

# DECOMMISSIONING PLAN FOR THE MAUNA KEA OBSERVATORIES

*A Sub-Plan of the Mauna Kea Comprehensive Management Plan*

**January 2010**

*Prepared for:*



Office of Mauna Kea Management  
University of Hawai'i-Hilo

*Prepared by:*



Sustainable Resources Group Intn'l, Inc.



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*Prepared for:*

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## Executive Summary

The *Decommissioning Plan for Mauna Kea Observatories* (Decommissioning Plan) is a sub-plan of the Mauna Kea Comprehensive Management Plan (CMP). It was required as a condition of approval of the CMP by the Board of Land and Natural Resources (BLNR) in April 2009. The purpose of this Decommissioning Plan is to describe a process for decommissioning observatories on Mauna Kea, including financial planning. Although some observatories have made preliminary inquiries regarding what might be expected of them if they were to cease operations, neither the State, nor the University, have guidelines for the decommissioning of facilities. This Decommissioning Plan provides the guidelines recommended by the University.

The Decommissioning Plan provides a framework that can be used by both existing and future observatories on Mauna Kea to ensure that the Department of Land and Natural Resources (DLNR) as the land owner and lessor, UH as the lessee, and the observatories as sublessees have clear expectations of the observatory decommissioning process. In presenting the decommissioning process, the plan acknowledges the distinction between the requirements for existing and new and/or renegotiated subleases. The information in this plan is also expected to assist in future planning for new facilities with respect to decommissioning.

Section 1 defines what is meant by decommissioning, including the desired future condition and necessary steps to achieve it, and the responsible entities and their roles. Section 2 outlines the decommissioning terms currently contained in the master lease and subleases and addresses potential terms for new and/or renegotiated subleases. Section 3 provides information on financial planning for decommissioning. This will help to ensure that adequate funds are available to pay for the costs of deconstruction and site restoration at the end of the life of the observatory.

Section 4 provides guidance for practical implementation of the decommissioning process including site restoration. It presents specific details on the course of action to be implemented by sublessees to comply with terms of subleases related to decommissioning. Section 5 addresses UH's goal of maintaining a world-class observatory complex and the role of telescope decommissioning in achieving limited growth. By the end of the current lease (2033) UH foresees there may be ten observatories in the Astronomy Precinct, based on UH's current understanding. Section 6 describes the need for regular review and updating of the Decommissioning Plan based on adaptive management strategies as described in the Mauna Kea CMP.

A list cross-referencing Mauna Kea CMP management actions to related sections in the Decommissioning Plan is provided in Table 1 to aid in implementing both plans. This list focuses on those actions directly related to the decision-making process of decommissioning, including options for facility removal and site restoration. Other related management information pertains to the specific activities that will occur during implementation of the decommissioning process (i.e., deconstruction, habitat restoration). These actions are detailed in Appendix A.

**Table 1. Mauna Kea CMP Management Actions Cross-Referenced to the Decommissioning Plan**

MKCMP Management Action		DP Section
<b>CMP Section 7.1.1: Native Hawaiian Cultural Resources</b>		
	<b>Management</b>	
CR-1	Kahu Kū Mauna shall work with families with lineal and historical connections to Mauna Kea, <i>kūpuna</i> , cultural practitioners, the Office of Hawaiian Affairs and other Native Hawaiian groups, including the Mauna Kea Management Board's Hawaiian Culture Committee, toward the development of appropriate procedures and protocols regarding cultural issues.	4.1, 4.2.3, 4.2.4
	<b>Historic Properties</b>	
CR-12	Consult with Kahu Kū Mauna about establishing buffers (preservation zones) around known historic sites in the Astronomy Precinct, to protect them from potential future development.	App D
<b>CMP Section 7.1.2: Natural Resources</b>		
	<b>Ecosystem Protection, Enhancement, and Restoration</b>	
NR-7	Delineate areas of high native diversity, unique communities, or unique geological features within the Astronomy Precinct and at Hale Pōhaku and consider protection from development.	App D
NR-10	Incorporate mitigation plans into project planning and conduct mitigation following new development.	App D
NR-12	Create restoration plans and conduct habitat restoration activities, as needed.	4.2.4
<b>CMP Section 7.2.2: Permitting and Enforcement</b>		
	<b>Laws and Regulations</b>	
P-1	Comply with all applicable federal, state, and local laws, regulations, and permit conditions related to activities in the UH Management Areas.	1, 2, 4, 6
P-2	Strengthen CMP implementation by recommending to the BLNR that the CMP conditions be included in any Conservation District Use Permit or other permit.	1.3, 4
<b>CMP Section 7.3.3: Site Recycling, Decommissioning, Demolition and Restoration</b>		
	<b>Site Recycling, Decommissioning, Demolition, and Restoration</b>	
SR-1	Require observatories to develop plans to recycle or demolish facilities once their useful life has ended, in accordance with their sublease requirements, identifying all proposed actions.	This plan
SR-2	Require observatories to develop a restoration plan in association with decommissioning, to include an environmental cost-benefit analysis and a cultural assessment.	4.2.4
SR-3	Require any future observatories to consider site restoration during project planning and include provisions in subleases for funding of full restoration.	3.1.2, 4.2.4

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## Acronyms

ALMA	Atacama Large Millimeter/Submillimeter Array	NEPA	National Environmental Policy Act
ASTM	American Society for Testing and Materials	NGLT	Next Generation Large Telescope
AUI	Associated Universities, Inc.	NHPA	National Historic Preservation Act
BLNR	Board of Land and Natural Resources	NOI	Notice of Intent
BOR	Board of Regents	NPDES	National Pollutant Discharge Elimination System
CDP	Complex Development Plan	NRAO	National Radio Astronomy Observatory
CDUA	Conservation District Use Application	NRMP	Natural Resources Management Plan
CDUP	Conservation District Use Permit	NSF	National Science Foundation
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	OCCL	Office of Conservation and Coastal Lands
CFHT	Canada-France-Hawai‘i Telescope	O/IR	Optical/Infrared
CMP	Comprehensive Management Plan	OMKM	Office of Mauna Kea Management
CRMP	Cultural Resource Management Plan	OSDA	Operating and Site Development Agreement
CSO	Caltech Submillimeter Observatory	RAP	Remedial Action Plan
DFP	Decommissioning Funding Plan	RDP	Research Development Plan
DLNR	Department of Land and Natural Resources	SAP	Sampling and Analysis Plan
DOH	Department of Health	SDP	Site Decommissioning Plan
EA	Environmental Assessment	SDRP	Site Deconstruction and Removal Plan
EPA	Environmental Protection Agency	SHPD	State Historic Preservation Division
ESA	Environmental Site Assessment	SMA	Submillimeter Array
HAR	Hawaii Administrative Rules	STFC	Science and Technology Facilities Council
HRS	Hawaii Revised Statutes	TMT	Thirty-Meter Telescope
IfA	Institute for Astronomy	UH	University of Hawai‘i
IRTF	Infrared Telescope Facility	UHH	University of Hawai‘i, Hilo
JCMT	James Clerk Maxwell Telescope	UKIRT	United Kingdom Infrared Telescope
MKMB	Mauna Kea Management Board	VLBA	Very Long Baseline Array
NAOJ	National Astronomical Observatory of Japan		
NAR	Natural Area Reserve		
NASA	National Aeronautics and Space Association		

## Definitions

*Deconstruction* pertains to the actions that result when a structure is no longer needed and equipment and infrastructure must be dismantled and removed from the site. Depending on the specific project, deconstruction may be partial or total.

*Demolition* includes the destructive removal of buildings and/or infrastructure that are not salvageable.

*Existing observatories* are those that are presently located on Mauna Kea and have an existing sublease agreement with UH.

*Facility* refers to the physical structures existing on site at each observatory.

*Infrastructure* refers to non-facility structures, including all supporting structures beyond a facility footprint (i.e., utility lines, roads), if common or shared.

*Land use* is defined in HAR §13-5 as “The construction, reconstruction, demolition, or alteration of any structure, building, or facility on land.”

*Observatory* is used in reference to either existing or proposed observatories.

*Obsolescence* refers to a technology that is no longer scientifically competitive.

*Recycling* is used to describe any action involving use of an existing structure that houses equipment or is used in support of research that is reused, retrofitted, rebuilt, or expanded.

*Removal* is defined as the total or partial removal of all structures and infrastructure to the extent achievable under normal engineering deconstruction planning protocols.

*Restoration* is defined as the total return, or return to the greatest extent possible, of the impacted areas to their pre-construction condition.

# 1 Observatory Decommissioning on Mauna Kea

## 1.1 Background and Purpose

The *Decommissioning Plan for Mauna Kea Observatories* (Decommissioning Plan) was initiated in response to a conditional requirement made pursuant to approval of the *Mauna Kea Comprehensive Management Plan* (CMP) by the Board of Land and Natural Resources (BLNR) in April 2009 (Ho‘akea LLC dba Ku‘iwalu 2009). BLNR required completion and approval of the Decommissioning Plan, including a financial plan, within one year or prior to the submittal of a Conservation District Use Application (CDUA), whichever occurs first.

There are currently 13 observatories on University of Hawai‘i (UH) leased land on Mauna Kea. Sublease terms specify that unless the facilities are sold or otherwise transferred, they must be removed and the site restored. The current master lease ends December 31, 2033, and would require removal of facilities at all sites to be completed by this date unless the Chairman of BLNR approves abandonment in place. Neither the master lease nor the subleases provide any guidelines for the observatory decommissioning process.

The purpose of this Decommissioning Plan is to describe a decommissioning process for observatories to follow that is acceptable to UH and the Department of Land and Natural Resources (DLNR). The Decommissioning Plan provides a framework for eventual removal of observatories and site restoration that can be used by both existing and potential future observatories on Mauna Kea to ensure that BLNR as the lessor, UH as the lessee, and the observatories as sublessees have clear expectations of the observatory decommissioning process. This plan identifies the trigger for initiating the decommissioning process, financial planning needs (Section 3) and detailed guidance on the decommissioning process for sublessees (Section 4). It also contains information that may be required under new and/or renegotiated lease agreements between the UH and sublessees, which is expected to assist them in the planning process for their facilities. The plan presents a revised statement from UH on objectives and future plans for astronomy development on Mauna Kea (Section 5). Finally, it recognizes that adaptive management strategies are to be utilized by the University (Section 6). This adaptive strategy suggests that as more information becomes available and as circumstances change, the Decommissioning Plan will be amended to adapt to new information and changed circumstances.

This Decommissioning Plan does not address specific timelines or dates for decommissioning observatories, except that all decommissioning activities shall be completed by the end of the master lease (see Section 2.2.5), nor does it address the process of renegotiation of a new master lease or sublease agreements.

## 1.2 Observatory Decommissioning Process

Decommissioning refers to a process that results in the *partial or total* removal of all structures associated with an observatory facility and the restoration of the site, to the *greatest extent possible*, to its pre-construction condition.<sup>1</sup> An observatory shall enter into consultation with DLNR and UH regarding the

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<sup>1</sup> This expands on the definition contained in the 2009 Mauna Kea CMP, which stated “*Decommissioning* relates to the process when a facility is deemed obsolete and a determination has been made by the facility lessee to remove the telescope and restore the site.”

decommissioning process when a decision is made by the sublessee to cease operations, and deconstruct and remove their facilities on Mauna Kea. The sublessee that negotiates the decommissioning process shall be the legally recognized entity identified in the sublease agreement with UH and shall have full legal power to represent the operator, or consortium of operators, of the observatory. If and when astronomy use on Mauna Kea ends, all observatories will be decommissioned.

Decommissioning is initiated when a sublessee decides to cease operation due to changing priorities, lack of funding, or obsolescence; when the sublease expires; or if UH revokes a sublease (see Section 5.1). The decommissioning process guides the deconstruction of the observatory facility and its supporting infrastructure and restoration of the site (see Section 4). In addition to a funding plan (see Section 3.1), the four components of the process include (1) a Notice of Intent, (2) an environmental due diligence review, (3) a Site Deconstruction and Removal Plan and, (4) a Site Restoration Plan.

### 1.3 Entities with a Role in the Observatory Decommissioning Process

The decommissioning process involves several different entities with responsibilities related to decommissioning (see Table 2). Since UH leased lands are within the State Conservation District, land use is subject to the requirements of Hawai'i Administrative Rules (HAR) §13-5. Additional information about these entities can be found in Section 3.3 of the Mauna Kea CMP.

**Table 2. Mauna Kea Observatory Decommissioning Roles and Responsibilities**

Entity		Roles and Responsibilities
<b>Department of Land and Natural Resources</b>		
Board of Land and Natural Resources (BLNR)	-	Land owner and issuer of master lease Final approval over all land uses on Conservation District lands pursuant to the Conservation District Use Permit (CDUP) process
Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL)	-	Regulates and enforces land use for lands that lie within the State's Conservation District Processes Conservation District land use requests Discussion and approval of decommissioning options per lease terms Any decommissioning plan in which a facility would be deconstructed and a site restored is subject to review and consideration by DLNR through the CDUP process <sup>2</sup>
Department of Land and Natural Resources, Land Division	-	Manages State-owned lands Responsible for master lease negotiations between DLNR and UH
State Historic Preservation Division (DLNR-SHPD)	-	Reviews proposed construction and deconstruction projects to ensure minimal effects on historic and cultural properties
<b>Department of Health</b>		
Clean Water Branch	-	Reviews National Pollutant Discharge Elimination System (NPDES) permit
Safe Drinking Water Branch	-	Reviews cesspool and septic tank abandonment/removal plans
Waste Water Branch	-	Reviews cesspool and septic tank abandonment/removal plans

<sup>2</sup> DLNR will review all Notices of Intent and then decide if a CDUP is necessary (see Section 4.2.1). If yes, the Site Decommissioning Plan (SDP) may be included in the CDUA and made a condition of the CDUP.

Entity		Roles and Responsibilities
<b>County of Hawai'i</b>		
Building Division	-	Issues building, plumbing and electrical permits <sup>3</sup>
Engineering Division	-	Reviews grubbing, grading, and stockpile permits
Planning Department	-	Reviews grubbing, grading, and stockpile permits
<b>University of Hawai'i</b>		
Office of Mauna Kea Management (OMKM)	-	<ul style="list-style-type: none"> <li>Oversees day-to-day management of the UH Management Areas<sup>4</sup></li> <li>Has advisory committees (Environment Committee, Wēkiu Bug Scientific Committee, Hawaiian Culture Committee, and Public Safety Committee)</li> <li>Responsible for overall coordination of the decommissioning process</li> <li>Responsible for reviewing project designs and ensuring that any proposed project is consistent with the 2000 Master Plan and the Mauna Kea CMP</li> <li>Responsible for coordination of the 'Major Project Review Process', which addresses new construction and site recycling<sup>5</sup></li> </ul>
Mauna Kea Management Board (MKMB)	-	<ul style="list-style-type: none"> <li>Volunteer board representing the community and advising on activities, operations, proposed land uses, and decommissioning planned for UH Management Areas</li> <li>In consultation with Kahu Kū Mauna, is responsible for reviewing and recommending proposed facility's Site Decommissioning Plan (SDP)</li> </ul>
Kahu Kū Mauna	-	<ul style="list-style-type: none"> <li>Volunteer council appointed by MKMB</li> <li>Advises MKMB, OMKM, and the UH Hilo Chancellor on Hawaiian cultural matters affecting the UH Management Areas</li> <li>Responsible for reviewing proposed facility's SDP from a cultural perspective</li> </ul>
Mauna Kea Observatories Support Services (MKSS)	-	Oversees the general maintenance and logistical services to all Mauna Kea observatories and the facilities at Hale Pōhaku
Institute for Astronomy (IfA)	-	Promotes and provides guidance regarding astronomical research, including long-term planning and visioning.
<b>Observatories</b>		
Sublessees <sup>6</sup>	-	Responsible for working with UH and DLNR during the decommissioning process and for submitting and implementing a decommissioning plan that both complies with the terms of their sublease and is consistent with the Mauna Kea CMP and its sub-plans.

<sup>3</sup> Plumbing and electric permits not required for total demolition.

<sup>4</sup> The UH Management Areas on Mauna Kea extend from approximately 9,200 ft to the summit at 13,796 ft, encompassing three distinct areas: the Mauna Kea Science Reserve, the mid-level facilities at Hale Pōhaku, and the Summit Access Road.

<sup>5</sup> The Major Project Review Process, as approved by the BOR, includes the Master Plan Design Review Process, an environmental review process, the Master Plan Project Approval Process, and the DLNR CDUA Process.

<sup>6</sup> Two of the observatories (the UH 2.2-m and the UHH 0.9-m) are wholly owned and operated by the University of Hawai'i. UH has an equity interest in the Canada-France-Hawaii Telescope, as a member of the CFHT Corporation. The NASA IRTF is owned by NASA and operated by UH under a Cooperative Agreement with NASA. All the others are owned and operated by a single entity or by a consortium that does not include UH (see Table 3).

## 1.4 BLNR Approvals and Potential Conditions

When BLNR approved the Mauna Kea CMP in April 2009, it imposed a condition that UH develop a Decommissioning Plan, including a financial plan. The Decommissioning Plan, if approved by BLNR, shall become part of the Mauna Kea CMP, which is the approved management plan for the UH Management Areas on Mauna Kea.

Subleases from UH are conditional on receipt of a CDUP from BLNR for the proposed land use within the Conservation District. Land use is defined in HAR §13-5, Conservation District as:

*“the construction, reconstruction, demolition, or alteration of any structure, building, or facility on land.”*

Issuance of a CDUP by BLNR indicates that the proposed land use (i.e. construction of an observatory) has been reviewed pursuant to Hawai‘i Revised Statutes (HRS) Chapter 183 and HAR §13-5. The CDUP process is used to evaluate the compatibility of use and the potential impacts to valued cultural, historical and natural resources. As the lease holder for the Science Reserve, UH is responsible for obtaining the CDUP for all sublessees. CDUPs may also be required as part of the decommissioning process when the observatory is demolished (see Section 4.2).

Observatories that follow the decommissioning process outlined in this plan will ensure that all elements of the process adhere to all applicable statutes and local ordinances and are coordinated with and approved by UH and DLNR. Although this process cannot be required of existing sublessees (see Section 2.2.1), it is recommended that existing sublessees utilize this process in the eventual removal of their observatories. In addition, the process and proposed requirements may also be included in any new or renegotiated leases or subleases in the Mauna Kea Science Reserve.

## 1.5 Guidance from the Mauna Kea CMP

The Mauna Kea CMP provides a guide for managing existing and future activities and uses to ensure ongoing protection of Mauna Kea’s cultural and natural resources, many of which are unique. The role of the Mauna Kea CMP in considering future land use is to guide the evaluation of proposed projects from the standpoint of potential impacts to cultural and natural resources, and to provide management actions that can be adopted by BLNR as special conditions in any CDUPs that it may issue.<sup>7</sup> As a sub-plan, the Decommissioning Plan is consistent with the information and management actions set forth in the Mauna Kea CMP.

Site recycling, decommissioning, demolition, and restoration were specifically developed as a component plan as part of the guidelines for managing the built environment (see Section 7.3.3 of the Mauna Kea CMP). The desired outcome of this component plan as stated in the CMP is:

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

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<sup>7</sup> Similarly, the Decommissioning Plan presents a process that can be incorporated in part or in full into CDUPs for decommissioning activities (see Section 4).

Many of the activities related to decommissioning that will occur during its implementation (i.e., deconstruction, habitat restoration, archaeological monitoring) are addressed in the CMP and related sub-plans. Additional details and considerations are found in the Mauna Kea CMP, the *Cultural Resources Management Plan for the UH Management Areas on Mauna Kea* (CRMP) and the *Natural Resources Management Plan for the UH Management Areas on Mauna Kea* (NRMP) (McCoy et al. 2009; SRGII 2009) (see Appendix A).

## 2 Decommissioning Terms in Lease Agreements

### 2.1 Mauna Kea Science Reserve Master Lease

The Mauna Kea Science Reserve (Science Reserve) was established in 1968 through a 65-year lease (General Lease No. S-4191) between BLNR (Lessor) and UH (Lessee). It encompasses 11,288 acres (ac) above approximately 11,500 ft elevation, except for the area within the Mauna Kea Ice Age Natural Area Reserve (NAR).<sup>8</sup> According to the lease the Science Reserve is to be used ‘as a scientific complex’. The University’s Master Plan for the Mauna Kea Science Reserve (2000 Master Plan) designated 525 ac of the leased land as an “Astronomy Precinct,” where development is to be consolidated to maintain a close grouping of astronomy facilities and support infrastructure. The remaining 10,763 ac are designated a Natural/Cultural Preservation Area in order to protect natural and cultural resources (Group 70 International 2000).

