development. These issues are identified below and are accompanied by a short description of the status of each.

Section 106 consultation process pursuant to the NHPA

As further outlined in Section 5-Notification, Public Involvement, and Consulted Parties, NSF has been involved in a Section 106 consultation process for the proposed ATST Project since 2005. Nearly 30 formal and informal consultation meetings have been held with consulting parties; three more consultation meetings will be held on June 8, 9, and 10, 2009. NSF has been working with the consulting parties, including the Hawaiʻi State Historic Preservation Division (SHPD, the Advisory Council on Historic Preservation (ACHP), and the National park Service (NPS) to develop a programmatic agreement to address the adverse effects related to the proposed ATST Project. This process is also intended to serve as the Section 106 process for the NPS in support of its consideration of the issuance of the Special use Permit (SUP) required by the NPS to operate commercial vehicles on the Haleakalā National Park Road (HALE) during the construction and operation of the proposed ATST Project.

Special Use Permit

Since August of 2008, NSF has been working with the ATST Project team and the NPS on a proposed SUP to allow ATST-related commercial vehicles to traverse along the Park road during the construction and operations phases of the proposed ATST Project. The environmental compliance efforts required in support of the SUP are underway; the NPS is working with NSF with the goal of using NSF's environmental compliance efforts to satisfy the obligations of both agencies. While the parties have agreed to several items in concept, the details of the SUP are currently being negotiated.

Federal Aviation Administration Mitigation

The National Science Foundation and the Federal Aviation Administration (FAA) are working together to address any potential issue involving a degradation of signal as a result of the proposed ATST Project. If there is such a degradation of signal, a resolution of the issue will be developed and accompanied by the appropriate level of NEPA compliance. In addition, NSF will work with the FAA to obtain adequate funding for implementation of the resolution.

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7.0 REFERENCES

11 CFR Part 77.35, FAA Obstruction Evaluation and Spectrum Management

36 CFR (Code of Federal Regulations) Part 800, Protection of Historic Properties.

36 CFR § 5.6, Commercial Vehicles

36 CFR § 800 Protection of Historic Properties

40 CFR 262.30 Packaging

40 CFR 262.31 Labeling

40 CFR 262.32 Marking

40 CFR 262.33 Placarding

40 CFR Parts 1500-1508, NEPA [National Environmental Policy Act] of 1969, as amended, Title 42, United States Code §4321 et seq., the implementing regulations of the Council on Environmental Quality (CEQ)

45 CFR Parts 640, National Science Foundation (NSF), Office of the General Counsel, Compliance with NEPA; Environmental Assessment Procedures NEPA.

ABR, Inc. 2005. "Movements of Hawaiian Petrels Near USAF Facilities Near the Summit of Haleakalā, Maui Island, Fall 2004 and Spring 2005". Prepared for USAF AFRL. September 2005.

ACE. [Dept. of the Army, Army Corps of Engineers], Honolulu District, Letter from George P. Young, P. E., Chief, Regulatory Branch. March 24, 2009, File No.: POH-2008-296.

ACHP [Advisory Council on Historic Preservation]

______ Code of Federal Regulations, 36 CFR Part 800, Protecting Historic Properties. Web site: http://www.achp.gov/regs.html.

______ 2006. Letter to Mr. Donald Kima, Director, Office of Federal Agency Programs from Bijan Gilanshah, Assistant General Counsel, National Science Foundation, July 6, 2006.

AFRL [U. S. Air Force Research Laboratory]. April 2005. "Draft Environmental Assessment: Proposed Advanced Electro-Optical System (AEOS) Mirror Coating Facility at the Maui Space Surveillance Complex (MSSC), Haleakalā, Maui, Hawai'i". Prepared by Belt Collins.

AMEL Technologies, Inc. December 20, 2005. "Energy Efficiency Design Assistance Study for Advanced Technology Solar Telescope Enclosure and Support and Operations Facilities, Haleakalā, Maui". Submitted to Maui Electric Co., Inc.

APA [American Planners Association]. 2002. "The Language of Traffic: Definitions and Their Applications". Web site: http://www.planning.org/thecommissioner/spring02.htm. Web site accessed December 7, 2005.

ATST [Advanced Technology Solar Telescope]:

______ "Site Feasibility Report: Big Bear Lake", Web site: http://atst.nso.edu/projbook/fac/reports/bigbear.html.

______ "Site Feasibility Report: La Palma", Web site: http://atst.nso.edu/projbook/fac/reports/lapalma.html.

______ Section 106 public information: Web site: http://atst.nso.edu/library/EIS.shtml.

______ 2006. "Cultural Resource Evaluation and Traditional Practices Report, January 2006". Link to "E Mālama Mau Ka La'a: Preserve the Sacredness". Web site: http://atst.nso.edu/library/EIS.shtml.

______ 2004. "Site Survey Working Group Final Report, October 6, 2004", Report #0021, Rev. A. Web site: http://atst.nso.edu/site/reports_final.html.

______ 2002. "ATST Site Requirement Goals, Project Document Specification 0006 Rev. A, October 16, 2002", Web site: http://atst.nso.edu/library/docs/SPEC-0006.pdf.

Baker, Elaine. 2005. Solid Waste Engineer, County of Maui, Solid Waste Division. Personal communication with Andrew Gentile of Tetra Tech, Inc. December 7, 2005.

BEA [Bureau of Economic Analysis]

______ 2007a. Regional Economic Accounts. Personal Income by Major Source and Earnings by NAICS Industry. Hawaii and Maui County. Web site: http://www.bea.gov/regional/reis/action.cfm. Web site accessed February 15, 2008.

______ 2007b. Per Capita Personal Income for Hawaii and Maui County. Web site: http://www.bea.gov/regional/reis/action.cfm. Web site accessed February 15, 2008.

______ 2007c. Per Capita Personal Income for Hawaii and Maui County between 2001 and 2005. Web site: http://www.bea.gov/regional/reis/action.cfm. Web site accessed February 15, 2008.

Bergmanis, E.C., J. M. Sinton and F. A. Trusdell, 2000. "Rejuvenated Volcanism Along the Southwest Rift Zone, East Maui, Hawai'I", Bull. Volcanol., 62, 239-255.

Bhattacharji, S. 2005. "Geological Survey of the University of Hawai'i Haleakalā Observatories and Haleakalā Summit Region, East Maui, Hawai'i." App. A, UH IfA Haleakalā Long Range Development Plan (LRDP), 2005.