The master lease expires on December 31, 2033. It may be terminated at any time by the Lessee or for cause by the Lessor. Under the master lease, DLNRs reserved rights include hunting and recreation, water, and trails and access. The lease allows for the construction of improvements (buildings, infrastructure and other improvements), with BLNR’s approval. Without a new lease, or approval from the Chairman of BLNR to abandon them in place, permitted improvements within the Science Reserve must be removed prior to December 31, 2033.<sup>9</sup> There is no specific provision in the master lease related to decommissioning or site restoration.

Relevant sections of the master lease relating to Lessee responsibilities, returning the land back to the State of Hawai‘i, and the fate of improvements include:

*The Lessee, in consideration of the premises, covenants with the Lessor as follows:*

- 1. Surrender. The Lessee shall, at the expiration or sooner termination of this lease, peaceably and quietly surrender and deliver possession of the demised premises to the Lessor in good order and condition, reasonable wear and tear excepted.*
- 2. Maintenance of the Premises. The Lessee shall keep the demised premises and improvements in a clean, sanitary and orderly condition.*

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<sup>8</sup> The Science Reserve originally encompassed approximately 13,321 acres, but in 1998 2,033 acres were withdrawn as part of the Mauna Kea Ice Age Natural Area Reserve (NAR).

<sup>9</sup> In order to operate observatories past the current lease end date, the University will need to negotiate a new lease with DLNR. If a new master lease is negotiated, new subleases will likely be negotiated with the observatories.

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

5. Assignments. *The Lessee shall not sublease, sub-rent, assign or transfer this lease or any rights thereunder without the prior written approval of the Board of Land and Natural Resources.*

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

13. Objects of Antiquity. *The Lessee shall not appropriate, damage, remove, excavate, disfigure, deface or destroy any object of antiquity, prehistoric ruin or monument of historical value.*

## **2.2 Sublease Terms**

With the exception of the two UH telescopes, the entities that own or operate the existing observatories each have a sublease with UH outlining the terms of their occupancy. Terms of current subleases are tied to the terms of the master lease and expire on December 31, 2033. Current sublessees shall abide by the terms of their subleases (see Section 2.2.1) until they are renegotiated (see Section 2.2.2) or terminated (see Section 2.2.3). New observatories will require a new sublease (see Section 2.2.2).

### **2.2.1 Terms of Existing Subleases**

Existing subleases specify terms for the disposition of observatory facilities in the event of termination or expiration of tenancy (see Table 3). Unless and until existing observatories revise their subleases, they need only comply with the existing terms. In general, the terms require sublessees to 1) remove the facilities and restore the property at the expense of the sublessee; 2) sell the facilities to UH or a third party; or 3) surrender the facilities to UH upon approval of UH and the Chairman of BLNR. This decommissioning plan addresses the first option, which is to remove the facilities and restore the site.

Decommissioning provisions in existing subleases require the removal of the facility, at the sublessees' sole expense, and restoration of the observatory site to either "even grade" or "original condition". Subleases do not state whether removal means complete removal of all facilities and infrastructure. The following is from the sublease to the Science and Engineering Research Council dated February 10, 1984, and is indicative of terms of other subleases:

*In the event that part of the property is removed, Sublessee shall restore the demised premises, or any portion affected thereby, to even grade to the extent that improvements are removed, and shall repair any damage done to the improvements in the event that equipment is removed. . . . [A]ll property shall be razed and removed at the sole expense of Sublessee. Such action shall be completed within ONE (1) year after termination or expiration of this Sublease, unless otherwise*



*agreed in writing by Sublessor. In the event of such removal, Sublessee shall restore the demised premises, or any portion affected thereby, to even grade. In the event Sublessee shall fail to remove such property or debris and restore the demised premises within the time specified above, such property may be removed, the land restored to even grade by Sublessor at the expense of Sublessee.*

The existing subleases do not provide details about the decommissioning process. A process is outlined as part of this Decommissioning Plan in the form of a Site Decommissioning Plan (SDP) (see Section 4). In accordance with the Mauna Kea CMP and this Decommissioning Plan, it is recommended that existing sublessees develop SDPs. If sublessees develop the SDP as described, they will ensure that all elements of the deconstruction and site restoration process adhere to all applicable statutes and local ordinances and are coordinated with and approved by UH and DLNR.

### **2.2.2 Proposed Terms for New and/or Renegotiated Subleases**

Potential future observatories will be required to obtain CDUPs from BLNR in coordination with UH, and sign sublease agreements with UH, subject to approval by BLNR. New subleases will likely be more specific regarding the actual terms of the requirements for decommissioning, including compliance with the policies, objectives and recommendations of the Mauna Kea CMP and this Decommissioning Plan, as well as other applicable plans, policies and/or permits.

If UH negotiates a new master lease for the Science Reserve with DLNR, there will be an opportunity to renegotiate existing subleases. Similar to the requirements for potential new observatories, any renegotiated sublease will likely be more specific in terms of requirements for decommissioning, including compliance with the policies, objectives and recommendations of the Mauna Kea CMP and this Decommissioning Plan, as well as other applicable plans, policies and/or permits.

### **2.2.3 Terminating Subleases**

Subleases are terminated upon conclusion of operation of a particular telescope by a sublessee, expiration of tenancy at the end of a lease, or revocation of a sublease by UH. Unless the facility is recycled, it must be deconstructed and the site restored per the terms of the sublease.

### **2.2.4 Site Abandonment**

Although unlikely, it is possible that a sublessee could abandon an observatory in place, without deconstructing and site restoration. If this happens, UH, as the lessee to DLNR, will ultimately be responsible for the site through the terms of their master lease. If the facility cannot be recycled, site decommissioning could include having to remove facilities and restore the site. Funding mechanisms to limit the possibility of the financial burden from falling on UH in this situation should be included in any new or renegotiated sublease (see Section 3.1).

### **2.2.5 Existing Decommissioning Information**

During preparation of the Mauna Kea CMP, UH IfA asked observatories to clarify their understanding of and commitment to compliance with their sublease terms regarding removal of their facilities. Appendix B includes copies of the written confirmation provided to IfA from each observatory. Table 3 summarizes the latest available information related to decommissioning by observatories including sublessee, sublease

start date, operational start date, lease/sublease end date; planned operational period; lease/sublease terms; decommissioning date; funding source for decommissioning; and other related information.

Due to contractual and legal agreements between sublessees and UH, a timeline for decommissioning of individual facilities is not possible except to note that unless otherwise stated by the sublessee, observatories are assumed to be operational through the end of their sublease term (see Section 5.3).

**Table 3. Mauna Kea Observatories: Summary of Information Related to Decommissioning**

Topic		Description
<b>Optical/Infrared</b>		
<b>UHH 0.9-m Telescope</b>		
UH 0.9-m telescope	<b>Sublessee</b>	University of Hawai'i at Hilo
	<b>Sublease Start Date</b> <sup>10</sup>	N/A
	<b>Operational Start Date</b>	2008
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b> <sup>11</sup>	Operational for minimum of 20 yr (new facility)
	<b>Lease /Sublease Terms</b>	Remove or dispose of by UH at the expiration or sooner termination of the lease, unless BLNR Chair approves that facilities may remain in place
	<b>Decommissioning Date</b>	Not planned at this time
	<b>Funding Source for Decommissioning</b>	
	<b>Other</b>	UHH received funding from the National Science Foundation (NSF) for an educational and research telescope on Mauna Kea, for the use of its faculty and students. The building is a reuse of the UH 0.6m observatory that operated from 1968-2008. The 0.9-m telescope is currently being built, with planned operation by 2010. <sup>12</sup>
<b>UH 2.2-m Telescope</b>		
UH 2.2-m telescope	<b>Sublessee</b>	University of Hawai'i
	<b>Sublease Start Date</b> <sup>10</sup>	N/A
	<b>Operational Start Date</b>	1970
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b>	Expected to continue until replacement by Pan-STARRS (estimated 2012)
	<b>Lease /Sublease Terms</b>	Same as UHH 0.9m
	<b>Decommissioning Date</b>	Planned for replacement by Pan-STARRS. Timing will be determined by permitting process and availability of funding.
	<b>Funding Source for Decommissioning</b>	
	<b>Other</b>	Pan-STARRS would reuse the site and operate for a minimum of 10 years.
<b>NASA Infrared Telescope Facility (IRTF)</b>		
IRTF	<b>Sublessee</b>	NASA
	<b>Sublease Start Date</b>	November 29, 1974
	<b>Operational Start Date</b>	1979
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b>	

<sup>10</sup> The two UH observatories are covered by the terms of the 65-year General Lease No. S-4191 between BLNR and UH established in 1968. All other entities have sublease agreements with UH.

<sup>11</sup> Per R.P. Kudritzki, MKCMP Appendix A9: Reflects planned operations.

<sup>12</sup> "UH Hilo Educational Telescope" <http://www.astro.uhh.hawaii.edu/NewEducationalTelescope.php> (2009).

Topic		Description
	<b>Lease /Sublease Terms</b>	1. Surrender to UH subject to approval of UH and BLNR Chair 2. Removal of facilities and restoration of property at expense of NASA Minimum period of advance notice for terminating sublease in writing by sublessee is not specified.
	<b>Decommissioning Date</b>	Not planned at this time
	<b>Funding Source for Decommissioning</b>	Subject to the availability of appropriated funding i.e. congressional approval for the expenditure of taxpayer dollars.
	<b>Other</b>	Has not quantified any termination costs.
<b>Canada-France-Hawai'i Telescope (CFHT)</b>		
CHFT	<b>Sublessee</b>	Canada-France-Hawai'i Telescope Corporation. Telescope is shared by Canada, France and UH
	<b>Sublease Start Date</b>	December 18, 1975
	<b>Operational Start Date</b>	1979
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b>	
	<b>Lease /Sublease Terms</b>	1. Surrender to UH subject to approval of UH and BLNR Chairman 2. Removal of facilities and restoration of property at expense of CFHT Sublease has provision that allows termination by sublessee with six (6) months notice.
	<b>Decommissioning Date</b>	Not planned at this time
	<b>Funding Source for Decommissioning</b>	CFHT Corporation
	<b>Other</b>	\$6 million quote for decommissioning was given in 2004. This did not include any clean-up of contaminated soil. Planning for one year of operational costs for 'cleaning cost'. Potentially sell Waimea headquarters to fund decommissioning.
<b>United Kingdom Infrared Telescope (UKIRT)</b>		
UKIRT	<b>Sublessee</b>	Science and Technology Facilities Council (STFC) of the United Kingdom
	<b>Sublease Start Date</b>	September 21, 1978
	<b>Operational Start Date</b>	1979
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b>	
	<b>Lease /Sublease Terms</b>	1. Sale to UH 2. Sale to a 3 <sup>rd</sup> party acceptable to UH 3. Surrender with the approval of BLNR Chair 4. Removal of facilities and restoration of property at expense of STFC Sublease has provision that allows termination by either party with five (5) years notice.
	<b>Decommissioning Date</b>	Not planned at this time
	<b>Funding Source for Decommissioning</b>	STFC
	<b>Other</b>	Received confidential quote for decommissioning in 2006. This information is not available for public record. Facility to be removed and site restored to original condition at end of operation. The financial provision for this is maintained within the STFC (not Joint Astronomy Centre) budget and is informed by an exercise conducted every 3-5 years to secure up-to-date estimates for decommissioning. <sup>13</sup>

<sup>13</sup> <http://www.jach.hawaii.edu/admin/Finance/JAC%20ASSET%20MANAGEMENT%20STRATEGY.htm>

<b>Topic</b>		<b>Description</b>
<b>W. M. Keck Observatory (Keck I)</b>		
<b>Keck I</b>	<b>Sublessee</b>	Caltech and the University of California
	<b>Sublease Start Date</b>	June 29, 1992
	<b>Operational Start Date</b>	1992
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b>	Operational for minimum of 20 yr
	<b>Lease /Sublease Terms</b>	<ol style="list-style-type: none"> <li>1. Removal of facilities and restoration of property at expense of Caltech</li> <li>2. Sale to UH</li> <li>3. Sale to a 3<sup>rd</sup> party, contingent upon the execution of a new Sublease and Operating and Site Development Agreement between the 3<sup>rd</sup> party and UH</li> <li>4. Surrender in place</li> </ol> <p>Options 2, 3, and 4 require approval of UH and DLNR. If none of these options are available, option 1 must be completed within 1 year.</p> <p>Sublease has provision that allows termination by sublessee with two (2) years notice.</p>
	<b>Decommissioning Date</b>	Not planned at this time
	<b>Funding Source for Decommissioning</b>	Caltech and University of California
	<b>Other</b>	
<b>W. M. Keck Observatory (Keck II)</b>		
<b>Keck II</b>	<b>Sublessee</b>	Caltech and the University of California
	<b>Sublease Start Date</b>	June 29, 1992
	<b>Operational Start Date</b>	1996
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b>	Operational for minimum of 20 yr
	<b>Lease /Sublease Terms</b>	Same as Keck I
	<b>Decommissioning Date</b>	Not planned at this time
	<b>Funding Source for Decommissioning</b>	Caltech and University of California
	<b>Other</b>	
<b>Subaru Telescope</b>		
<b>Subaru</b>	<b>Sublessee</b>	National Astronomical Observatory of Japan (NAOJ).
	<b>Sublease Start Date</b>	June 5, 1992
	<b>Operational Start Date</b>	1999
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b>	Operational for minimum of 20 yr
	<b>Lease /Sublease Terms</b>	<ol style="list-style-type: none"> <li>1. Removal of facilities and restoration of property at expense of NAOJ</li> <li>2. Sale to UH</li> <li>3. Sale to a 3<sup>rd</sup> party, contingent upon the execution of a new Sublease and Operating and Site Development Agreement between the 3<sup>rd</sup> party and UH</li> <li>4. Surrender in place</li> </ol> <p>Options 2, 3, and 4 require approval of UH and DLNR. If none of these options are available, option 1 must be completed within 1 year</p> <p>Sublease has provision that allows termination by sublessee with two (2) years notice.</p>
	<b>Decommissioning Date</b>	Not planned at this time
	<b>Funding Source for Decommissioning</b>	NAOJ
	<b>Other</b>	2008 estimate: Removal of the Subaru telescope would cost more than \$10 million.

Topic		Description
<b>Gemini North Telescope</b>		
<b>Gemini</b>	<b>Sublessee</b>	US National Science Foundation (NSF) <sup>14</sup>
	<b>Sublease Start Date</b>	August 9, 1994
	<b>Operational Start Date</b>	1999
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b>	Operational for minimum of 20 yr
	<b>Lease /Sublease Terms</b>	<ol style="list-style-type: none"> <li>1. Removal of facilities and restoration of property at expense of NSF</li> <li>2. Sale to UH</li> <li>3. Sale to a 3<sup>rd</sup> party, contingent upon the execution of a new Sublease and Operating and Site Development Agreement between the 3<sup>rd</sup> party and UH</li> <li>4. Surrender in place</li> </ol> <p>Options 2, 3, and 4 require approval of UH and DLNR. If none of these options are available, option 1 must be completed within 1 year</p> <p>Sublease has provision that allows termination by sublessee with two (2) years notice.</p>
	<b>Decommissioning Date</b>	Not planned at this time
	<b>Funding Source for Decommissioning</b>	NSF to pursue funding
	<b>Other</b>	2008 estimate: Removal of the Gemini North telescope would cost approximately \$9 million.
<b>Radio</b>		
<b>Caltech Submillimeter Observatory (CSO)</b>		
<b>CSO</b>	<b>Sublessee</b>	Caltech and the US National Science Foundation
	<b>Sublease Start Date</b>	December 20, 1983
	<b>Operational Start Date</b>	1987
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b>	
	<b>Lease /Sublease Terms</b>	<ol style="list-style-type: none"> <li>1. Sale to UH</li> <li>2. Sale to a 3<sup>rd</sup> party acceptable to UH</li> <li>3. Surrender with the approval of BLNR Chair</li> <li>4. Removal of facilities and restoration of property at expense of Caltech</li> </ol> <p>If none of options 1-3 is completed within 12 months after termination or expiration of the sublease, option 4 must be exercised.</p> <p>Sublease has provision that allows termination by sublessee with two (2) years notice.</p>
	<b>Decommissioning Date</b>	Plans call for the dismantling of the observatory to begin in 2016, with the return of the site to its natural state by 2018. <sup>15</sup>
	<b>Funding Source for Decommissioning</b>	Caltech
	<b>Other</b>	
<b>James Clerk Maxwell Telescope (JCMT)</b>		
<b>JCMT</b>	<b>Sublessee</b>	STFC. Telescope is shared by the UK, Canada and the Netherlands
	<b>Sublease Start Date</b>	February 10, 1984
	<b>Operational Start Date</b>	1987
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b>	

<sup>14</sup> The Gemini Observatory, comprising the Gemini North Telescope on Mauna Kea and the Gemini South Telescope in Chile, is a scientific collaboration among the US, UK, Canada, Australia, Argentina, Brazil and Chile. The Gemini Observatory is operated by the Association of Universities for Research in Astronomy Inc. under an agreement with the NSF.

<sup>15</sup> "Caltech Submillimeter Observatory in Hawaii to be decommissioned". <http://www.hawaii247.org/2009/05/01/caltech-submillimeter-observatory-in-hawaii-to-be-decommissioned/> (1 May 2009).

Topic		Description
	<b>Lease /Sublease Terms</b>	<ol style="list-style-type: none"> <li>1. Sale to UH</li> <li>2. Surrender with the approval of UH</li> <li>3. Sale to a 3<sup>rd</sup> party acceptable to UH</li> <li>4. Removal of facilities and restoration of property at expense of STFC</li> </ol> <p>If none of options 1-3 is agreed upon within six months, then option 4 must be exercised.</p> <p>Minimum period of advanced notice for terminating sublease in writing by sublessee is not specified.</p>
	<b>Decommissioning Date</b>	Not planned at this time
	<b>Funding Source for Decommissioning</b>	STFC
	<b>Other</b>	See details for UKIRT
<b>Submillimeter Array (SMA)</b>		
SMA	<b>Sublessee</b>	Smithsonian Astrophysical Observatory/Taiwan
	<b>Sublease Start Date</b>	May 15, 1995
	<b>Operational Start Date</b>	2002
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b>	Operational for minimum of 20 yr
	<b>Lease /Sublease Terms</b>	<ol style="list-style-type: none"> <li>1. Removal of facilities and restoration of property at expense of Smithsonian</li> <li>2. Sale to UH</li> <li>3. Sale to a 3<sup>rd</sup> party, contingent upon the execution of a new Sublease and Operating and Site Development Agreement between the 3<sup>rd</sup> party and UH</li> <li>4. Surrender in place</li> </ol> <p>Options 2, 3, and 4 require approval of UH and DLNR. If none of these options are available, option 1 must be completed within 1 year</p> <p>Sublease has provision that allows termination by sublessee with two (2) years notice.</p>
	<b>Decommissioning Date</b>	Not planned at this time
	<b>Funding Source for Decommissioning</b>	Smithsonian Institution
VLBA	<b>Other</b>	Smithsonian Institution has put forth a variety of technical options for decommissioning, but did not have any cost estimates at this time.
	<b>Very Long Baseline Array (VLBA)</b>	
	<b>Sublessee</b>	US National Radio Astronomy Observatory (NRAO), Associated Universities Inc., and the US NSF
	<b>Sublease Start Date</b>	September 28, 1990
	<b>Operational Start Date</b>	1992
	<b>Lease / Sublease End Date</b>	2033
	<b>Operations</b>	
	<b>Lease /Sublease Terms</b>	<ol style="list-style-type: none"> <li>1. Removal of facilities and restoration of property at expense of NRAO</li> <li>2. Sale to UH</li> <li>3. Sale to a 3<sup>rd</sup> party, contingent upon the execution of a new Sublease and Operating and Site Development Agreement between the 3<sup>rd</sup> party and UH</li> <li>4. Surrender in place</li> </ol> <p>Options 2, 3, and 4 require approval of UH and DLNR. If none of these options are available, option 1 must be completed within 1 year.</p> <p>Sublease has provision that allows termination by sublessee with one (1) year notice.</p>
	<b>Decommissioning Date</b>	Not planned at this time
	<b>Funding Source for Decommissioning</b>	NSF to pursue funding
	<b>Other</b>	Site will not be reused in the future.

### 3 Financial Planning for Decommissioning

Inclusion of a financing plan as part of the Decommissioning Plan was a specific condition of BLNR's conditional approval of the Mauna Kea CMP. Costs for decommissioning observatories have the potential to be substantial and, therefore a financial planning is critical to ensure sufficient funds are available for decommissioning activities. A financial assurance or other financial arrangement provided by a sublessee is a guarantee that funds for decommissioning will be available when needed. Financial assurance helps ensure that a suitable mechanism is in place for financing the deconstruction of facilities and site restoration. This is necessary to both fund the decommissioning activities and to ensure funding in the event that a sublessee is unable or unwilling to complete decommissioning in a timely manner. Obtaining and maintaining current updated estimates of these costs are essential over the long-term planning horizon. The amount of financial assurance obtained should be based on a conceptual cost estimate<sup>16</sup> and must be adjusted over time. Financial assurance is achieved through the use of financial instruments (see Section 3.2).