Bishop, Janice L.; Schiffman, Peter; Murad, Enver; Dyar, M. Darby; Drief, Ahmed; and Lane, Melissa D. "Characterization of Alternation Products in Tephra from Haleakalā, Maui: A Visible-Infrared Spectroscopy, Mössbauer Spectroscopy, XRD, EMPA and TEM Study" in, *Clays and Clay Minerals*; February 2007; v. 55; no. 1; p. 1-17.

Bird, Isabella L. 1890. "The Hawaiian Archipelago. Six months among the palm groves, coral reefs, and volcanoes of The Sandwich Islands". Web site: http://ebooks.adelaide.edu.au/b/bird/isabella/hawaii/hawaii.html. Web site accessed March 26, 2009.

Boeing, LTS.

______ 2005a. "Hazardous Waste Management Plan for Maui Space Surveillance Complex, Haleakalā Summit, Maui, Hawai'i, Revision 9, July 19, 2005", LIB11792. Prepared by Boeing LTS.

______ 2005b. The Boeing Company. "Hazardous Material Emergency Response Plan for the Maui Space Surveillance Complex, LIB11796. Haleakalā, Maui, Hawai'i Revision 9. July 19, 2005".

______ 2004. "HazMat Plan, Hazardous Material Emergency Response Plan for the Maui Space Surveillance Complex, LIB11796, Haleakalā, Maui, Hawai'i, Revision 6, June 4, 2004".

Bushnell, K.W. and H.H. Hammatt. 2002. "An Archaeological Inventory Survey of 1.5 Acres of the University of Hawai'i Facility at Haleakalā, Papa`anui Ahupua`a, Makawao District, East Maui (TMK: 2-2-07: 8)", for KC Environmental, Inc., by Cultural Surveys Hawai'i.

Carney-Nunes, Charisse. 2006. Assistant General Counsel, National Science Foundation, April 25, 2006. Record of Contact documentation with David Brown, Branch Chief, State Historic Preservation Division.

Carson, M. and Mintmier, M. "Archeological Survey of Previously Recorded Sites in Front Country Areas in the Summit District of Haleakalā National Park, Maui Island, Hawai'i. December 2007". For Official NPS Use Only.

Cavell, 2008. Cavell, Mertz & Associates, Inc. "Advanced Technology Solar Telescope FAA Interference Mitigation Engineering Statement, August 14, 2008".

CEQ [Council of Environmental Quality]. Code of Federal Regulations, 1997. Environmental Justice Guidance, December 10, 1997.

CfAO [Center for Adaptive Optics]. Web site: http://cfao.ucolick.org/.
Akamai Internship Program,
Web site: http://cfao.ucolick.org/EO/internshipsnew/akamai/index.php.
Professional Development Workshop, Web site: http://cfao.ucolick.org/EO/PDWorkshop/.

Chatters, J. C. July 1991. "Cultural Resources Inventory and Evaluation for Science City, Conducted for Expansion of the Maui Space Surveillance Site, Haleakalā, Maui, Hawai'i". Prepared for the U. S. Air Force Headquarters Space Division Air Systems Command, Los Angeles Air Force Base. Prepared by the Pacific Northwest Laboratory (Batelle Memorial Institute).

CKM Cultural Resources, "Cultural Resources Evaluation for the Summit of Haleakalā. Kū I Ka Mauna – Upright at the Mountain". March 2003.

Cole, F. R. *et. al.*, 1992. "Effects of the Argentine Ant Arthropod Fauna on Hawaiian High Elevation Shrublands".

Conant, S. and Stemmermann Kjargaard, M., Western Birds, Volume 15, Number 3, 1984. "Annotated Checklist of Birds of Haleakalā National Park, Maui, Hawai'i.

County of Maui.

______ Department of Water Supply. Monthly Water Production.
Web site: http://mauiwater.org/water.html. Web site accessed July 31, 2006.

______ Real Property. GIS TMK maps. Web site: http://www.mauipropertytax.com/Forms/MapDatalet.aspx?sIndex=0&idx=1&LMparent=20. Web site accessed April 17, 2009.

______ Title 16, Buildings and Construction, Chapter 16.26 (Building Code), Subsection 16.26.101.3 Subsection 101.3 amended. Web site: http://ordlink.com/cgi-bin/hilite.pl/codes/maui/_ DATA/TITLE16/Chapter_16_26__BUILDING_CODE.html#4. Web site accessed July 24, 2006.

______ 2009. Draft Maui Island Plan. Web site:http://www.co.maui.hi.us/index.asp?NID=1120. Web site accessed April 2009.

______ 2008a. Landfill Information.
Website: http://www.co.maui.hi.us/departments/EnvironmentalMgt/landfill.htm
Web site accessed May 19, 2008.

______ 2008b. Draft Maui Island Plan. Volume I, Background. Website: http://www.co.maui.hi.us/index.asp?NID=934. Web site accessed March 29, 2008.

______ 2006. Maui County Office of Economic Development, Maui County Data Book, 2006. Hawai‘i Small Business Development Center Network. Business Research Library. December 2006.

______ 2005. Landfill Information. Web site: http://www.co.maui.hi.us/departments/Public/landfill.htm. Web site accessed December 14, 2005.

______ 1996. Makawao-Pukalani-Kula Community Plan. July 23, 1996.
Web site: http://www.co.maui.hi.us/departments/Planning/pdf/makawao.pdf.

______ 1990. The General Plan of the County of Maui 1990 Update. June 22, 1990.
Web site: http://www.co.maui.hi.us/departments/Planning/generalPlan1990.htm.

CPWR [Center to Protect Worker’s Rights]. 2003. Construction Noise Hazard Alert.
Web site: http://www.cpwr.com/hazpdfs/kfnoise.PDF. Web site accessed December 6, 2005.

CKM [CKM Cultural Resources, LLC] March 2003. “Cultural Resources Evaluation for the Summit of Haleakalā”.

CSA MultiSearch. Cambridge Scientific Abstracts launched MultiSearch in 2005. CSA MultiSearch is a federated searching solution that provides integrated access to more than 2,000 electronic information resources.

Dames and Moore. Dec. 1991. “Report – Preliminary Foundation and Geophysical Investigation Site Selection Study, Proposed 4-meter Telescope, Haleakalā, Maui, Hawai‘i”.

DBEDT [State of Hawai‘i, Hawai’i Department of Business, Economic Development and Tourism]. 2007. County Economic Conditions. 4th Quarter 2007.
Web site: http://hawaii.gov/dbedt/info/economic/data_reports/qser/county.
Web site accessed February 15, 2008.