The need for financial assurance arises from concern that although current subleases contain provisions requiring "removal of facility and restoration of site" if no other option is selected or agreed upon, there are no financial assurances that funding is available for facility removal or site restoration. Although existing sublessees have affirmed their commitment to funding decommissioning activities, and some have obtained preliminary cost estimates, there are no known funds specifically set aside for this purpose (see Table 3 and Appendix B). Ideally, financial assurance for decommissioning should be obtained prior to the commencement of permitted activities, incorporated into sublease terms, and maintained until termination of the sublease. Such assurance may be included in all new or renegotiated subleases. This section outlines recommended financial planning requirements for decommissioning applicable to sublessees on Mauna Kea.

#### 3.1 Decommissioning Funding Plan

Funding details will be included in a Decommissioning Funding Plan (DFP) for each new or renegotiated sublease. A DFP is a document that contains a cost estimate for decommissioning, describes the method for assuring funds for decommissioning through one or more financial instruments, describes the means for adjusting both the cost estimate and funding level over the life of the sublease, and contains a certification of financial assurance that may include but not be limited to signed originals of the financial instruments provided as financial assurance. A certification of financial assurance documents the sublessee's assurance that a prescribed amount of funding has been secured for decommissioning and site restoration. The amount secured should be based on the conceptual cost-estimate and be sufficient to adequately perform the decommissioning proposed in the SDP and comply with all local, state and federal environmental regulations.

##### 3.1.1 Developing a Decommissioning Funding Plan

###### ***Existing Subleases***

It is recommended that existing sublessees develop a DFP or similar document as soon as a decision is made regarding the extent of facility removal and level of site restoration and, if feasible, at least two

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<sup>16</sup> Conceptual cost is a best estimate derived prior to development of detailed engineering plans. The value estimated should be considered provisional and it is derived using common engineering cost estimate methods.

years prior to the actual decommissioning of their facility (see Table 4). A DFP or similar document provides assurances to UH and DLNR that the sublessee has sufficiently planned for meeting the terms of their sublease agreement.

### ***New and Renegotiated Subleases***

For new and renegotiated subleases, DFPs should be developed when negotiating the sublease or upon an agreement between an observatory and its funding entity, and should become part of the subleases. This will allow the costs for deconstruction and site restoration to be recognized over the estimated life of the facilities. The DFP and associated cost estimates will be reviewed and updated periodically on an agreed upon term (at a minimum every 15 years) by the sublessee to current costs and submitted to UH in the form of an update to the DFP.

**Table 4. Timeline for Developing a Decommissioning Funding Plan**

<b>Activity</b>	<b>Existing Sublease</b>	<b>New or Renegotiated Sublease</b>
Submission of initial DFP, or similar document to UH	Requested as soon as a decision is made regarding the extent of facility removal and level of site restoration and, if feasible at least two (2) years prior to the actual decommissioning of the facility.	With sublease or upon acceptance of an agreement with observatory funding entity.
Submission of conceptual cost estimate	Component of initial DFP or similar document (recommended)	Component of initial DFP
Submission of detailed cost estimate	One to two (1-2) years prior to start of deconstruction, or as soon as feasible (recommended)	One to two (1-2) years prior to start of deconstruction
UH review; MKMB approval	Within six (6) months of receipt	With sublease
Updates	Requested every fifteen (15) years	Required every fifteen (15) years
Integrate into SDP	If a DFP or similar document is prepared, submit with NOI to include information on how funding for decommissioning is being assured	Submit with NOI

### **3.1.2 Estimating Costs for Decommissioning**

Conceptual cost estimates are used as a basis for determining the initial amount of financial assurance to be obtained. Conceptual cost is a best estimate derived prior to development of detailed engineering plans. The value estimated should be considered provisional and it is derived using common engineering cost estimate methods. Costs must be adjusted over time. The preparation of a conceptual cost estimate is part of the financial assurance and confirms that the sublessee has a plan, albeit preliminary, for removing their facilities and restoring the site, per their respective sublease terms. A conceptual cost estimate is subject to review by UH and/or DLNR.



When an SDP is initiated, the conceptual cost estimate should be replaced by a detailed cost estimate (see Table 4). The detailed cost estimate should be submitted together with other required SDP documents describing site deconstruction and restoration (see Section 4.2).

The detailed cost estimate should provide for removal of the facility and restoring the site to the ‘full’ level (see Section 4.2.4). The detailed cost estimate shall be prepared, preferably by a Licensed Engineer, and is subject to review at the request of UH and/or DLNR. The estimate shall be used as the basis for decision-making in terms of determining the extent of funding deconstruction and site restoration activities or, if allowed, allocating funds to a different purpose (see Section 4.3). Funding for site restoration is the responsibility of the sublessee. The detailed cost estimate shall include funding of an effectiveness monitoring program to evaluate the restoration for an agreed upon time. In the event that the monitoring schedule extends past the termination date of the sublease, the monitoring funds will be housed at OMKM, or at a mutually agreed upon agency or organization, and used to complete the monitoring.

### **3.1.3 Finalizing Decommissioning Costs**

DfPs are eventually incorporated into SDPs. When the information is included in the SDP at the end of operations, it will need to include: (a) an updated, detailed cost estimate for deconstruction and restoration; (b) one or more financial assurance mechanisms (including supporting documentation); (c) a comparison of the cost estimate with the financial assurance secured for decommissioning; and (d) a plan for assuring the availability of adequate funds for completion of decommissioning. A situation may arise in which a sublessee has set aside funding, but it does not engage in decommissioning. This would be the case if the site was sold to UH or another entity or surrendered to UH (see Section 2.2). The sublessee would be required to conduct any tasks outlined in contractual agreements related to decommissioning with these funds (e.g. environmental due diligence prior to land transfer). Any surplus funds are owned by the sublessee. A new owner would be responsible for complying with the sublease terms, including decommissioning and restoration of the site.

## **3.2 Financial Assurance Mechanisms**

A number of different types of financial instruments may be used to demonstrate financial assurance, for example, trusts, letters of credit, surety bonds, and guarantees. Some financial instruments provide a special account into which the sublessee may prepay the applicable costs. Other financial instruments guarantee funding by a suitably qualified third party, thereby providing contingency in the event the sublessee is unable or unwilling to pay these costs when they arise. There are a number of different mechanisms to choose from to comply with the financial assurance requirements for decommissioning, which can be used on their own or in combination. The following are examples of financial assurance “methods”:

*Prepayment.* Under this method, the sublessee provides advance decommissioning funding in full using an account segregated from the sublessee’s assets and outside the sublessee’s administrative control. Acceptable prepayment mechanisms include trust funds, escrow accounts, government funds, certificates of deposit, and deposits of government securities.

*Surety, insurance, or guarantee.* Under this method, an entity with adequate financial strength (e.g., bank, insurer, or other financial institution) guarantees that the required amount of funds will be available when

needed by the sublessee. Acceptable surety, insurance, or guarantee mechanisms include surety bonds, performance bonds, letters of credit, lines of credit, insurance policies, parent company guarantees, and self-guarantees. The amount should cover the estimated costs of deconstruction and site restoration.

DLNR uses performance bonds in their subleases. A performance bond is a surety bond issued by an insurance company or a bank to guarantee satisfactory completion of a project by a sublessee. In the case of observatory decommissioning on Mauna Kea, a performance bond would be required to be issued in favor of UH for whom the sublessee is constructing an observatory. If the sublessee fails to demolish the structure and restore the site according to the specifications laid out by the contract (most often due to the bankruptcy of the sublessee), UH is guaranteed compensation for any monetary loss up to the amount of the performance bond.

*External sinking fund/Reserve account.* This method allows a sublessee to gradually prepay for decommissioning by combining the use of a partially funded prepayment instrument (e.g., a trust or escrow) with a surety bond, a letter of credit, or insurance covering the unfunded balance. This mechanism may be implemented over the term of the sublease and funds adjusted based on updated cost estimates.

*Asset collateral.* This method allows a sublessee to pledge the market value of an existing asset, such as land or buildings, as funding for decommissioning activities. Market value of pledged assets should be updated regularly through a standard appraisal process.

*Statement of intent.* This method is a commitment that a government funded or operated sublessee shall request and obtain decommissioning funds from its funding body, when necessary. A Statement of Intent needs to state the estimated cost of decommissioning, as well as demonstrate that the party signing the statement has the authority to make such a statement on behalf of the government. The signatory should be the head of the agency or the designee. This instrument may be used by observatories that are funded or operated by a consortium of international, national, or State governments.

### **3.3 Documenting Financial Assurance**

The financial assurance shall be evaluated by UH to ensure that sufficient funds will be available to carry out deconstruction and site restoration activities in a safe and timely manner. The financial assurance submission shall include: a conceptual cost estimate for decommissioning; a description of the means for adjusting the cost estimate and associated funding level periodically over the life of the facility; a certification of financial assurance by the sublessee that financial assurance has been provided in the amount of the cost estimate; and one or more financial assurance mechanisms (including supporting documentation). UH shall review the financial assurance submission to ensure that it includes the information summarized above and demonstrates the following:

- the accuracy and appropriateness of the methods used by the sublessee to estimate the costs of decommissioning;
- the acceptability of the sublessee's submitted financial assurance mechanism(s) for decommissioning; and
- the means identified in the DFP or SDP for adjusting the cost estimate and associated funding level over the life of the facility.

The material to be reviewed by UH is technical in nature. UH will make a quantitative evaluation of the sublessee's cost estimate or prescribed amount, and financial assurance mechanism(s). The purpose of the review of the cost estimate is to ensure that the sublessee has developed a cost estimate for decommissioning based on documented and reasonable assumptions and that the estimated cost is sufficient to allow an independent third party to assume responsibility if the sublessee is unable to complete the decommissioning. Demonstration and acknowledgement of adequate financial assurance for decommissioning may be required as part of new and/or renegotiated subleases.

## 4 Decommissioning Process Requirements

The decommissioning process is initiated when either UH revokes a sublease, the sublessee decides to cease operations, or when it is decided observatory operations will end when the sublease expires (see Section 5.1). The decommissioning process is also initiated if the general lease between UH and DLNR expires and no new lease is negotiated. The decommissioning process includes a series of necessary steps to remove the observatory and its supporting infrastructure by deconstruction, demolition, and restoring the site to at or near its pre-construction condition.<sup>17</sup>

The decommissioning process is successful when all regulatory compliance requirements are met and the site is deemed returnable to the State. A *Site Decommissioning Plan* (SDP) documents the condition of the site, outlines the approach to decommissioning, and proposes a plan for site restoration. The phases and specific details of the SDP are presented in Section 4.2. An SDP should be submitted at least five years prior to either the termination date of a sublease, or a sublessee's decision to cease operations, or as soon as is feasible if decommissioning is to take place less than five years after a decision is made to cease operations, whichever occurs first.

Removal of facilities and restoration of property is a requirement in the existing subleases if ownership of the facility is not sold or otherwise transferred. These sublease documents do not specifically define the term "removal" or what this entails. This plan defines "removal" as the total or partial removal of all structures and infrastructure to the extent achievable under normal engineering deconstruction planning protocols. For decision making purposes, the starting point for determining the scope and extent of removal shall be total removal. With respect to "restoration," most of the existing subleases state that restoration shall be to "even grade," while two subleases require restoration to "original condition, reasonable wear and tear excepted." For purposes of this Decommissioning Plan, "restoration" is defined as the total return, or return to the greatest extent possible, of the impacted areas to their pre-construction condition. The starting point for determining the level to which a site is to be restored shall be total restoration to the pre-construction condition. The extent of removal and level of site restoration must be acceptable to both UH and DLNR.

Although the requirements to develop a SDP and a DFP are not contained in the existing sublease agreements between UH and the various sublessees, it is a BLNR condition that UH develop a Decommissioning Plan that describes a decommissioning process that includes a financial plan. BLNR is the final authority regarding approval of the Decommissioning Plan, CDUPs for construction of new

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<sup>17</sup> Any future project within the UH Management Areas that has the potential to have an adverse impact will require the preparation of an EA or EIS under the National Environmental Policy Act (NEPA) and/or HRS Chapter 343, Environmental Impact Statements and HAR Section 11-200, Environmental Impact Statement Rules.

observatory facilities, and CDUPs for removal of existing facilities (see Section 1.4). The requirements to develop a SDP and a DFP may be contained in new or renegotiated subleases.

#### **4.1 Coordinating the Decommissioning Process**

OMKM is responsible for overall coordination of the decommissioning process. OMKM will liaison with DLNR-OCCL as needed, will maintain all required reporting and documentation, and will provide DLNR-OCCL with all relevant documentation.

Deconstruction and site restoration efforts will be managed by the sublessees with oversight by OMKM. Sublessees will be responsible for securing all permits necessary to demolish, recycle, transport and dispose of all materials removed from the site, as well as for adherence to applicable State of Hawai‘i statutes pertaining to natural and cultural resource protection. All communications between sublessees to permitting agencies or other government entities during preparation and execution of the decommissioning process shall include OMKM on the correspondence list. It is important for OMKM to be apprised of all activities under the decommissioning process.

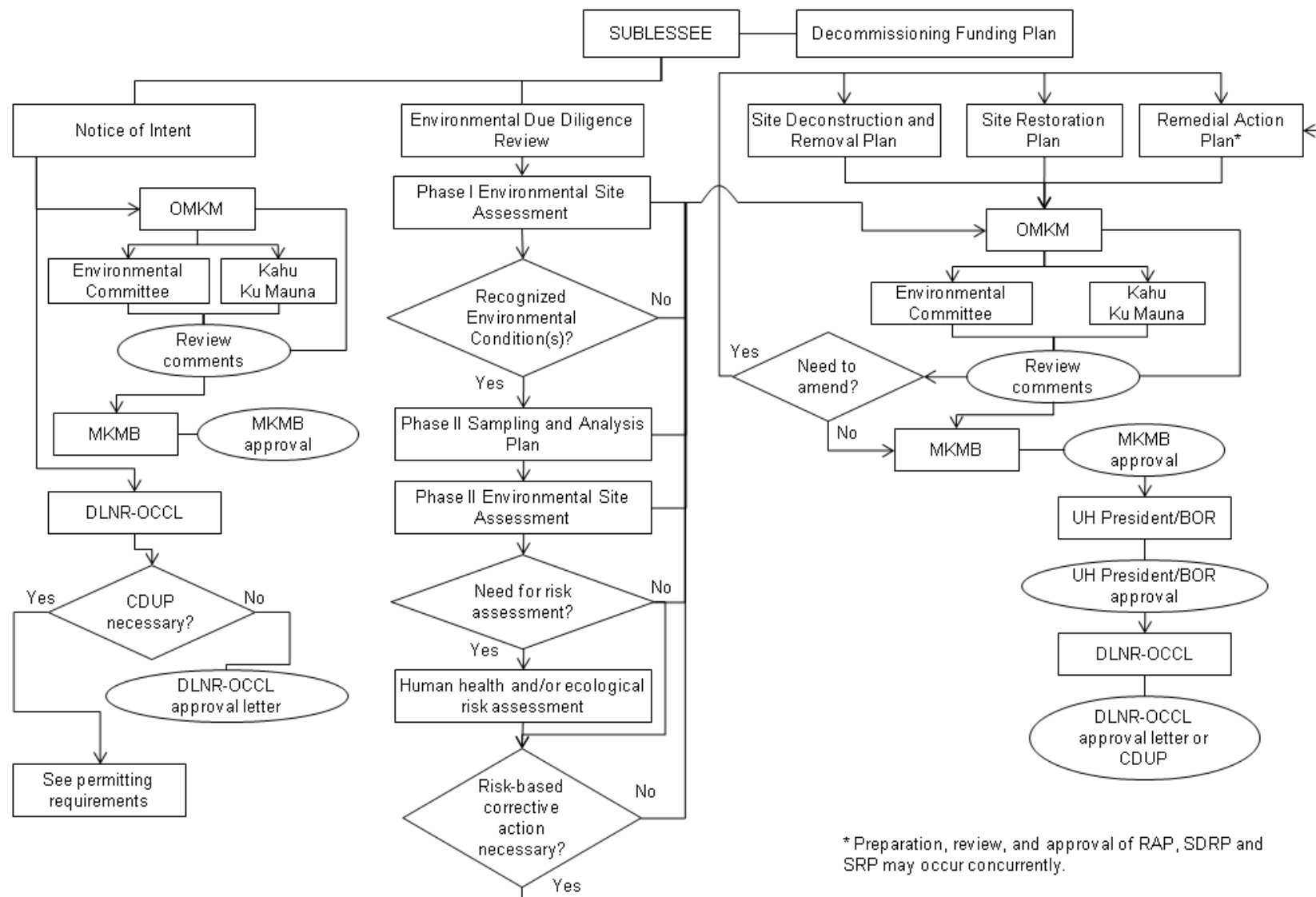
There are several elements of the decommissioning process that will incorporate community input. A process similar to the BOR-approved Major Project Review Process will be established to review, guide and recommend the disposition of a site, including site restoration and planning (see Figure 1). Reviewers will include OMKM, the Mauna Kea Management Board, Kahu Kū Mauna, and the Environment Committee. OMKM is considering forming a Decommissioning Working Group comprised of members of the observatories. The working group would provide guidance and a forum for ensuring consistency in the execution of the decommissioning process.

#### **4.2 Site Decommissioning Plan**

A *Site Decommissioning Plan* (SDP) documents the condition of the site, outlines an approach to decommissioning, and proposes a plan for site restoration, if applicable. Each SDP shall be developed in stages consisting of the following four components: (1) a Notice of Intent, (2) an environmental due diligence review, (3) a Site Deconstruction and Removal Plan and, (4) a Site Restoration Plan. Each of the four components of a SDP shall be submitted to UH<sup>18</sup> and DLNR-OCCL, except where noted below. Development of all components of a SDP shall be completed in coordination with OMKM. OMKM will coordinate reviews with Kahu Kū Mauna and the Environment Committee and provide written comments to MKMB. All components of each SDP shall be approved by MKMB followed by approval by the UH President. The final SDP may also require approval by the UH Board of Regents (BOR). DLNR-OCCL, reserves the right to request modification of the plan and/or require a BLNR-approved CDUP. Permitting and notification requirements for decommissioning are described in Section 4.2.3. The components of an SDP are presented as a flow chart in Figure 1. A timeline for submitting and implementing these different components is presented in Table 5.

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<sup>18</sup> In the context of review and approval, “UH” refers to all entities that fall under the University of Hawai‘i that will be reviewing the plans, including OMKM, MKMB, Kahu Kū Mauna, and Environment Committee.



**Figure 1. Components of a Site Decommissioning Plan**

#### 4.2.1 Notice of Intent

The first component of the decommissioning process is the preparation of a *Notice of Intent* (NOI) (see Figure 1). The purpose of the NOI is to propose whether a site will be removed, continued for use as an observatory by a third party, or retrofitted for a different use. Intentions for site restoration should also be described in the NOI. The NOI should be submitted to UH and DLNR-OCCL at least five years prior to either the termination date of a sublease, or a sublessee's decision to cease operations, or as soon as is feasible if decommissioning is to take place less than five years after a decision is made to cease operations, whichever occurs first. DLNR-OCCL reserves the right to require a CDUP pending a review of the proposed decommissioning activities described in the NOI (see Section 1.4 and Figure 1).

The NOI shall contain a site description that summarizes the overall condition and land use, including a description of all structures, equipment and other appurtenances. A site plan(s) drawn to scale showing all existing structures, above and below grade, should be included. Available historical information on the development, operation, and use of the site shall be presented. A description of the pre-construction condition of the site should be provided based on available information. For site restoration purposes, the pre-construction condition will be based on the site's topographic condition prior to the construction of the observatory. Acceptable information for establishing pre-construction conditions includes: topographic maps prepared at the time of the observatory's construction; oblique, aspect, and elevation photographs; engineering plans and drawings; site descriptions contained in narrative format; and other sources as available. OMKM will require complete documentation of sources and reserves the right to review information used to establish pre-construction site conditions.

#### 4.2.2 Environmental Due Diligence Review

The next component of the decommissioning process consists of conducting an environmental due diligence review (see Figure 1). For all cases of potential future use described in the NOI, a Phase I environmental site assessment (ESA) of the observatory property shall be conducted and the results submitted to UH and DLNR-OCCL. The goal of a Phase I ESA on a parcel of property is to identify *recognized environmental conditions*. The term recognized environmental conditions means the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, ground water, or surface water of the property. The term is not intended to include *de minimis* conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be *de minimis* are not recognized environmental conditions. A Phase I ESA is intended to satisfy one of the requirements to qualify for the innocent landowner, contiguous property owner, or bona fide prospective purchaser limitations on liability with respect to the range of contaminants within the scope of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. 9601) and petroleum products.