______ Visitor Report. “2007 Annual Visitor Research Report”.
Web Site: http://hawaii.gov/dbedt/info/visitor-stats/visitor-research/2007-annual-research.pdf.
Web site accessed April 15, 2009.

DLNR [State of Hawaiʻi, Department of Land and Natural Resources]

______ Hawaiʻi State Parks, Polipoli Spring State Recreation Area. Web site: http://www.hawaiistateparks.org/parks/maui/Index.cfm?park_id=39 Web site accessed February 26, 2008.

______ Maui Watershed. Website: http://www.state.hi.us/dlnr/dofaw/wmp/maui_part.htm. Web site accessed March 26, 2009.

______ 2006. Letter to Erik Fredericksen, Xamanek Researches, from Peter Young, DLNR. Subject: National Historic Preservation Act (NHPA) Section 106 Review – Preservation Plan for 11 Sites at Science City, Haleakalā, Papaanui-Ahupuaʻa, Makawao, Island o Maui, TMK: (2)2-2-007:por. 008.

______ 2003. Doc. No. 0307MK03, Log No. 2003.1138, Letter from P. Holly McEldowney, Acting Administrator, to Erik Fredericksen, Xamanek Researches, dated July 10, 2003.

DOH [State of Hawaiʻi, Department of Health]. 2005. Hawaiʻi Administrative Rules – Title II. Web site: http://hawaii.gov/health/about/rules/admrules.html. Web site accessed December 1, 2005.

DOI [U. S. Department of the Interior].

______ 2007. Web site: http://www.doi.gov/ohr/nativehawaiians/list.html. Web site accessed January 16, 2008.

______ 2006. “Interior Office of Hawaiian Relations Invites Public to Gatherings on August 14-17.” Web site: http://www.doi.gov/news/06_News_Releases/060804.htm.

______ 1994. “Guidelines for Evaluating and Documenting Traditional Cultural Properties”, National Register Bulletin 38.

DOT [State of Hawaiʻi, Department of Transportation].

______ 2007. Hawaiʻi DOT Traffic Station Maps, Final.

______ 2003. Highways Planning Branch 24-hour Traffic Count Station Summary. April 2003.

East Maui Watershed Partnership: Management and Research. Web site: http://ice.ucdavis.edu/~robyn/emhome.html. Web site accessed April 11, 2009.

EPA [U. S. Environmental Protection Agency], Code of Federal Regulations (CFR), Chapter 1, Subchapter I-Solid Wastes, Part 261-299. Web site: http://www.epa.gov/epahome/cfr40.htm.

Executive Order (EO)

______ EO 1987, December 12, 1961, State of Hawaiʻi, Setting Aside Land for Public Purposes.

______ EO 12898, February 11, 1994, Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations.

______ EO 13045, April 21, 1997, Protection of Children from Environmental Health Risks and Safety Risks.

FAA [Federal Aviation Administration]
______ 2009. Personal communication with A. Walker-Jack, FAA, Western Service Area, Technical Operations and Dr. Charlie Fein, KC Environmental, Inc.

______ 2007. "Determination of No Hazard to Air Navigation, Aeronautical Study No. 2007-AWP-1760-OE", issued to Pete Figgis, Boeing LTS for U. S. Air Force Telescope, May 11, 2007.

Federal Register. Web site: http://www.archives.gov/federal-register/the-federal-register/about.html.

______ Vol. 72, No. 186/Wednesday, September 26, 2007 / Notices, Department of the Interior, Office of the Secretary Native Hawaiian Organization Notification List.

FHWA [U.S. Department of Transportation] Federal Highway Administration]. Web site: http://www.fhwa.dot.gov/environment/conformity/ref_guid/glossary.htm#vmt. Web site accessed December 7, 2005.

______ 2008. Marquez, H. R.,Trip Report, Report #HALA 3-2-2009, March 2, 2008. Federal Highway Administration, Haleakalā Highway, Haleakalā National Park, Pavement/Drainage Condition Investigation, Distress Identification and Recommendations.

FTF EA [Faulkes Telescope Facility Environmental Assessment]. May 2001."Final Environmental Assessment/Negative Declaration for the Faulkes Telescope Facility at Haleakalā, Maui, Hawai'i". Prepared by KC Environmental, Inc.

Foote, D., Hill, Elmer H., Nakamura, Sakuichi, and Stephens, Floyd, Soil Conservation Service. Website: http://www.ctahr.hawaii.edu/soilsurvey/5is/maui.htm. Web site accessed March 29, 2009

Frasher, Heather, V. Parker-Geisman and G. R. Parish. 2007. "Hawaiian Hoary Bat Inventory in National Park on the Island of Hawai'i, Maui and Moloka'i." Technical Report 140. Pacific Cooperative Studies Unit, University of Hawai'i, Honolulu, Hawaii. 25 pp. (unpublished data).

Fredericksen, Erik and Fredericksen, Demaris. 2003. "Archaeological Inventory Survey of 18.1-acre parcel at Science City, Haleakalā Crater, Papa`anui ahupua`a, Makawao District, Maui Island (TMK: 2-2-07: por. 8)", Prepared for Mr. Charles Fein, KC Environmental, Inc., Makawao, Maui.

Fornander, Abraham,1812-1887, An account of the Polynesian race; its origin and migrations and the ancient history of the Hawaiian people to the times of Kamehameha I. Website: http://books.google.com/books?id=xOVPm_o8bW8C&dq=An+account+of+the+Polynesian+race%3B+its+origin+and+migrations+and+the+ancient+history+of+the+Hawaiian+people+to+the+times+of+Kamehameha+I.&printsec=frontcover&source=bl&ots=FlaEYrnOKn&sig=tWm2rjczpdccLfCckjEYG2cmSlA&hl=en&ei=rd3gSeKEKIeItAPdm7inCQ&sa=X&oi=book_result&ct=resu lt&resnum=1#PPR7,M1. Web site accessed March 25, 2009.

Fukunaga and Associates. 2003. "State Water Project Plans, Hawai'i Water Plan". Volume 4, SWPPP for Islands of Lanai/Maui/Molokai. February 2003.

Fullard, J.H., 1989. "'Ope'ape'a: Hawaii's Elusive Native Bat." Bats Magazine Vol: 17(3).

Gambino, Parker, *et. al.* 1990. “Invasion and Colonization of Upper Elevations on East Maui (Hawai‘i) by *Vespula pensylvanica”*.

Gambino, Parker, 1992. “Yellow-Jacket (*Vespula pensylvanica*) Predation at Hawai‘i Volcanoes and Haleakalā National Park’s: Identity of Prey Items”.

HALE [Haleakalā National Park].

______ 2009. E-mail from Cathleen Natividad Bailey to KC Environmental, Inc. stating “Bats have been detected near Park Headquarters and Hosmer Grove (Frasher et al. 2007, HALE unpubl. data), but there has been no effort made to determine if bats occur along the Park road.”

______ 2008. Internal HALE Memorandum from Raina Kaholoa‘a to Cathleen Bailey, November 2008. Subject: Review of Appendix C(2), Supplemental Arthropod Sampling at the Haleakalā High Altitude Observatories Maui, Hawai‘i

______ 2006. DEIS comment letter from HALE regarding 1.7 million annual visitors to HALE, Marilyn Parris, Park Superintendent, October 19, 2006.

______ 2005a. Haleakalā National Park Air Quality Information.
Web site: http://www2.nature.nps.gov/air/Permits/ARIS/HALE/.
Web site accessed December 1, 2005.

______ 2005b. Haleakalā National Park Official Web site. Planning your Visit: Weather.
Web site: http://www.nps.gov/hale/pages/tier_two/weather.htm.
Web site accessed December 1, 2005.

______ 2003. “Hawaiian Petrels Near the Haleakalā Observatories: A Report to KC Environmental, Inc. for Preparation of a Long-Range Development Plan”, Prepared by Cathleen Natividad Bailey, HALE Wildlife Biologist, Endangered Species Management.

______ 1994 and 2000. Haleakalā National Park Visitor Study.

______ 197? Stet.

HAR [State of Hawai‘i, Hawai‘i Administrative Rules]:

______ 11-46-3. HAR Title 11, Chapter 46. Community Noise Control (Department of Health).
Web site: http://gen.doh.hawaii.gov/sites/har/admrules/default.aspx.
Web site accessed May 19, 2008.

______ HAR Title 11, Chapter 60, Air Pollution Control.

______ HAR, Title 11, Chapter 200, Environmental Impact Statement Rules.

______ HAR, Title 13, Chapter 5, Conservation District, Subtitle 14, General Subzone.

______ HAR, Title 13, Department of Land and Natural Resources, Subtitle 13, State Historic Preservation Division Rules, Chapter 277, Rules Governing Requirements for Archaeological Site Preservation and Development.

Hawaiian Historical Society, 1997. “The Hawaiian Journal of History”, Vol. 31, 1997.

HRS [State of Hawai‘i, Hawai‘i Revised Statues]. Chapter 343 State Environmental Review Law.
______ Titles 13-14, Chapters 205, Land Use Commission.

______ §291-34 to 36, Traffic Violations.

IAC [Instituto de Astrofisica de Canarias]. Gallería de Imágenes.
Web site:http://www.iac.es/gabinete/difus/ruta/observatorios/roque.htm.

Island Geotechnical Engineering, Inc. 2005. "Report, Soils Investigation, Proposed Advanced Technology Solar Telescope, Haleakalā Observatory, May 5, 2005".
Web site: http://atst.nso.edu/contracts/Reports/CON-0014_IslandGeotech.pdf.

Iwado Court Reporters. 2006. Transcripts for the National Science Foundation, Section 106 Formal Meetings for the Advanced Technology Solar Telescope, March 28, 2006 and May 1, 2006.

Jackson, Frances. University of Hawai‘i Archivist. "Military Use of Haleakalā National Park". Hawaiian Journal of History, Vol. 6, 1972.

Jensen, Robert. 2005. Retired U.S. Air Force and Boeing LTS, Personal communication with Dr. Charlie Fein (KC Environmental, Inc.).

Kauhi, Greg. 2005. Email to Mike Maberry, UH IfA. August 11, 2005.

KCE [KC Environmental, Inc.].
______ 2009. Follow-up phone calls to agencies with facilities at Haleakalā summit, regarding "Cumulative Impact Analysis for Project on Haleakalā, Maui, HI", February 2009.

______ 2006, February. "Proposal for Implementation of an ‘Ua‘u Monitoring System at Haleakalā Observatories and Haleakalā National Park", submitted to U. S. Fish & Wildlife Service.

______ 2005. Letter from KCE sent to agencies with facilities at Haleakalā summit, regarding "Cumulative Impact Analysis for Project on Haleakalā, Maui, HI", November 9, 2005.

KHNL, 2007. KHNL News Archives, September 27, 2007. "Woman Killed in Downhill Bicycle Accident Identified". Website: http://www.khnl.com/Global/story.asp?S=7139939
Web site accessed April 10, 2009.

Klaeboe, R. Turunen-Riseb, I.H. Hårvikc, L. and Madshusc, C. 2003. "Vibration in dwellings from road and rail traffic-Part II: exposure-effect relationships based on ordinal logit and logistic regression models. Applied Acoustics 64, 89–109. Web site: http://www.defra.gov.uk/ENVIRONMENT/noise/research/pdf/human-response-vibration-residential-environments.pdf. Accessed on April 20, 2009.

Lawson, S., B. Kiser, K. Hockett, A. Ingram. 2008. "Research to Support Backcountry Visitor Use Management and Resource Protection in Haleakalā National Park Final Report". Department of Forestry, College of Natural Resources, Virginia Polytechnic Institute and State University.

Lopate, Cliff. 2005. University of Chicago Neutron Monitor. Personal communication with Daniel O'Gara of the Institute for Astronomy at the University of Hawai‘i. November 15, 2005.

Maxwell, Charles K. 2006. “Hālau ‘Imi ‘Ike Hōkū, Center for Traditional Hawaiian Navigation and Astronomy”, mitigation proposal submitted to National Science Foundation. March 28, 2006.

McKee and Taylor. 2001. National Research Council, “Astronomy and Astrophysics Survey Committee Decadal Survey: Astronomy and Astrophysics in the New Millennium”.

Medeiros, A.C., F.R. Cole, and L.L. Loope. 1994.

______ Medeiros, A. C., L. L. Loope and C. G. Chimera, 1998. Technical Report 120, “Flowering plants and Gymnosperms of Haleakalā National Park”. June 1998.

MichiganTech. 2004. Geological & Mining Engineering & Sciences Department. UPSeis. Web site: http://www.geo.mtu.edu/UPSeis/index.html.