If recognized environmental conditions are identified in the Phase I ESA, additional investigative analysis in the form of a Phase II ESA is typically required. The purpose of a Phase II ESA is to provide sufficient information regarding the nature and extent of contamination to assist in making informed business decisions about the property; and where applicable, providing the level of knowledge necessary to satisfy

the innocent landowner, contiguous property owner, or bona fide prospective purchaser defense under CERCLA. A Phase II Sampling and Analysis Plan (SAP) shall be prepared before conducting any intrusive sampling. Based on the results of the Phase II ESA, additional analysis in the form of a human health risk assessment and/or ecological risk assessment may be needed. Pending the results of the Phase II ESA and health/ecological risk assessments, a remedial action plan (RAP) may need to be developed and implemented to mitigate risks to human health and the environment. Recommendations and proposed activities described in the Phase I and II ESAs, Phase II SAP, health/ecological risk assessments, and the RAP shall be subject to review by UH and DLNR (see Figure 1).

Guidance for conducting environmental site assessments and risk-based corrective action are described in the following American Society for Testing and Materials (ASTM) standards:

- ASTM E1527 – 05 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process
- ASTM E2247 – 08 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland and Rural Property
- ASTM E1903 – 97(2002) Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process
- ASTM E2081 – 00(2004)e1 Standard Guide for Risk-Based Corrective Action
- ASTM E1739 – 95(2002) Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites
- ASTM E2205 / E2205M – 02(2009)e1 Standard Guide for Risk-Based Corrective Action for Protection of Ecological Resources

The Environmental Protection Agency (EPA) has established federal standards and practices for conducting all appropriate inquiries as required under sections 101(35)(B)(ii) and (iii) of CERCLA (40 CFR, Part 312). The final rule, known as the *All Appropriate Inquiries Regulation*, became effective November 1, 2006 and establishes specific regulatory requirements and standards for conducting all appropriate inquiries into the previous ownership and uses of a property for the purposes of meeting the all appropriate inquiries provisions necessary to qualify for certain landowner liability protections under CERCLA. EPA now recognizes both of ASTM's standard practices for Phase I ESAs (E1527-05 and E2247-08) as compliant with the All Appropriate Inquiries Regulation. Either of these ASTM Phase I standards may be used to satisfy the statutory requirements for conducting all appropriate inquiries under CERCLA. Additional information from EPA on CERCLA liability for state and local governments, and the All Appropriate Inquiries Regulation is presented in Appendix C.

#### **4.2.3 Site Deconstruction and Removal Plan**

The third component of the decommissioning process involves the preparation of a *Site Deconstruction and Removal Plan* (SDRP) (see Figure 1). The purpose of the SDRP is to document the proposed methods for demolishing, in part or total, any and all observatory structures and related infrastructure; grading and grubbing the site; stockpiling fill materials; and solid waste recovery, reuse and disposal. A SDRP will not be required when there is a transfer of ownership of an observatory to a third party and no deconstruction/construction activities are proposed. The SDRP shall include a description of all proposed activities and include copies of all required plans, drawings, permits, and authorizations. Plans for segregating demolition debris and for recycling/reusing building materials either on-site or off-site shall

be described. A cost benefit analysis and a schedule for implementing all aspects of the SDRP shall also be included.

Should a CDUP be required by DLNR-OCCL after reviewing the NOI (see Section 4.2.1 and Figure 1), a CDUA shall be submitted in coordination with UH and DLNR-OCCL. The CDUA could also require the preparation and submission of an environmental assessment (EA). Although the demolition of structures may be exempted from an EA as defined in HAR §11-200-8, there may be elements in a SDRP (and associated Site Restoration Plan – see Section 4.2.4) that are not exempt. The need for an EA will be based on the review of the NOI by DLNR-OCCL in coordination with OMKM. In conjunction with this process, UH must evaluate the need for and/or satisfy State and Federal environmental impact requirements (HRS Chapter 343 and the National Environmental Policy Act (NEPA)).

Compliance with laws relating to historic properties is also required. Any decommissioning activity funded by Federal funds will require compliance with Federal laws pertaining to historic preservation, including the National Historic Preservation Act (NHPA). The NHPA aims to ensure that historic properties are appropriately considered in planning Federal initiatives and actions. The Advisory Council on Historic Preservation is an independent federal agency responsible for administering the protective provisions of the act. SHPD should also be consulted, and provisions of HRS Chapter 6E, Historic Preservation and HAR §13-300 followed.

Additional permits and authorizations may be required from the County of Hawai‘i, State Department of Health, and DLNR-SHPD, depending on the nature and extent of demolition/construction activities. These may include building, plumbing and electrical permits for total or partial building demolition; authorization to abandon a cesspool/septic tank; and NPDES, grading, grubbing, and stockpiling permits for earth-moving activities. The sublessee will need to coordinate with the County of Hawai‘i Environmental Management Department, Solid Waste Division, to ensure that requirements for disposing of demolition waste are met. Specifically, a description of waste types and quantities, plan for recycling and reusing waste materials, and schedule for disposal should be prepared and submitted with the sublessee’s permit application for building/observatory demolition. For partial demolition (i.e. site recycling), the sublessee should coordinate with the County of Hawai‘i Planning Department and Fire Department to ensure that their requirements are met.

A summary of the permitting/notification requirements for the SDRP is presented in Figure 2. The sublessee is responsible for obtaining these permits and authorizations in coordination with OMKM. The permits and regulatory oversight will identify minimum requirements for each respective statute or ordinance. UH and DLNR-OCCL may require additional actions be taken to protect resources. All deconstruction planning must explore these issues through consultation with OMKM, Kahu Kū Mauna, and the Environment Committee. Compliance with Federal and State laws includes possible consultation with stakeholders.

#### **4.2.4 Site Restoration Plan**

The fourth and final component of the decommissioning process involves the preparation of a *Site Restoration Plan* (SRP) (see Figure 1). The purpose of a SRP is to present specific targets for site restoration and to describe the methodology for restoring disturbed areas after the demolition/construction activities described in the SDRP are completed. Each SRP shall be specific to the site and consider



cultural, biological and physical aspects of site restoration. Each SRP shall include a provision for effectiveness monitoring to characterize success and/or failure of restoration efforts. In addition, the principles of adaptive management shall be applied so that lessons learned from previous efforts can be applied to future restoration projects at the site. Upon request, OMKM can provide copies of previously approved SDRPs and/or SRPs from other observatory sites, as available.

Two primary objectives of site restoration include (1) restoring the look and feel of the summit prior to construction of the observatories, and (2) providing habitat for the aeolian arthropod fauna. These two objectives must be considered in any restoration planning.

(1) *Topography / Pu'u Restoration.* For many sites in the summit region, restoration to a historical condition could involve reconstruction of portions of cinder cones or pu'u. When developing restoration plans, an attempt should be made to obtain and review any original site construction documents for an idea of original topography. If relevant information cannot be found, effort should be made to restore the site to a basic topography consistent with the area.

(2) *Arthropod Community.* The summit pu'u provide habitat for a rare arthropod community, including the wēkiu bug (*Nysius wekiuicola*), currently a candidate for Federal protection under the Endangered Species Act. Restoration projects at the summit in known or potential wēkiu bug habitat should focus on creating habitat suitable for use by the native arthropods. OMKM shall be consulted with respect to designing restoration for natural resource purposes, including the wēkiu bug.

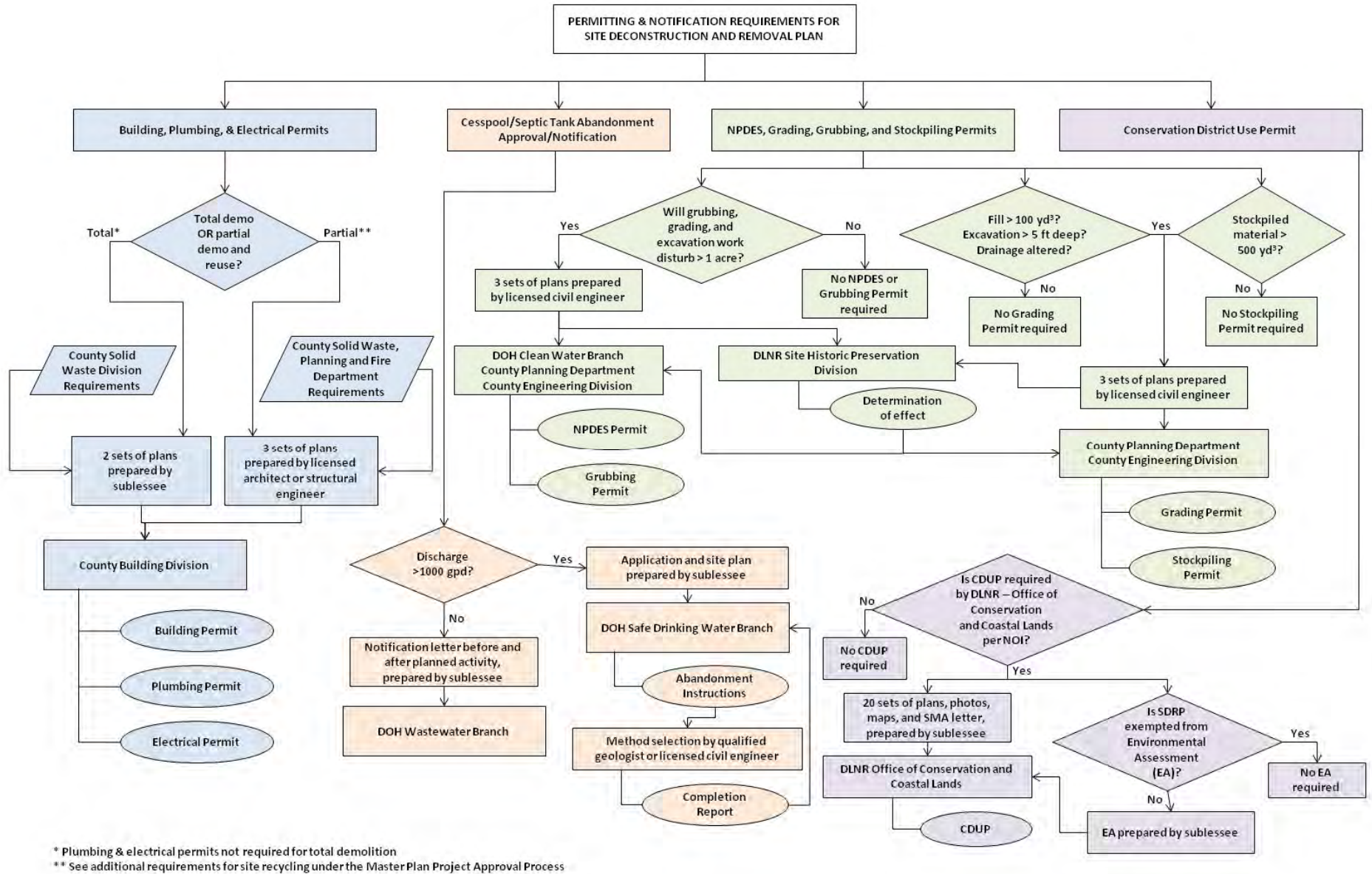
The starting point for negotiations shall be full restoration. All restoration activities shall also adhere to the applicable permitting requirements for site deconstruction (see Figure 2). UH and DLNR have final approval of the SRP and may require additional restoration activities.

For purposes of the SRP, site restoration is comprised of a physical component and an ecological component. Physical restoration implies returning the site to its pre-construction appearance in terms of topography, vegetation, and ground cover composition. According to the Society for Ecological Restoration, ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.<sup>19</sup>

Ideally, the target for all sites is restoration to the site's historical condition prior to construction of the facility. However, the SRP must also consider cultural sensitivities, the extent of infrastructure removal and deconstruction, the size of the site restoration effort, the use of backfill cinder with respect to its source and size. The level of restoration attempted and the potential benefits and impacts of the restoration activities on natural and cultural resources during and post-activity must be carefully evaluated. A cost-benefit analysis shall also be conducted. All site restoration planning must explore these issues through consultation with OMKM, Kahu Kū Mauna, and the Environment Committee.

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<sup>19</sup> <http://www.ser.org/content/adoption.asp>



**Figure 2. Permitting and Notification Requirements for Site Deconstruction and Removal Plan**

Specific factors that need to be considered during the development of a SRP include:

### **Cultural Sensitivity**

The Mauna Kea CMP provides a cultural perspective related to site restoration:

*From a cultural perspective there are many Native Hawaiians who have commented that once a site or pu'u has been developed it can never be fully restored as the mana (divine power) of the site has been destroyed forever. Although for many people in the Hawaiian community site restoration can never be fully attained, from a responsible management standpoint the CMP needs to address and provide guidance to OMKM and users on site restoration (2009 Mauna Kea CMP Section 7.3.3).*

Cultural considerations with respect to deconstruction and restoration activities will be identified as part of the SDRP and SRP assessment and evaluation (see Section 4.3). Given the inherent challenges in the process, the focus will be on what is possible in terms of addressing cultural sensitivities.

### **Extent of Infrastructure Removal and Deconstruction**

Many of the telescope facilities have foundations and basements extending below grade that would require considerable excavation to remove and significant material to backfill the voids. The following options exist with regards to removal of a facility and its infrastructure. Each has potential benefits and drawbacks that need to be assessed as part of the feasibility analysis.

*Complete infrastructure removal.* Involves removal of the entire facility, including underground utilities, pilings, and foundation to the extent practicable under normal engineering deconstruction practices. Under this scenario, there will be a very large hole in the substrate that needs to be filled prior to restoration efforts. Questions to consider related to filling this hole include what type of material will be used to fill the hole, where will the fill come from, and how stable will the site be. Bringing fill from offsite has the potential to introduce invasive species, and may also be considered by some as culturally inappropriate. Potential future facilities should consider the logistics of stockpiling excavated material for future use in restoration activities. Depending on the type of subsurface foundation material used in the construction of an observatory, removal may be impractical to nearly impossible. In such cases, the foundation should be considered an irreversible impact, left in place, and capped.

*Infrastructure capping.* Capping involves removal of above ground facilities, with or without utilities, and leaves all or part of the underground portion of the facility in place. The remaining infrastructure would be capped with an impermeable material such as concrete and then topped with cinder materials. This scenario would need to ensure that the capped infrastructure was stable and inert, without long-term effects to the surrounding environment.

### **Extent of Site Restoration**

The three-tiered approach to site restoration adopted by the Mauna Kea CMP is designed to ensure the development of appropriate strategies to address restoring the land. This tiered approach recognizes that in addition to the potential benefits of site restoration, there are also potential impacts. The desired goal for site restoration is the site's historical condition prior to construction of the observatory. The overall

context of the landscape should be considered when assessing any restoration plans. Any plan to restore habitat needs to be analyzed at the landscape level, rather than as only the footprint of a single observatory.

The three levels of restoration include: minimal, moderate, and full. All three require infrastructure to be removed, including buried utilities and underground structures, unless it is determined that removal would cause irreversible damage to resources.

*Minimal restoration* is the removal of all man-made materials and grading of the site, leaving the area in safe condition.

*Moderate restoration* goes beyond minimal to include enhancing the physical habitat structure to benefit the native arthropod community.

*Full restoration* would return the site to its original pre-construction topography, as well as restoring arthropod habitat.

For existing subleases, the extent of site restoration shall be guided by the principles above and shall be negotiated among UH, DLNR and the sublessee in accordance with the terms of the sublease.

For new or renegotiated subleases, the decision as to which level is executed shall be made by UH in consultation with DLNR. If less than full restoration is implemented, the observatory may be required to fund other mitigation measures, support management of the UH Management Areas, or surplus funds could revert to the sublessee. The starting point for determining the level a sublessee needs to restore a site to shall be full restoration.

### ***Use of Cinder***

Site restoration activities will involve using cinder either to fill holes or to reconstruct topography. Moving cinder has implications for 1) the area it is collected from (where will the cinder fill material come from, how will excavation and removal of cinder impact the collection area); 2) the pathway taken by the construction equipment; 3) the habitat surrounding the restoration area; and 4) the introduction of invasive plants and animals. Consideration must also be given to, the cultural implications of bringing cinder from a different place to the summit of Mauna Kea. Best management practices, such as ensuring that cinder is free of invasive species and contaminants and limiting dust released into the environment when cinder is moved, can reduce the impact to the environment, but the impact will never be zero.

## **4.3 SDRP, SRP, and RAP Assessment and Evaluation**

The SDRP, SRP, and RAP shall be submitted to UH for assessment and evaluation as part of the decommissioning process. UH will assess the level and extent of these plans and evaluate the benefits to the environment and cultural resources against the potential adverse impacts of implementing the proposed plans. The purpose of the assessment and evaluation is to determine if potential benefits from implementing the plans outweigh their potential negative impacts. After reviewing the plans, OMKM, Kahu Kū Mauna and the Environment Committee will either recommend approval to the MKMB, or not recommend approval and forward comments to the sublessee directing them to revise the plans to address the concerns. After revisions are made the sublessee shall resubmit the plans for another review. Final

versions of the SDRP, SRP, and RAP must be approved by MKMB and the UH President, and if applicable by the BOR, and DLNR-OCCL before a sublessee may implement the plans.

The approved plans may allow for partial removal of infrastructure and restoration that is less than full. A scenario that is less than total removal or full restoration might occur if it is not feasible to remove all infrastructure or if the activities are not culturally acceptable or have the potential to cause adverse environmental impacts. New subleases and renegotiated subleases may require funding for full restoration even if the restoration is not implemented to the full level. The differential in funding could be used for a different purpose (e.g. monitoring of resources, habitat restoration), if allowed, or surplus funds could revert to the sublessee.

A situation may arise in which UH, DLNR, and the observatory disagree on the decommissioning cost estimate or some other issue (i.e. extent of deconstruction and site restoration). In these instances the parties may engage in an alternative dispute resolution process (i.e., mediation, facilitation, or arbitration) as determined by the parties.

#### 4.4 Reporting

OMKM will hold the administrative record for decommissioning activities including documentation of decommissioning decision-making, DFPs, SDPs, permits and approvals, and a close-out inspection report including a final site survey. The close-out inspection shall be performed by UH or its contractor to determine if a sublessee has adequately decommissioned and met the terms of their sublease. Sublessee shall be responsible for close-out inspection costs. DLNR-OCCL may also participate in the close-out inspection. Results of monitoring activities will also be required.

**Table 5. Timeline for Developing and Implementing Site Decommissioning Plan**

Activity	Deadline
Notice of Intent	
Statement of intention to demolish, abandon, transfer and/or restore observatory property	At least five years prior to either the termination date of a sublease, or a sublessee's decision to cease operations, or as soon as is feasible if decommissioning is to take place less than five years after a decision is made to cease operations, whichever occurs first
Environmental Due Diligence Review	
Phase I ESA	Completed within six (6) months of NOI filing
Phase II ESA, human health/ecological risk assessment, remedial action plan (RAP), if needed	Within one (1) year of Phase I ESA
MKMB and DLNR-OCCL approval	Within six (6) months of Phase I ESA, Phase II ESA, risk assessment, or RAP
RAP implementation, if applicable	One (1) year or more prior to end of sublease or planned departure from the site, depending on project schedule

Activity	Deadline
<b>Site Deconstruction and Removal Plan</b>	
Submission of SDRP to UH and DLNR-OCCL	One to two (1-2) years prior to start of deconstruction
CDUP application, if needed <sup>20</sup>	One to two (1-2) years prior to start of deconstruction
Other permits, as needed <sup>21</sup>	One (1) year prior to start of deconstruction
OMKM Review; MKMB and DLNR-OCCL approval	Required prior to commencing implementation of SDRP
SDRP implementation	One (1) year or more prior to end of sublease, or planned departure from the site depending on project schedule. Completed according to sublease terms or negotiated schedule agreed to by the sublessee, UH and DLNR.
<b>Site Restoration Plan</b>	
Submission of SRP to UH and DLNR-OCCL	One to two (1-2) years prior to start of deconstruction
OMKM Review; MKMB and DLNR-OCCL approval	Required prior to commencing implementation of SRP
SRP implementation	One (1) year or more prior to end of sublease, or planned departure from the site, depending on project schedule. Completed according to sublease terms or negotiated schedule agreed to by the sublessee, UH and DLNR.
Monitoring	Begins upon completion of site restoration and continues for at least three (3) years.

## 5 The Future of Astronomy on Mauna Kea

IfA oversees long-term planning and visioning of astronomical research in the Science Reserve. Priorities change over time as technological advances are made, and the vision continues to evolve. In addition to the potential construction of new observatories, other possible changes to the astronomy facilities include recycling of existing sites, expansion of existing observatories, and removal of observatories. In order to better understand the factors that influence the decision-making process regarding the timing of decommissioning, a discussion of the lifecycle of a telescope facility is presented (see Section 5.1). The decision to recycle a site, which includes reuse of some facilities and infrastructure, may also involve some elements of the decommissioning process (see Section 5.2).