NASA [National Aeronautics and Space Administration].

______ 2006. Hathaway, Dr. David H., The Sunspot Cycle. Solar Physics web site: http://solarscience.msfc.nasa.gov/SunspotCycle.shtml.

______ 2005. Final Environmental Impact Statement for the Outrigger Telescope Project, February 2005.

Natividad Bailey. 2009. Technical Report 164. “Seabird Inventory at Haleakalā National Park, Maui, Hawai‘i. February 2009”.

Natividad Hodges, C. S N. and R. J. Nagata. 2001. “Effects of Predator Control on the Survival and Breeding Success of the Endangered Hawaiian Dark-rumped Petrel”. Studies in Avian Biology 22:308–318.

NSO [National Solar Observatory], 2007. Preliminary Seismic Design Analysis: Advanced Technology Solar Telescope. December 18, 2007.

NPCA [National Park Conservation Association] Press Release January 14, 2003.

NPS/USDOI [National Park Service/U.S. Dept. of the Interior]

______ NPS-28: “Cultural Resource Management Guidelines”, June 11, 1998.

______ 2009. Haleakalā National Park website: http://www.nps.gov/hale. Web site accessed March 19, 2009.

______ 2008a. HALE News Advisory. Bicycle Tours Moratorium to Continue at Haleakalā National Park. M. Parris, Superintendent, March 18, 2008.

______ 2008b. CLI. NPS “Cultural Landscapes Inventory”, May 28, 2008.

______ NPS Stats. National Park Service Public Use Statistics Office, 2007 and 2008.

______ 2001. NPS Director’s Order 12 Conservation Planning, Environmental Impact Analysis and Decision Making.

______ 2000. “Haleakalā National Park Visitor Study, Report, and Report Summary”.

______ 1959. Hawai‘i Nature Notes, The Publication of the Naturalist Division, Hawai‘i National Park and the Hawai‘i Natural History Association, June 1959.

______ Ethnographic Study. “An Ethnographic Overview and Study of the Cultural Impacts of Commercial Air Tours Over Haleakalā National Park, Island of Maui”. Prasad, U., Ph.D., Tomonari-Tuggle, M.J., M.A., International Archaeological Research Institute, Inc., June 2008.

______ Nagata, 2001. Letter from Ron Nagata, sr. HALE Chief of Resources Management to Paul Henson, Field Supervisor, USFWS Pacific Islands Ecoregion. “Subject: Update on Mitigation Measures for Road Resurfacing at Haleakalā National Park”. July 5, 2001.

OCCL [State of Hawai‘i, Office of Conservation and Coastal Lands].

______ Web site: http://www.hawaii.gov/dlnr/occl/conservation.php

______ Subzone maps. Web site: http://www.hawaii.gov/dlnr/occl/subzone.php.

______ 2006. Reference letter MA 06-47 from Mr. Sam Lemmo, Administrator, OCCL to Dr. Charlie Fein, Vice President, KC Environmental, Inc. September 23, 2006.

Odenwald, Sten. 1999. “Solar Storms”. Special to the Washington Post, Wednesday, March 10, 1999; Page H01. Web site: http://solar.physics.montana.edu/press/WashPost/Horizon/196l-031099-idx.html.

OEQC. [Hawai‘i State Department of Health Office of Environmental Quality Control]

______ 2005. Letter from Genevieve Salmonson (OEQC) to Mike Maberry (University of Hawai‘i Institute for Astronomy), Subject: Environmental Impact Statement (EIS) Preparation Notice, Advanced Technology Solar Telescope at Haleakalā.. September 12, 2005.

______ 1997] Guidelines for Assessing Cultural Impacts. Electronic Document, http://www.state.hi.us/health/oeqc/guidance/cultural.htm. Web site accessed April 2007.

OHA [Office of Hawaiian Affairs]. 2005. Letter to Dr. Charlie Fein, KC Environmental, Inc. from Mr. Clyde Nāmu‘o, OHA Administrator. October 17, 2005.

OSHA [Occupational Safety and Health Administration. 29 CFR part 1910, subpart Z (Toxic and Hazardous Substances). Website:http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9991&p_text_version=FALSE. Web site accessed on April 17, 2009.

Pacific Disaster Center, Stearns, Harold T. 1967. Department of Geography, University of Hawai‘i. “Atlas of Hawai‘i.” “Geology of the Hawaiian Islands.” Natural Hazard information. Web site: http://www.pdc.org/iweb/hazard_info.jsp.

Parker and Canizares. 1998. National Research Council, “Ground-based Solar Research: An Assessment and Strategy for the Future”.

Phelps, L. 2005. “Acoustic Evaluation of ATST Mechanical Equipment Building”. ATST Mechanical Engineering Group. July 2005.

RCRA [U. S. Environmental Protection Agency, Resource Conservation and Recovery Act]. Web sites: http://www.epa.gov/region5/defs/html/rcra.htm and http://www.eh.doe.gov/oepa/laws/rcra.html.

Resource Systems Group, Inc. 2006. The RSG Noise Primer. 12pp. Web site: http://www.rsginc.com/pdf/RSGNoisePrimer.pdf. Web site accessed April 2009.

Rocketdyne. 2003. Rocketdyne Technical Services, A Boeing Company. "Spill Prevention Control and Countermeasure Plan For Maui Space Surveillance Complex", LIB11796. February 2003.

Scholl, Martha A., Stephen B. Gingerich, and Gordon W. Tribble. 2002. "The Influence of Microclimates and Fog on Stable Isotope Signatures Used in Interpretation of Regional Hydrology: East Maui, Hawai'i". Journal of Hydrology 2002, v. 264, no 1-4, p. 170-184.

Shimko, S. 2005. Personal communication between S. Shimko (Boeing) and Sharon Loando-Monro (KC Environmental, Inc.), December 6, 2005.

______ 2004. FY04 Hazardous Waste Report for MSSC. September 30, 2004.

Simons, T. R., and C. Natividad Hodges. 1998. "Dark-rumped Petrel". The Birds of North America, No. 13 (A. Poole and F. Gill, eds.). Academy Natural Sci., Philadelphia, and Amer. Ornith. Union, Washington, D. C.

Sinton, J. 2003. University of Hawai'i School of Ocean and Earth Science and Technology (SOEST), personal communication with Dr. Charlie Fein (KC Environmental, Inc.).

Starr, Forest and Starr, Kim. 2002. "Botanical Survey, University of Hawai'i, Haleakalā Observatories", Island o Maui, Hawai'i, November, 2002.

Tele Atlas Map, 2009. Google Earth. Web site accessed April 13, 2009.

Turunen-Rise, I.H., Brekke, A., Hårvik, L., Madshus, C. and Klæboe, R. 2003. Vibration in dwellings from road and rail traffic – Part 1: a new Norwegian measurement standard and classification system. Applied Acoustics 64, (1), 71-87. Web site: http://www.defra.gov.uk/ENVIRONMENT/noise/research/pdf/human-response-vibration-residential-environments.pdf. Web site accessed April 20, 2009.

Ueshiro, R., 1999. SHEA Program Lead, Boeing LTS. Summary of Discussions on the Propylene Glycol Incident at MSSC.

UH IfA [University of Hawai'i, Institute for Astronomy].

______ 2009. Maberry, M., Assistant Director. Personal communication with Dr. Charlie Fein (KC Environmental, Inc.).

______ 2006. "Haleakalā High Altitude Observatory, Stormwater Management Plan". Prepared by Tetra Tech, Inc.2006.

______ 2005. "Haleakalā High Altitude Observatory Site Long Range Development Plan (LRDP)". KC Environmental, January 2005. Web site: http://www.ifa.hawaii.edu/haleakala/LRDP/.

______ 2005a. "Haleakalā High Altitude Observatory Stormwater Erosion Report". Prepared by Tetra Tech, Inc., July 2005.

______ 2005b. Institute For Astronomy, Haleakalā Division, “Hazardous Material and Hazardous Waste Management Program, Rev. Dec. 1, 2005”.

UH Manoa [University of Hawaiʻi at Manoa]. 2002, October. “Hazardous Material Management Program”.

U.S. Census Bureau.

______ 2006a. Maui County Selected Housing Characteristics: 2006.
Web site: http://factfinder.census.gov. Web site accessed February 14, 2008.

______ 2006b. Hawai’i Selected Housing Characteristics: 2006.
Web site: http://factfinder.census.gov. Web site accessed February 15, 2008.

______ 2006c. Maui County, Hawai’i. Selected Economic Characteristics: 2006.
Web site: http://factfinder.census.gov. Web site accessed February 18, 2008.

______ 2006d. Maui County, Hawai’i. 2006. American Community Survey. Data Profile Highlights.
Web site: http://factfinder.census.gov. Web site accessed February 18, 2008.

______ 2006e. Hawai’i. 2006. American Community Survey. Data Profile Highlights.
Web site: http://factfinder.census.gov. Web site accessed February 18, 2008.

U.S. Code, Title 16. 1, 2, 3, and 4. The National Park Service Organic Act .

USFWS [U.S. Fish and Wildlife Service].

______ 2004. “Draft Revised Recovery Plan for the Nēnē or Hawaiian Goose”.
First revision July 2004. Region 1, USFWS, Portland, Oregon.

______ 1998. “Terrestrial Mammal, ʻŌpeʻapeʻa or Hawaiian Hoary Bat, Lasiurus cinereus semotus. Species Status: Federally listed as Endangered, State listed as Endangered, State recognized as Indigenous (at the species level and Endemic at the subspecies level) Nature Serve Heritage Rank G2/T2 – Species secure/Subspecies imperiled, Recovery Plan for the Hawaiian Hoary Bat – USFWS 1998”.

USGS [U.S. Geological Survey]. Web site: http://pubs.usgs.gov/gip/hazards/earthquakes.html.

_____ NED [National Elevation Dataset] website: http://ned.usgs.gov/.
Web site accessed August 1, 2008.

U.S. Soil Conservation Service, 1972.

Wilson, E. O. & Taylor, R. W., 1967. The Ants of Polynesia.

WRCC [Western Regional Climate Center]. 2005. Haleakalā RS 338, Hawaiʻi (511004).
Web site: http://www.wrcc.dri.edu/cgi-bin/cliRECtM.pl?hihale.
Web site accessed November 7, 2005.

Yuen, George A. L. and Associates. 1990. “Water Resources Protection Plan Volumes I & II. Commission on Water Resource Management Department of Land and Natural Resources State of Hawaiʻi. June 1990”.

8.0 ACRONYMS, ABBREVIATIONS AND TERMINOLOGY

8.1 ACRONYMS

A	ACE	U. S. Dept. of the Army, Army Corps of Engineers
	ACHP	Advisory Council on Historic Preservation
	AEOS	Advanced Electro-Optical System
	AFRL	Air Force Research Laboratory
	AGNs	active galactic nuclei
	AIS	alien invasive species
	AMOS	ARPA Maui Optical Station
	AO	adaptive optics
	APA	American Planners Association
	APE	area of potential effect
	ARPA	Advanced Projects Research Agency
	ASHRAE	American Society of Heating, Air-conditioning and Refrigeration Engineers
	ASL	above sea level
	ASP	Astronomical Society of the Pacific
	ATRC	Advanced Technology Research Center
	ATST	Advanced Technology Solar Telescope
	AURA	Association of Universities for Research in Astronomy
	AVCO	AVCO Everett Research Laboratory
	AWS	Aircraft Warning Service
B	BAS	Bachelor of Applied Science
	BBSO	Big Bear Solar Observatory
	BEA	Bureau of Economic Analysis
	BPR	Bureau of Public Roads
	BLNR	Board of Land and Natural Resources
	BMPs	best management practices
C	CCC	Civilian Conservation Corps
	CDUA	Conservation District Use Application
	CDUP	Conservation District Use Permit
	CEQ	Council on Environmental Quality
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
	CFR	Code of Federal Regulations
	CfAO	Center for Adaptive Optics
	CKM	Kahu Charles Kauluwehi Maxwell
	CLI	Cultural Landscapes Inventory
	CME	coronal mass ejection
	CPWR	Center to Protect Worker's Rights
	CSH	Cultural Surveys Hawai'i, Inc.
	CZMA	Coastal Zone Management Area
	CZMP	Coastal Zone Management Permit
D	dBA	"A-weighted" decibel scale
	DBEDT	State of Hawai'i Department of Business, Economic Development and Tourism
	DEIS	Draft Environmental Impact Statement, dated September 2006
	DLNR	State of Hawai'i Department of Land and Natural Resources
	DoD	Department of Defense