UH sees a future for sustainable astronomy on the summit of Mauna Kea. The long-term goal is to eventually have fewer observatories in the summit region, but maintain its status as a world class center for education and research in ground-based astronomy. Section 5.3 presents an updated discussion of UH's current plans for observatory development on the summit of Mauna Kea. A related discussion on

<sup>20</sup> CDUP application would likely cover deconstruction and removal plans, as well as restoration plans.

<sup>21</sup> Permits would likely cover deconstruction and removal plans, as well as restoration plans.

guidelines for limiting development, including how the siting of telescopes plays a role in the long-term planning process, is included in Appendix D.

## **5.1 Lifecycle of a Telescope Facility**

There are four major components to a ground based optical/infrared (O/IR) telescope facility: the optics that collect and focus the light from the sky; the electro-mechanical structure that holds the optics in place and moves it to point in a desired direction; the enclosure; and the instrumentation that analyzes and records the light. The optics, electro-mechanical components, and enclosure can last indefinitely and continue to perform up to their original specifications so long as routine maintenance is performed and components are replaced at the end of their service life. As a result of technological advances, the performance of these components can often be improved over time at a cost that is modest compared to the original investment. For instrumentation, advancing technology, particularly in the area of detectors, can make instruments truly obsolete in a timeframe of 10-20 years. However, old instruments can be replaced with new ones at relatively small cost. The result is that ground-based O/IR telescopes can remain scientifically productive for many decades provided they receive proper maintenance and timely upgrades of their instrumentation. For example, the famous Mt. Palomar 200-inch telescope was commissioned in 1949 and is still in regular use. Since that time, 32 other O/IR telescopes with aperture three meters or larger have been commissioned (including seven on Mauna Kea), and all of these are still in operation.

Attempts to predict the timeline for removing ground-based O/IR telescopes from service will be difficult. These telescopes do not necessarily wear out or become scientifically unproductive, and the history of the last 60 years does not provide even a few examples for guidance. Barring a major accident, or some other contingency, such as the termination of a sublease, there are two distinct situations that would result in an O/IR telescope being closed and/or decommissioned: (1) replacement with better equipment or (2) loss of operational funding. In the case of replacement, this could be either by the original owner or by a new owner, and would depend on obtaining the required approvals and permits. A loss of operational funding could occur either because the owner simply no longer has the financial resources, or more likely, because the owner has a higher priority for the use of those funds, e.g. operational funding for a newer facility elsewhere. In the latter situation, attempts would almost certainly be made to find alternative sources of operational funding before a decision was made to decommission the telescope. Thus, the timescale on which a particular O/IR telescope is decommissioned will depend on whether and when it is replaced by something better and whether and when it loses its operational funding.

The situation with radio telescopes is somewhat different. Here, technological advances such as larger antennas and the use of interferometry can render older facilities scientifically obsolete. With O/IR telescopes, technological advances can be made by simply changing the instrument. This is much less the case for radio telescopes. Thus, for radio telescopes the situations that would result in decommissioning include the two described above for O/IR telescopes, and also obsolescence.

## **5.2 Site Recycling**

Site recycling is used to describe any action involving use of an existing structure that houses equipment or is used in support of research that is reused, retrofitted, rebuilt, or expanded. There could be a range of options for any particular site, considering both the structure and/or equipment. Recycling plans could include deconstruction and replacement of a current facility with a new one on an existing or expanded

footprint (limited to the immediately adjacent area), facility upgrades, or improvements to utilities. It is possible that site recycling could be partially implemented, if a portion of the observatory infrastructure was removed and a portion left to be reused, with the rest of the site restored. Recycling can include the use of the structure for non-observatory purposes. Site recycling aims to minimize disturbance to undeveloped areas if additional observatories seek to locate in the Astronomy Precinct. It is more cost effective to reuse previously modified sites and previously existing structures when current equipment becomes antiquated or reaches the end of its service life (Group 70 International 2000).

The review of any site recycling options shall be evaluated under the existing BOR-approved Major Project Review Process. The primary difference between site recycling and decommissioning is that the former results in continued use and occupation of structures at a site and the latter results in removal and cessation of site use. However, since rebuilding a site will, by de facto, require the existing site to be removed, at least three phases of the SDP will be required: NOI, environmental due diligence, and the SDRP and associated permits (see Section 4.2). If sublessees are going to remove a structure in part or in total and rebuild, they are advised to utilize the SDP to assist in identifying permits and approval process for deconstruction.

### 5.3 Observatory Development Plans

Over the last few years IfA has provided an updated vision for the future of observatory development on Mauna Kea. As described in a report to the Hawai‘i State Legislature on the long-term development of observatory sites on Mauna Kea, continued evolution of technology and priorities require modified plans (Kudritzki 2006).

*Since the development of the Master Plan, the scientific priorities of astronomy for the new century have become much clearer, and a new more concise concept for future astronomical development has emerged that will guarantee Hawaii’s continued world leadership in astronomical research and education, while at the same time being well balanced with the needs for cultural and environmental protection of Mauna Kea.*

In this report potential observatory development was grouped into five categories: (1) construction of new telescopes, (2) expansion of existing observatories, (3) redevelopment of existing observatories, (4) operation of existing observatories, and (5) removal of existing observatories (see Table 6 and Appendix B) (Kudritzki 2006). The potential for observatory decommissioning was mentioned, but no specific plans were presented: “We are confident that in this way the number of observatories on Mauna Kea in 20 years from now will be smaller than now,” (Kudritzki 2006).

During the Mauna Kea CMP process (2008-2009), IfA Director Rolf-Peter Kudritzki described IfA’s ‘Revised Plan’ with respect to decommissioning and replacement of telescopes on Mauna Kea (see Appendix B). He also addressed the issue of telescope removal and site restoration, clarifying that the current plan, as stated in the 2006 report to the legislature “is to demolish the old facility, to clean the site and recreate the site in a stage as it was, before the facility had been built.”

This Decommissioning Plan presented an opportunity for IfA to provide additional specifics about their current vision for observatory development and decommissioning. With regard to the 13 existing telescopes on Mauna Kea (nine O/IR, four radio), a possible date can be foreseen for ceasing current operations of one of the telescopes. In May 2009, Caltech announced its intention to decommission the



Caltech Submillimeter Observatory (CSO) and remove it from the mountain during the period 2016 – 2018. This is the time frame in which the Atacama Large Millimeter/Submillimeter Array (ALMA) in Chile will become fully operational. CSO has one 10-meter antenna, while ALMA will eventually have 60 12-meter antennas. Once ALMA begins operations, CSO will no longer be scientifically competitive. A NOI is recommended to be developed based on proposed future use or decommissioning of this facility.

For the other 12 telescopes, no decommissioning date is foreseen at the present time. Five of the O/IR telescopes are relatively new: Keck I & II, Subaru, Gemini, and the UH Hilo Instructional Telescope. All have subleases that expire in 2033. Three of the O/IR telescopes, CFHT, IRTF, and UKIRT, have been in operation for 30 years. Over the years, all have had major upgrades to their instrumentation and to other aspects of their facility. As a result, they remain scientifically viable and could possibly remain in operation for another 20 years or more or be recycled. IfA's plan foresees dismantling the UKIRT facility and restoring the site at the end of its sublease, or earlier if it decides to cease operations prior to the end of its sublease. The other O/IR telescope, the UH 2.2-meter, is planned for replacement by the Pan-STARRS project.

For the other three radio telescopes besides CSO (JCMT, VLBA, and SMA), it is not possible to predict with any degree of certainty when these might be decommissioned. It will depend on their ability to remain scientifically competitive and to continue to attract operational funding. The SMA is the newest of these and will likely remain in operation for at least 20 years. The VLBA, which is not within the Astronomy Precinct, will not be replaced by another telescope once it is decommissioned. IfA's plan envisions that for CSO, JCMT, and SMA, at most one would be replaced by a new facility and the other two would be decommissioned.

There are currently two projects that are considering Mauna Kea as a site for their observatory facility. IfA is pursuing a project to replace the UH 2.2-meter Telescope with a wide-field imaging facility called Pan-STARRS. The second proposed observatory project is the construction and operation of an O/IR next generation large telescope known as the Thirty Meter Telescope (TMT). The proposed location for the TMT is on an estimated five acres of presently undeveloped land off the summit in an area referred to as the northern plateau within the Astronomy Precinct of the Science Reserve. Both projects are described in the 2000 Master Plan as allowable types of developments for Mauna Kea (see Table 6). PanSTARRS is a Type 1, redevelopment of an existing facility, and TMT is a Type IV, a next generation large telescope. As with any proposed observatory project for Mauna Kea, these projects will be required to go through the BOR-approved Major Project Review Process, and will require securing of and compliance with all applicable environmental analyses, permits, subleases, and approvals.

In summary, by the end of the current lease (2033) UH foresees there may be ten observatories in the Astronomy Precinct (see Table 8), based on UH's current understanding. UH is cognizant that if no new lease is granted, the observatories will need to be removed and the site restored no later than the lease end date (December 31, 2033).

Table 6. Evolution of Recent Observatory Development Plans for Mauna Kea<sup>22</sup>

2000 Master Plan Allowable Development	2006 IfA Statement	2009 IfA Plan
<b>Type I. Redevelopment of Existing Observatory Sites on the Summit Ridge</b>	<b>Redevelopment of Existing Observatories</b>	
Redevelopment or “recycling” of up to five existing telescopes, including NASA/IRTF, CFHT, UH 2.2 m, UKIRT, and UH 0.6 m. Anticipate up to three or four facilities may be redeveloped over the next 20 years.	Redevelopment of the UH 0.6m telescope into an instructional telescope for UH Hilo.	Completed in 2008 as UHH 0.9m telescope.
	Redevelopment of the UH 2.2m telescope into a Pan-STARRS observatory. Redevelopment would involve removal of the existing building and telescope and construction of a new, smaller building to house the PS4.	Plan to decommission UH 2.2m telescope in 2012 for replacement. Project is conducting the required environmental review process (see <a href="http://pan-starrs.ifa.hawaii.edu/">http://pan-starrs.ifa.hawaii.edu/</a> ).
	Refurbishment of some facilities if an important scientific case can be made.	Plans to be considered; which facilities and project timing are currently unknown.
<b>Type II. Expansion of Existing Observatories</b>	<b>Expansion of Existing Observatories</b>	
Expansion of the Keck Observatory with the addition of four to six 1.8-m. outrigger telescopes.	Plan no longer being considered.	Plan no longer being considered.
Addition of up to 12 new antennas and 24 new pads to the Submillimeter Array over the next 20 years.	Addition of two antennas and two pads to the SMA.	Plans still being considered.
	Relocation of two existing SMA antenna pads located at the base of Pu’u Poli’ahu, a culturally significant site.	Plans still being considered.
	<b>Construction of New Telescopes</b>	
<b>Type III. New Conventional Optical/IR Telescope:</b> New conventional telescope comparable to the Keck or Gemini Observatories at a currently undeveloped site.	Plan no longer being considered.	Plan no longer being considered.

<sup>22</sup> The 2000 Master Plan was approved by the UH Board of Regents, while the 2006 and 2009 IfA statements were not.

2000 Master Plan Allowable Development	2006 IfA Statement	2009 IfA Plan
<b>Type IV. Next Generation Large Telescope (NGLT):</b> A single optical/IR telescope of 25 m. aperture or greater.	Construction of the Thirty-Meter Telescope (TMT) located at a new site on the northern plateau facing Waimea below the summit ridge, at a site called 13N. Would be the largest O/IR telescope in the world.	Project has chosen Mauna Kea as its preferred site and is conducting the required environmental review process (see <a href="http://www.tmt.org">www.tmt.org</a> ).
<b>Type V. Optical/IR Interferometer Array Site:</b> A general area is proposed for this observatory. No facilities are included in this Plan.	Plan no longer being considered.	Plan no longer being considered.
	<b>Operation of Existing Observatories</b>	
	Operation of newer facilities (Keck I & II, Gemini, Subaru, Pan-STARRS, UH Hilo, and SMA) for at least 20 years.	No change.
	<b>Removal of Existing Observatories</b>	
	IfA's vision for the future of observatories on Mauna Kea includes a reduction in the overall number of facilities, however there are currently no specific plans for removal of existing facilities:	CSO to be decommissioned and removed during the period 2016-2018. See Table 8.

**Table 7. Mauna Kea Telescopes (2010)**

Source: [http://www.ifa.hawaii.edu/mko/telescope\\_table.htm](http://www.ifa.hawaii.edu/mko/telescope_table.htm)

	Name	Mirror	Owner/Operator	Year Built
<b>Optical/Infrared</b>				
UHH 0.9m <sup>23</sup>	UHH 0.9-m Telescope	0.9m	University of Hawai'i, Hilo	2008
UH 2.2m	UH 2.2-m Telescope	2.2m	University of Hawai'i	1970
IRTF	NASA Infrared Telescope Facility	3.0m	NASA	1979
CFHT	Canada-France-Hawai'i Telescope	3.6m	Canada/France/UH	1979
UKIRT	United Kingdom Infrared Telescope	3.8m	United Kingdom	1979
Keck I	W. M. Keck Observatory	10m	Caltech/University of California	1992
Keck II	W. M. Keck Observatory	10m	Caltech/University of California	1996
Subaru	Subaru Telescope	8.3m	Japan	1999
Gemini	Gemini North Telescope	8.1m	USA/UK/Canada/Argentina/Australia/Brazil/Chile	1999
<b>Radio</b>				
CSO	Caltech Submillimeter Observatory	10.4m	Caltech/NSF	1987
JCMT	James Clerk Maxwell Telescope	15m	UK/Canada/Netherlands	1987
SMA	Submillimeter Array	8x6m	Smithsonian Astrophysical Observatory/Taiwan	2002
VLBA	Very Long Baseline Array	25m	NRAO/AUI/NSF	1992

**Table 8. Projected Observatories on Mauna Kea During Current Lease Term**

Observatory	Count
<b>Current observatories in the Astronomy Precinct</b>	
CFHT, UH 2.2m, Gemini, IRTF, UHH 0.9m, Keck I, Keck II, Subaru, SMA, JCMT, CSO, UKIRT	12
<b>Current observatories off the summit</b>	
VLBA	1
<b>Total observatories currently in the Science Reserve</b>	<b>13</b>
<b>No replacement of facility; estimated to be removed by the end of the current lease</b>	
UKIRT	-1
VLBA	-1
Two of the three radio telescopes (SMA, JCMT, or CSO)	-2
<b>New facility</b>	
Thirty Meter Telescope	+1
<b>Total observatories in the Science Reserve approaching end of lease</b>	<b>10</b>

Observatory	Count
<b>Continued use or recycling of existing facilities</b>	
CFHT, UH 2.2m, Gemini, IRTF, UHH 0.9m, Keck I, Keck II, Subaru	8
One of the three radio telescopes (SMA, JCMT, or CSO)	1
<b>New facility</b>	
Thirty Meter Telescope	+1
<b>Total observatories in the Science Reserve approaching end of lease</b>	<b>10</b>

<sup>23</sup> In 2008 the UH 0.6-m telescope (built in 1968) was replaced by the UHH 0.9-m telescope.

## 6 Plan Updates

Adaptive management involves adjusting management policies and strategies as new information becomes available, and requires that management plans undergo regular review to reduce uncertainty and incorporate lessons learned. This ensures that the most effective tools are in place to protect the resources. This Decommissioning Plan provides a framework for managing the decommissioning process for observatories on Mauna Kea. It will likely need to be revised as the process is gone through based on what works and what does not work. This will help streamline the process in the future for all entities responsible for decommissioning – the sublessees, UH, and DLNR. In addition, it will be important and advantageous to make previous site-specific plans (SDPs and DFPs), or portions of them, available to future decommissioning efforts in order to share lessons learned and streamline the process.

Regular review of the Decommissioning Plan is needed to determine if its provisions are effective over time and are meeting management needs. The plan is process-oriented, and it is possible, that over time, updates will be required based on changes in operations and policies. The Decommissioning Plan should be reviewed and updated every five years as part of the evaluation and revision process for the Mauna Kea CMP (see Mauna Kea CMP Section 7.4.2). Changes to the Decommissioning Plan will reflect changes in conditions noted in the Mauna Kea CMP, including its sub-plans. Updates to the Decommissioning Plan will incorporate changes to DLNR rules and regulations, renegotiated leases, new and renegotiated subleases, new management agreements, or new statutes or changes to existing laws and/or court decisions that are related to deconstruction and site restoration.

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## Appendices

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## Appendix A. Summary of Information Relating to Decommissioning in CMP, CRMP & NRMP

The table below identifies specific component plans in the Mauna Kea CMP that are relevant to the decommissioning process. It includes those that contain actions directly related to the decision-making process, including options for facility removal and site restoration, and those that contain specific activities that will occur during implementation of the decommissioning process (i.e., deconstruction, habitat restoration).

Mauna Kea CMP Management Component Plan	Information Relevant to Decommissioning
7.1.1: Native Hawaiian Cultural Resources	Considerations for protection and restoration of cultural resources
7.1.2: Natural Resources	Considerations for protection and restoration of natural resources
7.2.2: Permitting and Enforcement	General discussion regarding compliance with CDUPs
7.3.1: Infrastructure and Maintenance	Consider and follow during any deconstruction and site restoration activities conducted as part of decommissioning
7.3.2: Construction Guidelines	Consider and follow during any deconstruction and site restoration activities conducted as part of decommissioning
7.3.3: Site Recycling, Decommissioning, Demolition and Restoration	General guidelines requiring planning for demolition and site restoration
7.3.4: Future Land Use	Considerations for potential future development
7.4.1: Operations and Implementation	Provides for stakeholder input

The *Cultural Resources Management Plan for the UH Management Areas on Mauna Kea* (CRMP) and the *Natural Resources Management Plan for the UH Management Areas on Mauna Kea* (NRMP) are sub-plans of the Mauna Kea CMP (McCoy et al. 2009; SRGII 2009). These plans were developed to ensure that the mandate to preserve and protect the cultural and natural resources in the UH Management Areas is fulfilled by UH. Many of the recommendations in the plans resulted from the consideration of human activities and uses in the UH Management Areas, including observatory development and operation. Human use of areas with sensitive natural or cultural resources can impact these resources through disturbance, habitat alteration, or introduction of invasive plants and animals. Both plans provide detailed information on Mauna Kea's resources, identify threats to resources from human activity, and outline management strategies to minimize potential impacts. The table below cross-references sections in related plans with information relevant to decommissioning for ease of reference.

### Cross-Referenced Information Relating to Decommissioning

Information Relevant to Decommissioning	CMP	CRMP	NRMP
Discussion of future land uses including redevelopment of existing sites and removal of observatories	6.2.6, 7.3.3	4.2.7	3.1.1.4, 5.1.1
Require observatories to develop plans to recycle or demolish facilities once their useful life has ended, in accordance with their sublease requirements, identifying all proposed actions	7.3.3		4.3.3.4.1

Information Relevant to Decommissioning	CMP	CRMP	NRMP
Description of HAR §13-5, CDUP	3.4.2	1.6.2	1.4.3.2
Description of HRS Chapter 343 and HAR §11-200, environmental review	3.4.2	1.6.3	1.4.3.2
Description of HRS Chapter 6E and HAR §13-300, cultural resources	3.4.2	1.6.1	1.4.3.2
Enforcement and compliance of all applicable laws, regulations and permit conditions	7.2.2, 7.3.2, 7.3.3	1.1	1.4.2, 1.4.3
Recommendations and compliance procedures for burial protection and inadvertent discoveries	7.1.1	4.2.7.2	4.3.2
Recommendations and compliance procedures for the determination of the effect on historic properties from demolition and site restoration activities	7.1.1	4.2.7.1	
Threats to resources related to construction activities <sup>24</sup>	6.3	4.1, 4.2.7	3.1.1.2.9, 3.2
Recommendations for minimizing habitat alteration due to the construction and demolition of building and infrastructure, as well as repairing degraded habitats	7.1.2, 7.3.4		4.2.3.1
Recommendations for minimizing dust generation from construction equipment	7.1.4, 7.3.2		4.2.3.2
Recommendations for preventing the escape and migration of potential contaminants into the environment and for spill response plans	7.4.1, 7.3.2	4.3.5	4.2.3.3
Recommendations to guide the management and removal of solid waste/debris from construction sites	7.2.1, 7.3.1	4.3.4	4.2.3.5
Recommendations for minimizing noise levels from construction equipment	7.3.2		4.2.3.6
Recommendations to prevent the introduction of invasive species due to construction activities	7.1.2, 7.2.1, 7.3.1, 7.3.2		4.2.3.7
Recommendations regarding mitigation plans	7.1.2, 7.3.4	4.2.7.3	4.3.3.3
General recommendations on habitat restoration and rehabilitation	7.1.2, 7.3.4		4.2.3.8, 4.3.3
Specific recommendations on habitat restoration following telescope decommissioning and removal	7.3.2, 7.3.3, 7.3.4		4.3.3.4.1
Support and implement inventory, monitoring and research projects to establish baseline status of resources and track changes over time	7.1.2, 7.3.2	4.3.1	4.1, 4.2.2
Recommendations on educating construction workers about cultural and natural resources that may be directly affected by their work	7.1.2, 7.1.3, 7.2.1, 7.3.2	4.3.3	4.4
Require use of best management practices (BMP's) for construction	7.3.2	4.2.7	4.1.4.2.3, 4.2.3, 4.3.3.4.1
Require on site monitors during construction activities	7.3.2	4.2.7	4.1.4.2.3, 4.2
Require any future observatories to consider site restoration during project planning and include provisions in subleases for funding of full restoration	7.3.3		4.3.3.4.1

<sup>24</sup> All references to construction also apply to deconstruction of facilities.

## **Appendix B. Documentation of Long-Term Observatory Development Plans**

Response to HCR 314, Regular Session of 2006; Report on long-term development of observatory sites on the summit of Mauna Kea, Rolf-Peter Kudritzki

Mauna Kea CMP Appendix A9: Institute for Astronomy's Plans to Remove and Decommission Obsolete Telescopes

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**Response to**

**HCR 314, Regular Session of 2006**

**Report on long-term development of observatory sites on the summit of Mauna Kea**

**by**

**Rolf-Peter Kudritzki**  
**Director, Institute for Astronomy**  
**University of Hawaii**

**December 1, 2006**

**Summary. A report on the long-term future development of observatory sites on the Summit of Mauna Kea is given. A conceptual plan is presented that proposes a much smaller number of future projects than foreseen in the University of Hawaii Master Plan of 2000. The long-range goal is to have eventually fewer observatories than now, but still the very best in the world in this way securing continued world leadership in astronomical research and education in Hawaii for the next decades.**

#### **1. Introduction.**

This report is submitted in response to the request by the House of Representatives of the Twenty-third Legislature of the State of Hawaii, Regular Session of 2006, the Senate concurring, "that the University of Hawaii Institute for Astronomy prepares a report on the long-term development of observatory sites on the summit of Mauna Kea, including a conceptual plan that consolidates the number of observatory sites, to enhance the quality of astronomy research and limit the size of the geographical area on which to situate new observatories."

The report is structured as follows. We first describe the present situation of astronomical research and education in Hawaii and its important role for the State and the University. Then, we discuss the concept for long-term astronomical development, as it is described in the comprehensive and detailed "Mauna Kea Science Reserve Master Plan", which was approved by the Board of Regents in June 2000. Since the development of the Master Plan, the scientific priorities of astronomy for the new century have become much clearer, and a new more concise concept for future astronomical development has emerged that will guarantee Hawaii's continued world leadership in astronomical research and education, while at the same time being well balanced with the needs for cultural and environmental protection of Mauna Kea. This concept will be introduced in section three of this report.

#### **1. The role of astronomy in Hawaii.**

To appreciate the role of astronomy in our state, one first needs to understand the history of astronomy development in Hawaii; the basic philosophy behind that development; the essential role played by the Institute for Astronomy; and the educational, scientific and economic benefits that accrue from astronomy.

The Institute for Astronomy (IfA) is 38 years old and is by far the youngest among top-ranked astronomy programs in the U.S. In this short time, the Institute has grown to become one of the most visible of UH's scientific research programs and one of the most respected astronomy institutes in the world. The IfA plays in the same league as Caltech, Harvard, Princeton, Berkeley, and Cambridge. It attracts the best faculty and the best students from around the world. It has become a pillar of academic excellence and certainly an engine of economic growth in the State. Where once school kids in the world learned that the center of astronomy was Mount Palomar in California, now they learn it is in Hawaii. How has this story of scientific success been possible in such a short time?

The answer to this question is the superior quality of Mauna Kea and Haleakala as the world's best observatory sites and the concept developed by the IfA, the University and the State to build up the most capable observatory in the world. The astronomers of the IfA were the first in the world to dare to build a technologically very challenging and complex observatory with small, but very efficient, telescopes at the extreme elevation and thin air of 13,796 ft. With their exciting astronomical detections they were able to demonstrate to the world that Mauna Kea is unique as an astronomical site.

Scientifically, the logical consequence for UH would have been to use this enormous advantage to build the next generation of most powerful telescopes on its own, as the universities in California, Texas, Arizona and on the East Coast did before. However, UH was (and is) a medium size State University with a very limited budget, and Hawaii is a small state with limited resources. Thus, a different concept was developed—the concept of scientific partnerships.

Within this concept the national and international partners contribute the capital funding for the facility, carry most or all of the operational costs, and contribute to the infrastructure development. The University, through the IfA, provides the leadership and know-how to operate an observatory at extreme altitude, the management of the physical and operational infrastructure (roads, power, fiber-optics communications, food, lodging) and ongoing protection from adverse intrusions such as light pollution and radio frequency interference. The University also provides the land for the observatory site from its lease from the State, along with assistance in planning and permitting. The University and its partners collaborate in the scientific use of the telescopes including development of technologically advanced instrumentation. Most importantly, they share the scientific observing time on the facilities with no cost to the University.

In this way, the University and the State did not have to contribute the enormous capital costs to design and build the extremely powerful new telescopes, but were still able to provide researchers with access to these unique facilities and give them the opportunity to build up one of the best research and education programs in the world. The benefits, both economic and otherwise, are substantial as indicated below.

1. Astronomy facilities on Mauna Kea and Haleakala represent a capital investment of close to \$1 billion. The economic impact of astronomy to the State amounts to \$150 million per year. New projects for Haleakala and Mauna Kea have the potential to double these numbers.
2. The observatories and other astronomy-related activities on Mauna Kea and Haleakala provide 600 quality jobs in a clean high-tech industry on the neighbor islands. It is important to note that only a small fraction of these jobs are for astronomers. Most of them are for technical, administrative and logistic services. This number will increase if we continue to follow the sound policies that have been in place for nearly 30 years. Beyond the simple numbers, there is the fact that astronomy as a high-tech science diversifies the Hawaii economy and gives local young people with scientific and technical talents a wealth of opportunities to realize their potential without having to leave their family and friends in Hawaii to pursue employment elsewhere. Unlike some high-tech industries, astronomy is fundamentally rooted in Hawaii. Once established, an astronomy facility cannot be easily relocated to the mainland or overseas.
3. The IfA has developed into one of the world's preeminent centers for astronomical research. The Institute receives extramural awards totaling between \$20 to \$25 million annually for astronomical research, for development of new astronomical instrumentation, for improving its own old telescopes and for operating telescopes, such as the NASA Infrared Telescope Facility on Mauna Kea and the Mees Solar Observatory on Haleakala. Its graduate program belongs to the best in the world and about 1,000 undergraduate students per year participate in astronomy courses in Manoa. In addition, UH Hilo has recently developed a very successful astronomy undergraduate program. Astronomy is one of UH's most successful programs.
4. The Mauna Kea Observatories are the world's largest observatory complex, and will remain so for the foreseeable future. Hawaii and its State University are recognized around the world for this outstanding achievement—a source of tremendous prestige for the State. Approximately 1,500 scientists come to work at the Observatories each year; most add some vacation time to their trip. Hundreds of others come to Hawaii each year to participate in astronomy-related conferences. Several small companies make a business of providing quality tours to Mauna Kea. The observatories' base facilities in Hilo, Waimea and on Maui are a major addition to those communities and contribute in many ways.

5. Over the years, the observatories have made significant monetary contributions to the infrastructure, much of which is of benefit to the general community. This includes \$2 million for road improvements on Mauna Kea and another \$2 million to assist GTE Hawaiian Tel to install a fiber optics cable across the Saddle from Waimea to Hilo. This cable provides state-of-the-art service for both the Big Island telephone system and the observatories.
6. The observatories operate the Visitor Information Station at Hale Pohaku, which provides free public star gazing seven nights a week and welcomes about 100,000 visitors each year.
7. The observatories pay the entire cost of maintenance and snow removal for the road and they pay for emergency services. The public can use the road all the time. The costs for this service and the Visitor Station amount to \$700,000 a year.

Although the economic benefits are substantial, it is important to keep in mind that the primary mission of astronomy is not to generate revenue. Astronomy is basic science and concentrates on the scientific exploration of the universe. Astronomy is the mother of all sciences and has changed our understanding of the world and our thinking as humans like no other science. The telescopes on Mauna Kea and Haleakala have contributed fundamentally to the advancement of modern astronomy. They are world-class research facilities, and the best window our planet provides on the strange and wonderful universe we live in.

## **2. Long-term astronomical development in the 2000 Master Plan.**

The 2000 Master Plan is a comprehensive document, which was approved by the Board of Regents in June 2000 after an arduous, two-year process with input from all sectors of the community, and supervised by a community-based advisory committee chaired by two faculty members at UH Hilo's College of Hawaiian Language, Dr. Pila Wilson and Mr. Larry Kimura. It was accompanied by a State Environmental Impact Statement signed by the Governor of the State. The Master Plan has been submitted to the Legislature on many occasions and is available on the Institute for Astronomy's website. The scope of the Master Plan is much broader than future development of astronomy. It addresses the cultural and environmental aspects of the University's use and responsibility for the Mauna Kea Science Reserve and proposes a new organizational structure, which has been implemented by establishing the Office of Mauna Kea Management, based at the University of Hawaii at Hilo, and two important community-based advisory bodies, the Mauna Kea Management Board, and Kahu Ku Mauna, the Office's and Board's cultural advisory council. Within the new organizational structure the Institute for Astronomy's responsibility on Mauna Kea is limited to astronomical operation, research and education, whereas the Office has the responsibility for the cultural and environmental protection and all other aspects of land management. In this report we will not discuss these latter aspects. It is our understanding from the 2006 hearings that the objective of HCR 314 is to obtain information on the prospects and

plans for future astronomical development on Mauna Kea, and we have restricted the report accordingly.

The scientific progress in modern astronomy is intimately related to the development of new technologies, new instrumentation, and new and more powerful telescopes. Without such development it is impossible to stay at the forefront of astronomical research. It is therefore natural that the Master Plan also contains a section about very ambitious future astronomical development. However, this development together with all but one of the existing facilities is confined to the "Astronomy Precinct", a very small fraction of less than five percent (4.65% or 525 acres) of the existing Mauna Kea Science Reserve of 11,288 acres in order to maintain a close grouping of astronomy facilities, roads and support infrastructure. This approach minimizes the potential impact to the natural and cultural resources of the summit region. The criteria to be followed for new facilities proposed in the Astronomy Precinct include:

- Emphasize recycling of existing sites when possible so as not to disturb existing habitat areas, archeology and landforms;
- Limit visual impact and scattering of facilities by clustering within the existing development areas;
- Utilize the natural forms in the summit area to shield views of built facilities;
- Implement design measures to allow facilities to blend better with the existing landscape;
- Minimize infrastructure development by locating near the existing roadway and utility network;
- Minimal impact on existing facilities;
- Minimum impact of Wekiu bug habitat;
- Avoidance of archeological sites;
- Suitability for observations.

A vigorous UH approval process for new project has been introduced, which includes reviews by the Office of Mauna Kea Management, the Kahu Ku Mauna Council, the Mauna Kea Management Board, the Chancellor of UH Hilo, the UH President and finally the Board of Regents. In addition, new projects have to carry out an environmental analysis in the form of either an Environmental Assessment or an Environmental Impact Statement and they have to go through the State process with the Department of Land and Natural Resources to obtain a Conservation District Use Permit. In the whole process each new facility will be required to present a detailed justification addressing the following questions

- (1) Why is the facility needed?
- (2) Why is Mauna Kea the best site for the facility?
- (3) What other location options are available?
- (4) What are the expected benefits with regard to research and education, employment and economy
- (5) What is the expected facility lifetime and term of sublease agreement?

There are currently 12 observatories on Mauna Kea. The Master Plan identifies five of those (the UH 0.6m, the UH 2.2m, the Canada-France-Hawaii Telescope, the United Kingdom Infrared Telescope, and the NASA Infrared Telescope Facility) as older facilities, several of which could be upgraded or replaced within the next 20 years. The expectation is that the new or upgraded telescopes would come in a range of sizes from 2 to 15 meter mirror sizes (note that the 10m-class mirrors of the existing Keck, Gemini and Subaru Telescopes represent the current state-of-the art observatory facilities), however there are clear restrictions in terms of the height and volume for these facility redevelopments. The Master Plan also assumes that the other seven existing facilities would remain as is over the next 20 years.

In addition, the Master Plan envisages the expansion of two existing facilities. For the Keck Observatory it proposes the addition of four to six 1.8m outrigger telescopes to create a very powerful infrared interferometer, which would study cosmic objects for spatially resolved fine details, for instance the motion of stars caused by the presence of Jupiter-like planets orbiting around them. For the existing Harvard-Smithsonian Submillimeter Array (SMA) – an array of 12 movable radio telescope antennas distributed over 24 fixed concrete pads – the plan foresees an extension by 12 more antennas and 24 additional pads to increase the sensitivity and efficiency.

Three new projects at three new sites are proposed in the Master Plan. The first is the UH Hilo instructional telescope, a relatively small (1m mirror) telescope planned for a site adjacent to the existing UH 0.6m telescope. This facility is planned to be used for the education and training of undergraduate students in UH Hilo's Department of Physics and Astronomy program. The second is a new optical/infrared telescope comparable in size and capability to the existing Keck or Gemini telescopes. For environmental and cultural reasons a site below the summit ridge on the north shield is proposed.

The third new facility proposed is a revolutionary new telescope with a very large mirror of 25m to 50m diameter. This would be the largest telescope in the world. The site foreseen for this telescope is on the north-west lava plateau below the summit. This location minimizes visibility of the new facility from Hilo and Honokaa and would not affect Wekiu bug habitat.

The future astronomical development on Mauna Kea as foreseen in the University's Master Plan gives very high priority to the protection of natural and cultural resources, but at the same it also proposes a considerable expansion of future astronomical activity on Mauna Kea. If all facilities discussed in the Master Plan were built, the number of observatories would increase from 12 to 15 and two of the existing ones would be expanded.

In the next section we will introduce a modified plan, which proposes significantly less future development.

### **3. A modified plan for long-term astronomical development on Mauna Kea.**

When future development for the next 20 years was discussed in the Master Plan of the year 2000, the goal was to be as comprehensive as possible in order not to exclude potentially important scientific options for the future. However, now six years later and after detailed scientific discussion within the Institute for Astronomy it has become clear that the number of future projects envisaged for the next 20 years is much smaller than anticipated in the Master Plan. The long-range goal is to have eventually fewer observatories than now, but certainly still the very best in the world.

After six years of successful operation under the Master Plan in coordination and collaboration with the Office of Mauna Kea Management and its community-based advisory boards it is well recognized that future plans for Mauna Kea require balanced management to preserve, protect and enhance the cultural and natural resources as well as providing a world-class center for education and research in astronomy. As laid out in the Master Plan and also described in the previous section, all major future development will be subject to stringent review by the Office of Mauna Kea Management, Mauna Kea Management Board, and Kahu Ku Mauna Council, as well as the community-based Hawaiian Culture and Environment committees, which report to the Board. In addition, as also already described in the section before, all major developments require a Conservation District Use Permit from the State Board of Land and Natural Resources. As the leaseholder for the Science Reserve, UH is responsible for submitting the use application. In conjunction with this process, UH must satisfy State and Federal environmental impact requirements (Chapter 343 and NEPA). The Institute for Astronomy is committed to sponsor only projects that are considered the best in the world, and not simply to add projects for the sake of adding another telescope to the mountain.

The goal of our new plan is to keep Hawaii's world leadership in ground-based astronomy. This achievement and recognition as a world leader will benefit not only UH as an educational and research institution but the entire state. The advancing and leading edge technologies associated with astronomy research and development will aid Hawaii's efforts to boost its technology industry, including software and instrument development.

In the following, we will discuss the new modified plan in detail. We will also compare it with the development as proposed in the Master Plan. We will start with the two observatories, for which significant expansion was proposed, the Keck Observatory and the Submillimeter Array (SMA). For the Keck Observatory the addition of six Outrigger telescopes was planned. In our new plan we do not foresee adding any more telescopes to the Keck Observatory.

For the SMA, the Master Plan proposed 12 more antennas and 24 new concrete pads for the array; however in our new plan, we consider only the very moderate expansion of two

more antennas and two pads. UH is also working on the relocation of two existing antenna pads located at the base of Pu'u Poliahu, a culturally significant site.

In the Master Plan a new observatory site on the summit ridge was proposed for the UH Hilo instructional telescope. In order not to increase the number of observatory sites on the summit ridge, the Institute for Astronomy has agreed to give its UH 0.6m telescope and the site to UH Hilo so that the instructional telescope can be built there with only little if any modification of the existing site. This minimizes cultural and environmental impact for this important educational project, which was described in the previous section. An Environmental Assessment of the project by UH Hilo has been completed.

Another redevelopment of an existing site in our new plan is the use of the UH 2.2m site for the Institute for Astronomy's new Pan-STARRS observatory. Pan-STARRS uses completely new technology being developed by the Institute to detect killer asteroids which threaten to impact the Earth. It will detect the majority of the most dangerous objects about 30 years before their potential impact giving some time to develop protection for mankind in case of a serious threat. This project is federally funded. The Institute for Astronomy is preparing a federal EIS in collaboration with the federal funding agency. In addition, UH will submit a comprehensive Mauna Kea management plan to the State Board of Land and Natural Resources for review and approval, before applying for a Conservation District Use Permit for this project.

In addition to the UH Hilo instructional telescope the Master Plan proposes two new telescopes at two new sites, as described in the previous section. One of them, the optical/infrared telescope of Keck or Gemini size, is not pursued any further in our new plan. With the enormously increased efficiencies of Keck, Gemini, and Subaru we do not believe that there is a scientific need anymore for another telescope of this size. It is worth mentioning at this point that the observatories on Mauna Kea are experimenting with the use of new fiber optics technology to combine the light from the already existing telescopes, the so-called Ohana Project. This is a challenging project, which will probably take decades to be successful, but it will greatly expand the capability and utility of the existing observatories.

The only project at a new site proposed in our new plan is the Thirty Meter Telescope (TMT). With its mirror of 30m diameter it will be the largest telescope in the world, and will be ten times more powerful than the Keck telescopes. It will be able to image planets orbiting around other stars and to analyze the light coming from these planets and, thus, to ascertain whether the conditions exist for the formation of life in planetary systems around other stars. It will also be able to detect the most distant galaxies in the universe and will see them in stage when the universe was still very young after its birth in the Big Bang.

As described in the previous section a site is foreseen for this observatory on the northern plateau below the summit ridge. This new site is preferable to a replacement of one of the existing telescopes, because the facility would be less visible and the environmental



and cultural impact would be smaller. The Institute for Astronomy is currently carrying out site testing and atmospheric characterization measurements at this site.

The TMT is a \$1 billion project and the most ambitious project of modern astronomy. It is the dedicated goal of the Institute for Astronomy and UH to attract this unique project to Hawaii. It will have an enormous scientific, educational and economic impact and it will secure leadership of Hawaii in astronomical science for the next decades. This is the key project for the future of astronomy in Hawaii.

In summary, our new plan does not propose any further extension of the Keck Observatory with Outrigger telescopes and only a very small expansion of the SMA. It proposes two new projects, the UH Hilo instructional telescope and Pan-STARRS, which will use existing sites and will stay within the footprints of the existing facilities. As the most important project it proposes the TMT on a new site on the northern plateau below the summit ridge.

While the Master Plan of the year 2000 assumed that all existing facilities, which would not be replaced by new ones would continue to exist for the next 20 years, we do not make this assumption for the new plan. It is clear that newer facilities such as Keck, Gemini, Subaru, Pan-STARRS, the UH Hilo telescope and the SMA will certainly continue to operate over the next 20 years. However, some of the others will not continue with their operation, because other aspects of astronomical observations will become more important. In such cases our plan is not to refurbish all of them but only a few and only in cases where an extremely important scientific case can be made. Otherwise, our new plan is to demolish the old facility, to clean the site and to recreate the site in a stage as it was, before the facility had been built. (It is important to note that Operating and Site Development Agreements – the contracts between UH and the telescope partners on Mauna Kea – require that the costs for such reestablishment of the site in its original status have to be paid by the telescope partners.) We are confident that in this way the number of observatories on Mauna Kea in 20 years from now will be smaller than now. But with all the new facilities, in particular the TMT, Hawaii will still have the very best in the world.



Kuiwahu

July 11, 2008

Dr. Rolf-Peter Kudritzki  
Director, Institute for Astronomy  
University of Hawai'i  
2680 Woodlawn Drive  
Honolulu, Hawai'i 96822

Dear Dr. Kudritzki:

Over the last several months, the Mauna Kea Comprehensive Management Team has been involved in extensive community outreach to gain a better understanding of the community's views on how Mauna Kea should be protected and managed. We have been asking hard questions about the community's view on the co-existence of Hawaiian culture and science, specifically existing and potential future development on Mauna Kea.