	DOE	U.S. Department of Energy
	DOH	State of Hawaiʻi Department of Health
	DOI	U. S. Department of the Interior
	DOT	State of Hawaiʻi Department of Transportation
E	E&O	Education and Outreach
	EIS	Environmental Impact Statement
	EISPN	Environmental Impact Statement Preparation Notice
	EO	Executive Order
	EPA	U. S. Environmental Protection Agency
	EPE	Estimated Position Error
	ESA	Endangered Species Act
	ESALS	Equivalent Single-Axis Loads
F	FAA	Federal Aviation Administration
	FDA	Food and Drug Administration
	FEIS	Final Environmental Impact Statement
	FHWA	Federal Highway Administration
	FTF	Faulkes Telescope Facility
	FY	fiscal year
G	GEODSS	Ground-Based Electro-Optical Deep Space Surveillance System
	GIS	Geographic Information Systems
	GONG	Global Oscillations Network Group
	GPS	global positioning system
H	HAER	Historic American Engineering Record
	HALE	Haleakalā National Park
	HAO	High Altitude Observatory
	HAVO	Hawaiʻi Volcanoes National Park
	HAR	Hawaiʻi Administrative Rules
	HAZMAT	hazardous materials
	HDOT	Hawaiʻi Department of Transportation
	HO	Haleakalā High Altitude Observatories
	HRS	Hawaiʻi Revised Statues
	HST	Hawaiʻi Standard Time
I	IAC	Instituto de Astrofisica de Canarias
	ICONA	Instituto Nacional para la Conservación de la Naturaleza
	IfA	University of Hawaiʻi, Institute for Astronomy
	IGY	International Geophysical Year
	IWS	Individual Wastewater System
K	kbs	kilobytes per second
	KCE	KC Environmental, Inc.
	kV	kilovolt
	kVA	kilovolt-ampere
L	LAT/LON	Latitude/Longitude
	LCOGT	Las Cumbres Observatory Global Telescope Network, Inc.
	LOS	Level of Service

	LRDP	Long Range Development Plan, UH IfA
	LUC	Land Use Commission
	LURE	Lunar Ranging Experiment
M	M1	primary mirror
	M2	secondary mirror
	MAGNUM	Multi-color Active Galactic Nuclei Monitor
	Mbs	Megabytes per second
	MCC	Maui Community College
	MCF	Mirror Coating Facility
	MECO	Maui Electric Co., Inc.
	MEDB	Maui Economic Development Board, Inc.
	MOA	Memorandum of Agreement
	MP	mile post
	MPD	Maui Police Department
	mph	miles per hour
	MREFC	Major Research Equipment and Facilities Construction
	MSDS	Material Safety Data Sheets
	MSO	C. E. Kenneth Mees Solar Observatory
	MSSC	Maui Space Surveillance Complex
	MSSS	Maui Space Surveillance System
	MSTEE	Maui Science and Technology Education Exchange
N	NARA	National Archives and Records Administration
	NASA	National Aeronautics and Space Administration
	NCAR	National Center for Atmospheric Research
	NED	National Elevation Dataset
	NEPA	National Environmental Policy Act
	NGS	National Geodetic Survey
	NHO	Native Hawaiian Organization
	NHPA	National Historic Preservation Act
	NOAA	National Oceanic and Atmospheric Administration
	NOAO	National Optical Astronomy Observatory
	NOI	Notice of Intent
	NPCA	National Park Conservation Association
	NPS	National Park Service
	NRHP	National Register of Historic Places
	NSF	National Science Foundation
	NSO	National Solar Observatory
O	OCCL	Office of Conservation and Coastal Lands
	ODS	ozone-depleting substance
	OEQC	Office of Environmental Quality Control
	OHA	State of Hawai‘i Office of Hawaiian Affairs
	ORM	Roque de los Muchachos Observatory, Canary Island, La Palma, Spain
	OSHA	Occupational Safety and Health Administration
P	Pan-STARRS	Panoramic-Survey Telescope and Rapid Response System
	PDW	Professional Development Workshop
	PPV	peak particle velocity

R	RCAG	Remote Communications Air/Ground
	RCRA	Resource Conservation and Recovery Act
	RBSE	Research Based Science Education
	RET	Research Experiences for Teachers
	REU	Research Experience for Undergraduates
	ROI	Region of Influence
S	S&O	Support and Operations Building
	SCIA	Supplemental Cultural Impact Assessment
	SCOPE	Southwest Consortium of Observatories for Public Education
	SDDS	Seamless Data Distribution System
	SDEIS	Supplement Draft Environmental Impact Statement
	SHPD	State Historic Preservation Division
	SHPO	State Historic Preservation Officer
	SIHP	State Inventory of Historic Properties
	SOC	Solar Observatory Counsel
	SOC	species of concern
	SOLAR-C	Scatter-free Observatory for Limb Active Regions and Coronae
	SOLIS	Synoptic Optical Long-term Investigations of the Sun
	SQG	Small Quantity Generator
	SRD	Science Requirements Document
	SSWG	Site Survey Working Group
	START	Science Teaching with Astronomical Robotic Telescopes
	STEM	science, technology, engineering, and math; CfAO program
	SUP	Special Use Permit
	SWG	Science Working Group
	SWMP	Stormwater Master Plan
T	TCP	Traditional Cultural Property
	TMK	Tax Map Key
	TOPS	Towards Other Planetary Systems
	TPD	trips per day
U	UH	University of Hawai‘i
	UHF	Ultra-High Frequency
	UK	United Kingdom
	UM	University of Michigan
	URM	under-represented minorities
	USAFRL	U. S. Air Force Research Laboratory
	USEPA	U.S. Environmental Protection Agency
	USFWS	U. S. Fish & Wildlife Service
	USGS	U. S. Geological Survey
	UV	ultraviolet
V	V/C	Volume/Capacity
	VHF	Very High Frequency
W	WRCC	Western Regional Climate Center

8.2 ABBREVIATIONS AND TERMINOLOGY

‘ahinahina	Haleakalā Silversword, *Argyroxiphium sandwicense subsp. Macrocephalum.* Low-growing plant found only in volcanic craters on Hawai‘i having rosettes of narrow pointed silver-green leaves and clusters of profuse red-purple flowers on a tall stem
ahu	altar or shrine
akamai	smart, clever
centimeter	A metric unit of measure where 2.5 centimeters equals 1 inch
chukar	Alectoris chukar
Cinder Land	rCl
cy	cubic yards
feral goat	*Capra hircus*
field-of-view	The size of the area that can be seen while looking through an optics device. The angular field-of-view is indicated on the outside of the binocular, in degrees. The linear field of view refers to the area that can be observed at 1,000 yards, and is expressed in feet. Field-of-view is related to magnification, with greater magnification typically resulting in a smaller field-of-view.
gauss	The centimeter-gram-second unit of magnetic flux density, equal to one maxwell per square centimeter.
Haleakalā	House of the Sun; mountain at 10,023 ft ASL on island of Maui
HazMat	hazardous material
Hawaiian Petrel	‘Ua‘u, *Pterodoma phaeopygia sandwichensis*
Hawaiian Goose	Nēnē, *Branta sandvicensis or Nesochen sandvicensis*
Hawaiian Hoary Bat	‘Ope ‘ape ‘a, *Lasiurus cinereus semotus*
Haleakalā Silversword	‘ahinahina, *Argyroxiphium sandwicense subsp. Macrocephalum* Low-growing plant found only in volcanic craters on Hawai‘i having rosettes of narrow pointed silver-green leaves and clusters of profuse red-purple flowers on a tall stem
Hinala‘anui	Name dedicated to West-facing ahu on Haleakalā
Honua‘lua	area of Maui once inhabited by Hawaiian people
ho‘omahanahana	dedication or “warming” offering

hula hālau	place to dance hula
I na ʻōiwi Hawaiʻi Aloha ʻāina	To the native caretakers of the land, please enter.
Indian mongoose	Herpestes auropunctatus
kamaʻāina	native born
Kanaka Maoli	Native Hawaiian
kahu	clergyman
Kāhuna Poʻo	head priest
Kanaka Maoli	indigenous Hawaiian person
Kinolau	supernatural forms taken by Pele
koʻa	ceremonial rock formations
Kolekole	Land section in Kilohana and Mākena. (1) One account explicates that Kolekole was named after the first Kole, for its similarity in the abundance of the rusty hue. (2) The second account stated that Kolekole means to “talk story”. Some believe it was an area where Kahuna Po’o or High Priests would come to delve over tough issues.
Konohiki	Headman of an ahupuaʻa land division under the chief; land or fishing rights under control of the konohiki; such rights are sometimes called konohiki rights
kuleana	responsibility
Kumu Hula	hula master
kupuna	elders
na poāo kāhuna	priest
mana	spirit
M1	primary mirror
M2	secondary mirror
Makahiki	Ancient festival beginning about the middle of October and lasting about four months, with sports and religious festivities and taboo on war

Maui Nui O Kama	the greater Maui
meter	A metric unit of measure that equals 39.37 inches
moʻolelo	stories
Nēnē	Hawaiian Goose, *Branta sandvicensis or Nesochen sandvicensis*
oli	chants
ʻOpe ʻape ʻa	Hawaiian Hoary Bat, *Lasiurus cinereus semotus*
ʻopihi	limpet, *Cellana spp.*
Pāʻele Kū Ai I Ka Moku	Name dedicated to East-facing ahu on Haleakalā
Pele	Goddess of the Volcano
PI-based observing	principal investigator-based observing
piko	navel
Pinus sp.	large genus of true pines
Polynesian rat	Rattus exulans
puʻu	hill
Puʻu Kolekole	land near the summit of Haleakalā
Puʻu Ulaʻula	Red Hill Overlook
Roof rat	Rattus rattus
seeing	Seeing is a term used by astronomers as a measure of the image quality with "excellent seeing" referring to conditions under which the images delivered through the atmosphere are very sharp and "bad seeing" referring to atmospheric conditions that blur the images.
Star Compass	a learning tool used to teach direction without instruments: The star compass is the basic mental construct for navigation, to help one memorize what is needed to navigate.
synoptic observations	A surface weather observation, made at periodic times (usually at 3-hourly and 6-hourly intervals specified by the World Meteorological Organization), of sky cover, state of the sky, cloud height, atmospheric pressure reduced to sea level, temperature, dew point, wind speed and direction, amount of precipitation, hydrometeors and lithometeors, and

	special phenomena that prevail at the time of the observation or have been observed since the previous specified observation.
telecon	telecommunication conversation
‘ua‘u	Hawaiian Petrel, *Pterodoma phaeopygia sandwichensis*
Wahi Pana	a legendary place

9.0 LIST OF PREPARERS

This Environmental Impact Statement for the Advanced Technology Solar Telescope project was prepared on behalf of the National Science Foundation and the National Solar Observatory by KC Environmental, Inc. The organizations and individuals listed in Table 9-1 contributed to the overall effort in the preparation of this document.

TABLE 9-1. LIST OF PREPARERS.

KC Environmental, Inc.	Charlie Fein, Ph.D.	Environmental Planner
	Tom Kekona	Technician/Graphic Artist
	Sharon Loando-Monro	Planning Projects Manager
National Optical Astronomy Observatory	Jeff Barr	Project Architect
National Solar Observatory	Scott Bulau	Controls Engineer
	Jennifer Ditsler	Project Assistant
	David Dooling	Public Education and Outreach Manager
	Bret Goodrich	High-Level Controls and Software Manager
	Eric Hansen	Lead Optical Systems Engineer
	Frank Hill	Program Scientist
	Robert Hubbard	Systems Engineer
	Rex Hunter	Facilities Manager
	Steve Keil	Project Director, ATST Principle Investigator
	LeEllen Phelps	Enclosure Engineer
	Thomas Rimmele	Project Scientist
	Jeremy Wagner	Project Manager
	Mark Warner	Mechanical Systems Engineer
Tetra Tech, Inc.	Constance Callahan, J.D.	Legal Review
	Susan Carstenn, Ph.D.	Biological Resources
	Yashekia Evans	GIS/Graphics
	Leslie Tice	Project Manager, NEPA Specialist
	Andrew Gentile	Air Quality, Noise, Hazardous Materials, and Solid Waste
	Rima Ghannam	Socioeconomics, Water Resources
	Landin Johnson	Traffic and Transportation
	Dawn A. Lleces	Environmental Scientist. Land Use, Cultural, Historic and Archeological Resources, Visual Resources and View Plane, Socioeconomics and Environmental Justice, Public Services and Facilities
	Marleina Overton	Environmental Scientist. Biological Resources, Topography, Geology, and Soils, Water Resources, Hazardous Materials, Solid Waste, Noise, Air Quality, Natural Hazards
	George Redpath	NEPA Specialist, Biological Resources
	Roy Roenbeck	Air Quality, Noise
	Cindy Schad	Word Processor
	Tom Whitehead	Water Resources
	Randolph Varney	Technical Editor

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