This question has generated intense discussion fueled with passion and emotion but a true desire to develop a comprehensive management plan that recognizes and protects the cultural integrity of Mauna Kea while continuing to support the University of Hawai'i as a premier astronomical institution in the world. There are many in the Hawaiian community who recognize the summit of Mauna Kea as one of the most culturally significant sites within the Mauna Kea Science Reserve if not all of Hawai'i. A recurrent theme by both the Hawaiian and non-Hawaiian community is that since the summit of Mauna Kea is so culturally significant, the community would like to see a specific plan that shows the removal of obsolete telescopes from the summit and decommissioning plans for each of the observatories for restoring the summit. In our view, this plan is critical to addressing the cultural concerns that have been consistently raised in our community outreach efforts.

We are aware of your report to the Legislature in 2007 on the Long Term Development of Observatory Sites on the Summit of Mauna Kea. It would be very helpful if you could update your report and provide a specific plan for decommissioning and removal of telescopes.

Your timely attention to this matter is greatly appreciated as we would like to share this information with the community in our future correspondence and public meetings. Should you have any questions, please don't hesitate to contact me at 539-3583.

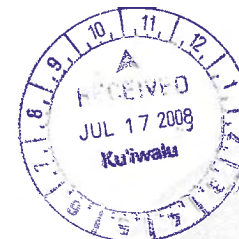
Sincerely,

DAWN N.S. CHANG  
Principal

Pauahi Tower, 27<sup>th</sup> Floor - 1001 Bishop Street - Honolulu, Hawaii 96813  
PHONE: (808) 539-3580 - FAX: (808) 539-3581 - EMAIL: kuiwahu@kuiwahu.com - WEBSITE: www.kuiwahu.com

# UNIVERSITY OF HAWAII AT MĀNOA

Institute for Astronomy  
Office of the Director



July 15, 2008

Ms. Dawn N. S. Chang  
Principal Kuiwahu  
1003 Bishop Street  
Pauahi Tower, 27<sup>th</sup> Floor  
Honolulu, Hawaii 96813

Dear Ms. Chang:

Thank you for your letter dated July 11, 2008. We greatly appreciate the opportunity to address the community's concerns related to telescope development on Mauna Kea.

In December 2006, responding to a request from the Hawaii State Legislature, I as director of the Institute for Astronomy (IfA), submitted a "Report on long-term development of observatory sites on the summit of Mauna Kea". Prior to its submittal, the report was approved by the President of the University of Hawaii. The report describes a long-term development plan that would see a much smaller number of future projects than were described in the UH Master Plan of 2000, but would still maintain Hawaii's world leadership in ground-based astronomy.

The key new developments in this plan are the use of the UH 2.2m telescope site for IfA's new Pan-STARRS observatory and the Thirty-Meter Telescope (TMT) at a new site on the northwest plateau, below the summit ridge. With Pan-STARRS and an appropriate scientific participation in the TMT, and with the present large telescopes on Mauna Kea, the University of Hawaii will be able to retain its world-leading position in astronomical research.

Taking into account the enormous scientific potential of these two new projects for research at UH, the report also addresses the future of the existing facilities:

*While the Master Plan of the year 2000 assumed that all existing facilities which would not be replaced by new ones would continue to exist for the next 20 years, we do not make this assumption for the new plan. It is clear that newer facilities such as Keck, Gemini, Subaru, Pan-STARRS, the UH Hilo telescope and the SMA will certainly continue to operate over the next 20 years. However, some of the others will not continue with their operation, because other aspects of astronomical observations will become more important. In such cases our plan is not to refurbish all of them but only a few and only in cases where an extremely important scientific case can be made. Otherwise, our new plan is to demolish the old facility, to clean the site and to recreate the site in a stage as it was, before the facility had been built. (It is important to note that Operating and Site Development Agreements—the contracts between UH and the telescope partners on Mauna Kea—require the cost for such reestablishment of the site in its original status have to be paid by the telescope partners). We are confident that in this way the number of observatories on Mauna Kea in 20 years from now will be smaller than now. But with all the new facilities, in particular the TMT, Hawaii will still have the very best in the world.*

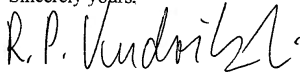
While this aspect of the report has found substantial support in the community, it has also been noted that the report is not specific about which of the facilities might be replaced or refurbished and which would not, in the event that their current operation ended before the expiration of the sublease with UH. This appears to be consistent with your observations in the community as well.

Accordingly, we present a Revised Plan that addresses this aspect. A fundamental component of our Revised Plan is that Pan-STARRS and the TMT will play a central role in future astronomical research at UH.

Currently, there are four radio telescope facilities on Mauna Kea: the Very Long Baseline Array (VLBA), the Caltech Submillimeter Observatory (CSO), the James Clerk Maxwell Telescope (JCMT) and the Submillimeter Array (SMA). Because of cultural concerns that have been raised about the location of the VLBA, the 2000 Master Plan did not include the VLBA site within the Astronomy Precinct. Therefore, should the operation of the VLBA terminate, or should an alternative site and relocation funding become available, we would not reuse this site for a new project. For the CSO, JCMT, and the SMA, the Revised Plan foresees replacing at most one of these three with a new observatory working preferably in the sub-millimeter or millimeter domain, for which Mauna Kea is well known as the best site in the northern hemisphere. This means that only one of the existing four radio observatory sites would be used in the long term for a new project resulting in possibly three of the radio telescope facilities being removed and those sites restored prior to the expiration of the lease to UH.

There are currently nine optical or infrared observatories on Mauna Kea: the two Kecks, Subaru, Gemini, Canada-France-Hawaii Telescope, NASA Infrared Telescope, United Kingdom Infrared Telescope (UKIRT), UH 2.2m (which if permitted would be replaced by Pan-STARRS, assumed to operate for only 10 years), and the UH 24-inch (which IfA has transferred to UH Hilo as the site for their instructional telescope). Here the Revised Plan is that when the operation of UKIRT comes to an end, the facility will be removed and the site restored.

Sincerely yours,



Rolf-Peter Kudritzki  
Director

RPK:nl

**UNIVERSITY OF HAWAII AT MĀNOA**

Institute for Astronomy  
Office of the Director

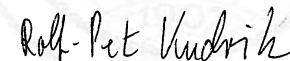
July 16 2008

Ms. Dawn N. S. Chang  
Principal Ku'iwalu  
1003 Bishop Street  
Pauahi Tower, 27<sup>th</sup> Floor  
Honolulu, Hawaii 96813

Dear Ms. Chang:

Enclosed for your information are copies of the ten letters we have sent to the Mauna Kea observatory directors asking about their plans for eventual removal and site restoration. We have asked for a response by August 22, 2008.

Sincerely yours,



Rolf-Peter Kudritzki  
Director

RPK:nl  
encl.



UNIVERSITY OF HAWAII AT MĀNOA

Institute for Astronomy  
Office of the Director

July 16, 2008

Dr. Christian Veillet  
Executive Director  
Canada-France-Hawaii  
65-1238 Mamalahoa Highway  
Kamuela, HI 96743

Dear Dr. Veillet:

Subject: Mauna Kea Comprehensive Management Plan

As you know, the University of Hawaii (UH) is developing a Comprehensive Management Plan (CMP) for the lands on Mauna Kea managed by UH. A very important part of this effort is consultation and dialog with the local community. The CMP team, led by the consulting firm, Ku'iwalu, has undertaken a wide range of initiatives to reach all types of interested groups and individuals in every part of the community. A recurrent theme in these discussions is the question of what will happen with a telescope and its site after the sublease expires, or in the event that a facility closes before the sublease expiration for reasons such as a change in funding agency priorities. There is a concern that telescope structures could remain on the summit after a facility closes, because removal turns out to be technically too complicated and/or too expensive. There are, unfortunately, a number of examples in the history of the State of Hawaii (not related to astronomy), which make these worries understandable. The CMP team wishes to address this issue to the maximum extent possible under the circumstances. To that end, they have asked the Institute for Astronomy to approach each of the Mauna Kea Observatories with the following request for information.

The sublease between UH and the Canada-France-Hawaii Telescope Corporation for the site of the Canada-France-Hawaii Telescope (CFHT) contains two options for the disposition of the facilities in the event of termination or expiration of the sublease:

- 1) surrender to UH subject to the approval of UH and the Chairman of the Board of Land and Natural Resources
- 2) removal of the facilities and restoration of the property at the expense of CFHT.

If option 1 is not approved, then option 2 must be exercised.

By this letter we are asking you to confirm that the CFHT is aware of the technical and financial implications of option 2 and that it can guarantee its implementation, should the need arise at some point in the future. We are also asking for whatever information you can provide regarding the expected cost and source of funding for option 2. Both the confirmation of the awareness and the information about cost and anticipated funding are very important for the development of the CMP and its acceptance by the local community.

Dr. Christian Veillet, CFHT – July 16, 2008 – Page 2

The CFHT is an outstanding facility that continues to deliver important and far-reaching scientific results. That being the case, we understand that this inquiry might seem premature and inappropriate. However, it is vitally important that the University of Hawaii and its partners on Mauna Kea address clearly the legitimate concerns raised by the community, and that we thereby demonstrate our commitment to careful long-term planning that is both environmentally and culturally sensitive.

Please be aware that the information you provide may be made public and included in the CMP. In order to keep the CMP process on schedule, we are asking for at least a preliminary response by August 22.

Thank you very much for your cooperation in responding to this request. Please do not hesitate to call me if you have questions about it.

Sincerely,

  
Rolf-Peter Kudritzki  
Director

RPK:nll

UNIVERSITY OF HAWAII AT MĀNOA

Institute for Astronomy  
Office of the Director

July 16, 2008

Dr. Alan T. Tokunaga  
Division Chief  
NASA Infrared Telescope Facility  
Institute for Astronomy  
2680 Woodlawn Drive  
Honolulu, HI 96822

Dear Dr. Tokunaga:

Subject: Mauna Kea Comprehensive Management Plan

As you know, the University of Hawaii (UH) is developing a Comprehensive Management Plan (CMP) for the lands on Mauna Kea managed by UH. A very important part of this effort is consultation and dialog with the local community. The CMP team, led by the consulting firm, Ku'iwalu, has undertaken a wide range of initiatives to reach all types of interested groups and individuals in every part of the community. A recurrent theme in these discussions is the question of what will happen with a telescope and its site after the sublease expires, or in the event that a facility closes before the sublease expiration for reasons such as a change in funding agency priorities. There is a concern that telescope structures could remain on the summit after a facility closes, because removal turns out to be technically too complicated and/or too expensive. There are, unfortunately, a number of examples in the history of the State of Hawaii (not related to astronomy), which make these worries understandable. The CMP team wishes to address this issue to the maximum extent possible under the circumstances. To that end, they have asked the Institute for Astronomy to approach each of the Mauna Kea Observatories with the following request for information.

The sublease between UH and NASA for the site of NASA Infrared Telescope Facility (IRTF) contains two options for the disposition of the facilities in the event of termination or expiration of the sublease:

- 1) surrender to UH subject to the approval of UH and the Chairman of the Board of Land and Natural Resources
- 2) removal of the facilities and restoration of the property at the expense of NASA.

If option 1 is not approved, then option 2 must be exercised.

By this letter we are asking you to confirm that the IRTF is aware of the technical and financial implications of option 2 and that it can guarantee its implementation, should the need arise at some point in the future. We are also asking for whatever information you can provide regarding the expected cost and source of funding for option 2. Both the confirmation of the awareness and the information about cost and anticipated funding are very important for the development of the CMP and its acceptance by the local community.

Dr. Alan T. Tokunaga, NASA IRTF – July 16, 2008 – Page 2

The IRTF is an outstanding facility that continues to deliver important and far-reaching scientific results. That being the case, we understand that this inquiry might seem premature and inappropriate. However, it is vitally important that the University of Hawaii and its partners on Mauna Kea address clearly the legitimate concerns raised by the community, and that we thereby demonstrate our commitment to careful long-term planning that is both environmentally and culturally sensitive.

Please be aware that the information you provide may be made public and included in the CMP. In order to keep the CMP process on schedule, we are asking for at least a preliminary response by August 22.

Thank you very much for your cooperation in responding to this request. Please do not hesitate to call me if you have questions about it.

Sincerely,



Rolf-Peter Kudritzki  
Director

RPK:nl

**UNIVERSITY OF HAWAII AT MĀNOA**

Institute for Astronomy  
Office of the Director

July 16, 2008

Dr. Gary R. Davis  
Director, Hawaii Operations  
Joint Astronomy Centre  
660 N. A'ohoku Place  
Hilo, HI 96720

Dear Dr. Davis:

Subject: Mauna Kea Comprehensive Management Plan

As you know, the University of Hawaii (UH) is developing a Comprehensive Management Plan (CMP) for the lands on Mauna Kea managed by UH. A very important part of this effort is consultation and dialog with the local community. The CMP team, led by the consulting firm, Ku'iwalu, has undertaken a wide range of initiatives to reach all types of interested groups and individuals in every part of the community. A recurrent theme in these discussions is the question of what will happen with a telescope and its site after the sublease expires, or in the event that a facility closes before the sublease expiration for reasons such as a change in funding agency priorities. There is a concern that telescope structures could remain on the summit after a facility closes, because removal turns out to be technically too complicated and/or too expensive. There are, unfortunately, a number of examples in the history of the State of Hawaii (not related to astronomy), which make these worries understandable. The CMP team wishes to address this issue to the maximum extent possible under the circumstances. To that end, they have asked the Institute for Astronomy to approach each of the Mauna Kea Observatories with the following request for information.

The sublease between UH and the Science and Technology Facilities Council (STFC) for the site of the United Kingdom Infrared Telescope (UKIRT) contains four options for the disposition of the facilities in the event of termination or expiration of the sublease:

- 1) sale to UH
- 2) sale to a third party acceptable to UH
- 3) surrender with the approval of the Chair of the Board of Land and Natural Resources
- 4) removal of the facilities and restoration of the property at the expense of STFC.

If none of options 1 to 3 is available, then option 4 must be exercised.

By this letter we are asking you to confirm that the UKIRT is aware of the technical and financial implications of option 4 and that it can guarantee its implementation, should the need arise at some point in the future. We are also asking for whatever information you can provide regarding the expected cost and source of funding for option 4. Both the confirmation of the awareness and the information about cost and anticipated funding are very important for the development of the CMP and its acceptance by the local community.

Dr. Gary R. Davis, UKIRT – July 16, 2008 – Page 2

The UKIRT is an outstanding facility that continues to deliver important and far-reaching scientific results. That being the case, we understand that this inquiry might seem premature and inappropriate. However, it is vitally important that the University of Hawaii and its partners on Mauna Kea address clearly the legitimate concerns raised by the community, and that we thereby demonstrate our commitment to careful long-term planning that is both environmentally and culturally sensitive.

Please be aware that the information you provide may be made public and included in the CMP. In order to keep the CMP process on schedule, we are asking for at least a preliminary response by August 22.

Thank you very much for your cooperation in responding to this request. Please do not hesitate to call me if you have questions about it.

Sincerely,

*Rolf-Peter Kudritzki*  
Rolf-Peter Kudritzki  
Director

RPK:nll

UNIVERSITY OF HAWAII AT MĀNOA

Institute for Astronomy  
Office of the Director

July 16, 2008

Dr. Thomas G. Phillips  
Director, Caltech Submillimeter Observatory  
Mail Stop 320-47  
George W. Downs Laboratory of Physics  
California Institute of Technology  
Pasadena, CA 91125

Dear Dr. Phillips:

Subject: Mauna Kea Comprehensive Management Plan

As you know, the University of Hawaii (UH) is developing a Comprehensive Management Plan (CMP) for the lands on Mauna Kea managed by UH. A very important part of this effort is consultation and dialog with the local community. The CMP team, led by the consulting firm, Ku'iwalu, has undertaken a wide range of initiatives to reach all types of interested groups and individuals in every part of the community. A recurrent theme in these discussions is the question of what will happen with a telescope and its site after the sublease expires, or in the event that a facility closes before the sublease expiration for reasons such as a change in funding agency priorities. There is a concern that telescope structures could remain on the summit after a facility closes, because removal turns out to be technically too complicated and/or too expensive. There are, unfortunately, a number of examples in the history of the State of Hawaii (not related to astronomy), which make these worries understandable. The CMP team wishes to address this issue to the maximum extent possible under the circumstances. To that end, they have asked the Institute for Astronomy to approach each of the Mauna Kea Observatories with the following request for information.

The sublease between UH and Caltech for the site of the Caltech Submillimeter Observatory (CSO) contains four options for the disposition of the facilities in the event of termination or expiration of the sublease:

- 1) sale to UH
- 2) surrender with the concurrence of UH
- 3) sale to a third party acceptable to UH
- 4) removal of the facilities and restoration of the property at the expense of Caltech.

If none of options 1 to 3 is satisfactorily completed within twelve months, then option 4 must be exercised.

By this letter we are asking you to confirm that the CSO is aware of the technical and financial implications of option 4 and that it can guarantee its implementation, should the need arise at some point in the future. We are also asking for whatever information you can provide regarding the expected cost and source of funding for option 4. Both the confirmation of the awareness and the information about cost and anticipated funding are very important for the development of the CMP and its acceptance by the local community.

Dr. Thomas Phillips, CSO – July 16, 2008 – Page 2

The CSO is an outstanding facility that continues to deliver important and far-reaching scientific results. That being the case, we understand that this inquiry might seem premature and inappropriate. However, it is vitally important that the University of Hawaii and its partners on Mauna Kea address clearly the legitimate concerns raised by the community, and that we thereby demonstrate our commitment to careful long-term planning that is both environmentally and culturally sensitive.

Please be aware that the information you provide may be made public and included in the CMP. In order to keep the CMP process on schedule, we are asking for at least a preliminary response by August 22.

Thank you very much for your cooperation in responding to this request. Please do not hesitate to call me if you have questions about it.

Sincerely,

*Rolf-Peter Kudritzki*  
Rolf-Peter Kudritzki  
Director

RPK:nll

**UNIVERSITY OF HAWAII AT MĀNOA**

Institute for Astronomy  
Office of the Director

July 16, 2008

Dr. Robert L. Dickman  
Assistant Director, VLA/VLBA Operations  
National Radio Astronomy Observatory  
P. O. Box O  
Socorro, NM 87801-0387

Dear Dr. Dickman:

Subject: Mauna Kea Comprehensive Management Plan

As you know, the University of Hawaii (UH) is developing a Comprehensive Management Plan (CMP) for the lands on Mauna Kea managed by UH. A very important part of this effort is consultation and dialog with the local community. The CMP team, led by the consulting firm, Ku'iwalu, has undertaken a wide range of initiatives to reach all types of interested groups and individuals in every part of the community. A recurrent theme in these discussions is the question of what will happen with a telescope and its site after the sublease expires, or in the event that a facility closes before the sublease expiration for reasons such as a change in funding agency priorities. There is a concern that telescope structures could remain on the summit after a facility closes, because removal turns out to be technically too complicated and/or too expensive. There are, unfortunately, a number of examples in the history of the State of Hawaii (not related to astronomy), which make these worries understandable. The CMP team wishes to address this issue to the maximum extent possible under the circumstances. To that end, they have asked the Institute for Astronomy to approach each of the Mauna Kea Observatories with the following request for information.

The sublease between UH and the National Radio Astronomy Observatory (NRAO) for the site of the VLBA Antenna contains four options for the disposition of the facilities in the event of termination or expiration of the sublease:

- 1) removal of the facilities and restoration of the property at the expense of NRAO,
- 2) sale to UH,
- 3) sale to a third party, contingent upon the execution of a new Sublease and Operating and Site Development Agreement between the third party and UH,
- 4) surrender in place.

Options 2, 3, and 4 require the approval of both UH and the Department of Land and Natural Resources. If none of these three alternatives is available, then option 1 (removal and restoration) must be completed within one year.

By this letter we are asking you to confirm that the VLBA is aware of the technical and financial implications of option 1 and that it can guarantee its implementation, should the need arise at some point in the future. We are also asking for whatever information you can provide regarding the expected cost and source of funding for option 1. Both the confirmation of the awareness and the information about cost and anticipated funding are very important for the development of the CMP and its acceptance by the local community.

2680 Woodlawn Drive, Honolulu, Hawaii 96822  
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Appendix A9: IfA Telescope Plans

A9-15

April 2009

Dr. Robert L. Dickman, VLBA – July 16, 2008 – Page 2

The VLBA is an outstanding facility that continues in the prime of its scientific life. That being the case, we understand that this inquiry might seem premature and inappropriate. However, it is vitally important that the University of Hawaii and its partners on Mauna Kea address clearly the legitimate concerns raised by the community, and that we thereby demonstrate our commitment to careful long-term planning that is both environmentally and culturally sensitive.

Please be aware that the information you provide may be made public and included in the CMP. In order to keep the CMP process on schedule, we are asking for at least a preliminary response by August 22.

Thank you very much for your cooperation in responding to this request. Please do not hesitate to call me if you have questions about it.

Sincerely,

*Rolf-Peter Kudritzki*  
Rolf-Peter Kudritzki  
Director

RPK:nll

Appendix A9: IfA Telescope Plans

A9-16

April 2009



UNIVERSITY OF HAWAII AT MĀNOA

Institute for Astronomy  
Office of the Director

July 16, 2008

Dr. Taft E. Armandroff  
Director, W. M. Keck Observatory  
California Association for Research  
in Astronomy  
65-1120 Mamalahoa Highway  
Kamuela, HI 96743

Dear Dr. Armandroff:

Subject: Mauna Kea Comprehensive Management Plan

As you know, the University of Hawaii (UH) is developing a Comprehensive Management Plan (CMP) for the lands on Mauna Kea managed by UH. A very important part of this effort is consultation and dialog with the local community. The CMP team, led by the consulting firm, Ku'iwalu, has undertaken a wide range of initiatives to reach all types of interested groups and individuals in every part of the community. A recurrent theme in these discussions is the question of what will happen with a telescope and its site after the sublease expires, or in the event that a facility closes before the sublease expiration for reasons such as a change in funding agency priorities. There is a concern that telescope structures could remain on the summit after a facility closes, because removal turns out to be technically too complicated and/or too expensive. There are, unfortunately, a number of examples in the history of the State of Hawaii (not related to astronomy), which make these worries understandable. The CMP team wishes to address this issue to the maximum extent possible under the circumstances. To that end, they have asked the Institute for Astronomy to approach each of the Mauna Kea Observatories with the following request for information.

The sublease between UH and the California Institute of Technology (Caltech) for the site of the W. M. Keck Observatory contains four options for the disposition of the facilities in the event of termination or expiration of the sublease:

- 1) removal of the facilities and restoration of the property at the expense of Caltech,
- 2) sale to UH,
- 3) sale to a third party, contingent upon the execution of a new Sublease and Operating and Site Development Agreement between the third party and UH,
- 4) surrender in place.

Options 2, 3, and 4 require the approval of both UH and the Department of Land and Natural Resources. If none of these three alternatives is available, then option 1 (removal and restoration) must be completed within one year.

By this letter we are asking you to confirm that Keck is aware of the technical and financial implications of option 1 and that it can guarantee its implementation, should the need arise at some point in the future. We are also asking for whatever information you can provide regarding the expected cost and source of funding for option 1. Both the confirmation of the awareness and the information about cost and anticipated funding are very important for the development of

Dr. Taft E. Armandroff, W. M. Keck Observatory – July 16, 2008 – Page 2

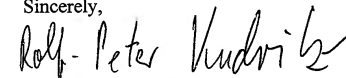
the CMP and its acceptance by the local community.

Keck is an outstanding facility in the prime of its scientific life. That being the case, we understand that this inquiry might seem premature and inappropriate. However, it is vitally important that the University of Hawaii and its partners on Mauna Kea address clearly the legitimate concerns raised by the community, and that we thereby demonstrate our commitment to careful long-term planning that is both environmentally and culturally sensitive.

Please be aware that the information you provide may be made public and included in the CMP. In order to keep the CMP process on schedule, we are asking for at least a preliminary response by August 22.

Thank you very much for your cooperation in responding to this request. Please do not hesitate to call me if you have questions about it.

Sincerely,



Rolf-Peter Kudritzki  
Director

RPK:nll

UNIVERSITY OF HAWAII AT MĀNOA

Institute for Astronomy  
Office of the Director

July 16, 2008

Dr. Masahiko Hayashi  
Director, Subaru Telescope  
National Astronomical Observatory of Japan  
650 N. A'ohoku Place  
University Park  
Hilo, HI 96720

Dear Dr. Hayashi:

Subject: Mauna Kea Comprehensive Management Plan

As you know, the University of Hawaii (UH) is developing a Comprehensive Management Plan (CMP) for the lands on Mauna Kea managed by UH. A very important part of this effort is consultation and dialog with the local community. The CMP team, led by the consulting firm, Ku'iwalu, has undertaken a wide range of initiatives to reach all types of interested groups and individuals in every part of the community. A recurrent theme in these discussions is the question of what will happen with a telescope and its site after the sublease expires, or in the event that a facility closes before the sublease expiration for reasons such as a change in funding agency priorities. There is a concern that telescope structures could remain on the summit after a facility closes, because removal turns out to be technically too complicated and/or too expensive. There are, unfortunately, a number of examples in the history of the State of Hawaii (not related to astronomy), which make these worries understandable. The CMP team wishes to address this issue to the maximum extent possible under the circumstances. To that end, they have asked the Institute for Astronomy to approach each of the Mauna Kea Observatories with the following request for information.

The sublease between UH and the National Astronomical Observatory of Japan (NAOJ) for the site of the Subaru Telescope contains four options for the disposition of the facilities in the event of termination or expiration of the sublease:

- 1) removal of the facilities and restoration of the property at the expense of NAOJ,
- 2) sale to UH,
- 3) sale to a third party, contingent upon the execution of a new Sublease and Operating and Site Development Agreement between the third party and UH,
- 4) surrender in place.

Options 2, 3, and 4 require the approval of both UH and the Department of Land and Natural Resources. If none of these three alternatives is available, then option 1 (removal and restoration) must be completed within one year.

By this letter we are asking you to confirm that Subaru Telescope is aware of the technical and financial implications of option 1 and that it can guarantee its implementation, should the need arise at some point in the future. We are also asking for whatever information you can provide regarding the expected cost and source of funding for option 1. Both the confirmation of the awareness and the information about cost and anticipated funding are very important for the development of the CMP and its acceptance by the local community.

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Appendix A9: IfA Telescope Plans

A9-19

April 2009

Dr. Masahiko Hayashi, Subaru Telescope – July 16, 2008 – Page 2

The Subaru Telescope is an outstanding facility in the prime of its scientific life. That being the case, we understand that this inquiry might seem premature and inappropriate. However, it is vitally important that the University of Hawaii and its partners on Mauna Kea address clearly the legitimate concerns raised by the community, and that we thereby demonstrate our commitment to careful long-term planning that is both environmentally and culturally sensitive.

Please be aware that the information you provide may be made public and included in the CMP. In order to keep the CMP process on schedule, we are asking for at least a preliminary response by August 22.

Thank you very much for your cooperation in responding to this request. Please do not hesitate to call me if you have questions about it.

Sincerely,



Rolf-Peter Kudritzki  
Director

RPK:nl

Appendix A9: IfA Telescope Plans

A9-20

April 2009

UNIVERSITY OF HAWAII AT MĀNOA

Institute for Astronomy  
Office of the Director

July 16, 2008

Dr. Douglas A. Simons  
Director, Frederick C. Gillett Gemini Observatory  
Northern Operations Center  
670 N. A'ohoku Place  
University Park  
Hilo, HI 96720-2700

Dear Dr. Simons:

Subject: Mauna Kea Comprehensive Management Plan

As you know, the University of Hawaii (UH) is developing a Comprehensive Management Plan (CMP) for the lands on Mauna Kea managed by UH. A very important part of this effort is consultation and dialog with the local community. The CMP team, led by the consulting firm, Ku'iwalu, has undertaken a wide range of initiatives to reach all types of interested groups and individuals in every part of the community. A recurrent theme in these discussions is the question of what will happen with a telescope and its site after the sublease expires, or in the event that a facility closes before the sublease expiration for reasons such as a change in funding agency priorities. There is a concern that telescope structures could remain on the summit after a facility closes, because removal turns out to be technically too complicated and/or too expensive. There are, unfortunately, a number of examples in the history of the State of Hawaii (not related to astronomy), which make these worries understandable. The CMP team wishes to address this issue to the maximum extent possible under the circumstances. To that end, they have asked the Institute for Astronomy to approach each of the Mauna Kea Observatories with the following request for information.

The sublease between UH and the National Science Foundation (NSF) for the site of the Frederick C. Gillett Gemini North Telescope contains four options for the disposition of the facilities in the event of termination or expiration of the sublease:

- 1) removal of the facilities and restoration of the property at the expense of NSF,
- 2) sale to UH,
- 3) sale to a third party, contingent upon the execution of a new Sublease and Operating and Site Development Agreement between the third party and UH,
- 4) surrender in place.

Options 2, 3, and 4 require the approval of both UH and the Department of Land and Natural Resources. If none of these three alternatives is available, then option 1 (removal and restoration) must be completed within one year.

By this letter we are asking you to confirm that Gemini is aware of the technical and financial implications of option 1 and that it can guarantee its implementation, should the need arise at some point in the future. We are also asking for whatever information you can provide regarding the expected cost and source of funding for option 1. Both the confirmation of the awareness and the information about cost and anticipated funding are very important for the development of

Dr. Douglas A. Simons, Gemini Observatory – July 16, 2008 – Page 2


the CMP and its acceptance by the local community.

Gemini is an outstanding facility in the prime of its scientific life. That being the case, we understand that this inquiry might seem premature and inappropriate. However, it is vitally important that the University of Hawaii and its partners on Mauna Kea address clearly the legitimate concerns raised by the community, and that we thereby demonstrate our commitment to careful long-term planning that is both environmentally and culturally sensitive.

Please be aware that the information you provide may be made public and included in the CMP. In order to keep the CMP process on schedule, we are asking for at least a preliminary response by August 22.

Thank you very much for your cooperation in responding to this request. Please do not hesitate to call me if you have questions about it.

Sincerely,



Rolf-Peter Kudritzki  
Director

RPK:nll

**UNIVERSITY OF HAWAII AT MĀNOA**

Institute for Astronomy  
Office of the Director

July 16, 2008

Dr. Raymond Blundell  
Director, Submillimeter Array  
Smithsonian Astrophysical Observatory  
60 Garden Street  
Cambridge, MA 02138

Dear Dr. Blundell:

Subject: Mauna Kea Comprehensive Management Plan

As you know, the University of Hawaii (UH) is developing a Comprehensive Management Plan (CMP) for the lands on Mauna Kea managed by UH. A very important part of this effort is consultation and dialog with the local community. The CMP team, led by the consulting firm, Ku'iwalu, has undertaken a wide range of initiatives to reach all types of interested groups and individuals in every part of the community. A recurrent theme in these discussions is the question of what will happen with a telescope and its site after the sublease expires, or in the event that a facility closes before the sublease expiration for reasons such as a change in funding agency priorities. There is a concern that telescope structures could remain on the summit after a facility closes, because removal turns out to be technically too complicated and/or too expensive. There are, unfortunately, a number of examples in the history of the State of Hawaii (not related to astronomy), which make these worries understandable. The CMP team wishes to address this issue to the maximum extent possible under the circumstances. To that end, they have asked the Institute for Astronomy to approach each of the Mauna Kea Observatories with the following request for information.

The sublease between UH and the Smithsonian Institution (Smithsonian) for the site of the Submillimeter Array (SMA) contains four options for the disposition of the facilities in the event of termination or expiration of the sublease:

- 1) removal of the facilities and restoration of the property at the expense of Smithsonian,
- 2) sale to UH,
- 3) sale to a third party, contingent upon the execution of a new Sublease and Operating and Site Development Agreement between the third party and UH,
- 4) surrender in place.

Options 2, 3, and 4 require the approval of both UH and the Department of Land and Natural Resources. If none of these three alternatives is available, then option 1 (removal and restoration) must be completed within one year.

By this letter we are asking you to confirm that the SMA is aware of the technical and financial implications of option 1 and that it can guarantee its implementation, should the need arise at some point in the future. We are also asking for whatever information you can provide regarding the expected cost and source of funding for option 1. Both the confirmation of the awareness and the information about cost and anticipated funding are very important for the development of the CMP and its acceptance by the local community.

2680 Woodlawn Drive, Honolulu, Hawaii 96822  
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Appendix A9: IfA Telescope Plans

A9-23

April 2009

Dr. Raymond Blundell, Submillimeter Array – July 16, 2008 – Page 2

The SMA is an outstanding facility in the prime of its scientific life. That being the case, we understand that this inquiry might seem premature and inappropriate. However, it is vitally important that the University of Hawaii and its partners on Mauna Kea address clearly the legitimate concerns raised by the community, and that we thereby demonstrate our commitment to careful long-term planning that is both environmentally and culturally sensitive.

Please be aware that the information you provide may be made public and included in the CMP. In order to keep the CMP process on schedule, we are asking for at least a preliminary response by August 22.

Thank you very much for your cooperation in responding to this request. Please do not hesitate to call me if you have questions about it.

Sincerely,



Rolf-Peter Kudritzki  
Director

RPK:nll

Appendix A9: IfA Telescope Plans

A9-24

April 2009

UNIVERSITY OF HAWAII AT MĀNOA

Institute for Astronomy  
Office of the Director

July 16, 2008

Dr. Gary R. Davis  
Director, Hawaii Operations  
Joint Astronomy Centre  
660 N. A'ohoku Place  
Hilo, HI 96720

Dear Dr. Davis:

Subject: Mauna Kea Comprehensive Management Plan

As you know, the University of Hawaii (UH) is developing a Comprehensive Management Plan (CMP) for the lands on Mauna Kea managed by UH. A very important part of this effort is consultation and dialog with the local community. The CMP team, led by the consulting firm, Ku'iwalu, has undertaken a wide range of initiatives to reach all types of interested groups and individuals in every part of the community. A recurrent theme in these discussions is the question of what will happen with a telescope and its site after the sublease expires, or in the event that a facility closes before the sublease expiration for reasons such as a change in funding agency priorities. There is a concern that telescope structures could remain on the summit after a facility closes, because removal turns out to be technically too complicated and/or too expensive. There are, unfortunately, a number of examples in the history of the State of Hawaii (not related to astronomy), which make these worries understandable. The CMP team wishes to address this issue to the maximum extent possible under the circumstances. To that end, they have asked the Institute for Astronomy to approach each of the Mauna Kea Observatories with the following request for information.

The sublease between UH and the Science and Technology Facilities Council (STFC) for the site of the James Clerk Maxwell Telescope (JCMT) contains four options for the disposition of the facilities in the event of termination or expiration of the sublease:

- 1) sale to UH
- 2) surrender with the approval of UH
- 3) sale to a third party acceptable to UH
- 4) removal of the facilities and restoration of the property at the expense of STFC.

If none of options 1 to 3 is agreed upon within six months, then option 4 must be exercised.

By this letter we are asking you to confirm that the JCMT is aware of the technical and financial implications of option 4 and that it can guarantee its implementation, should the need arise at some point in the future. We are also asking for whatever information you can provide regarding the expected cost and source of funding for option 4. Both the confirmation of the awareness and the information about cost and anticipated funding are very important for the development of the CMP and its acceptance by the local community.

Dr. Gary R. Davis, JCMT – July 16, 2008 – Page 2

The JCMT is an outstanding facility that continues to deliver important and far-reaching scientific results. That being the case, we understand that this inquiry might seem premature and inappropriate. However, it is vitally important that the University of Hawaii and its partners on Mauna Kea address clearly the legitimate concerns raised by the community, and that we thereby demonstrate our commitment to careful long-term planning that is both environmentally and culturally sensitive.

Please be aware that the information you provide may be made public and included in the CMP. In order to keep the CMP process on schedule, we are asking for at least a preliminary response by August 22.

Thank you very much for your cooperation in responding to this request. Please do not hesitate to call me if you have questions about it.

Sincerely,



Rolf-Peter Kudritzki  
Director

RPK:nll



Ms. Dawn S. Chang,  
Principal Ku'iwalu,  
by email.

27 July 2008

Dear Ms Chang,

#### Revised IfA Plan for Future Development

I am writing to amplify slightly on the letter sent to you by Professor Kudritzki on 15<sup>th</sup> July. It was stated in that letter that, should UKIRT cease operations before the expiration of the general lease in 2033, the IfA would not seek to re-use the site for astronomy. That decision is entirely the University's prerogative as holder of the general lease.

I want to emphasize that, whilst it is possible that UKIRT will cease operations before 2033, there is no fixed timeline for this. UKIRT is owned by a scientific research body in the United Kingdom, and the future of the facility is one element of that organization's forward strategic planning. I can confirm that UKIRT is not scheduled for closure within the organization's current planning horizon; indeed, as its Director, I believe it has the potential to continue operating for many years at the forefront of infrared astronomy.

I trust this helps to clarify the situation. Should you require any further information pertaining to these issues, please do not hesitate to ask.

Kindest regards,

Professor Gary Davis,  
Director JAC.

cc: Prof. Kudritzki, IfA  
Ms S. Nagata, OMKM  
Mr B. Taniguchi, MKMB

## Joint Astronomy Centre

660 N. A'ohōkū Place, University Park  
Hilo, Hawaii 96720-2700, USA

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+1 808 969 6591 (Directorate Office)

**Professor Gary R. Davis** *BSc MSc DPhil*  
Director, Joint Astronomy Centre  
James Clerk Maxwell Telescope  
United Kingdom Infrared Telescope

Tel: +1 808 969 6504 (Direct)  
Email: [g.davis@jach.hawaii.edu](mailto:g.davis@jach.hawaii.edu)

## UNIVERSITY OF HAWAII AT MĀNOA

Institute for Astronomy  
Office of the Director

August 28, 2008

Ms. Dawn N. S. Chang  
Principal Ku'iwalu  
1003 Bishop Street  
Pauahi Tower, 27<sup>th</sup> Floor  
Honolulu, Hawaii 96813

Dear Ms. Chang:

Enclosed for your information are copies of the eight responses we have received to my July 16 letter asking the observatories about their plans for eventual removal and site restoration. We have heard from all of the observatories except for VLBA. Note that the letter from Professor Davis addresses both UKIRT and JCMT.

Sincerely yours,

Rolf-Peter Kudritzki  
Director

RPK:nl  
encl.

Canada - France - Hawaii Telescope Corporation  
65-1238 Mamalahoa Highway, Kamuela, Hawaii 96743 USA



Société du Télescope Canada - France - Hawaii  
Telephone (808) 885-7944 Fax (808) 885-7288

6 August 2008

Dr. Rolf-Peter Kudritzki  
Director  
Institute for Astronomy  
University of Hawai'i at Manoa  
2680 Woodlawn Drive  
Honolulu, HI 96822

Dear Dr. Kudritzki,

Subject: Mauna Kea Comprehensive Management Plan

In response to your letter dated July 16, 2008 inquiring about CFHT's potential obligation to remove its facilities on Mauna Kea and restoring the property at its expense, I am pleased to let you know that this issue is well known to the CFHT Corporation.

Very early on in my directorship, I looked thoroughly at all the options for the future of CFHT, including the one I liked the least, i.e. the closure of the telescope. I asked for a quote from a demolition company located on Oahu, Island Demo Inc. (<http://www.islanddemo.com/>) which looked at the drawings of the summit facility and pictures of the construction, and visited the site on Mauna Kea. The quote came to approximately \$6M, with a strong warning on possible substantial additional cost for cleaning soil contamination that could be found once the facility is removed (a problem often encountered at industrial sites). This quote was issued back in 2004, and corresponded at the time to a one-year operating budget of the Corporation.

I asked at that time to present the observatory at an MKMB meeting, as a first courtesy visit. I outlined not only the current and planned activities of CFHT, but also the various scenarios for the future, including the closure and restoration of the site.

Since then, I have kept in mind that the demolition cost would be the equivalent of one year of operation of the facility. So, the owners of the Corporation should think of the cleaning cost as one year of funding once the observatory is closed.

This cost also happens to be the value of CFHT's property in Waimea, which is a nice piece of land for business use in town. For CFHT, the sale of the Corporation's assets could therefore pay for the cleanup of its Mauna Kea site.

I hope that this information is helpful. Please do not hesitate to come back to me, should you need more information.

CV/ms  
File: 1920.02/1116.05

Aloha  
  
Christian Veillet  
Executive Director

National Aeronautics and Space Administration  
Headquarters  
Washington, DC 20546-0001



RC: Rf  
orig file

AUG 14 2008

Reply to Attn of: Planetary Division

Professor Rolf-Peter Kudritzki  
Institute for Astronomy  
2680 Woodlawn Ave.  
Honolulu, Hawaii 96822

Dear Professor Kudritzki:

Through the IRTF Director, Alan Tokunaga, NASA has received your letter date July 16, 2008, and related recent email communications from Alan Tokunaga of your staff at UH. NASA has also reviewed the November, 1974 Sublease agreement between the University of Hawaii and the agency regarding the NASA Infrared Telescope Facility (IRTF), and has taken into consideration the needs you have expressed regarding information for the Mauna Kea Comprehensive Management Plan.

Your letter of 16 July references the sublease agreement with respect to two (2) options "for the disposition of the facilities in the event of termination or expiration of the sublease:

- 1) surrender to UH subject to the approval of UH and the Chairman of the Board of Land and Natural Resources
- 2) removal of the facilities and restoration of the property at the expense of NASA"

Your letter also seeks that NASA "confirm that the IRTF is aware of the technical and financial implications of Option 2 and that it can guarantee its implementation," and also seeks "whatever information [NASA] can provide regarding the expected cost and source of funding" for "option 2." Your letter also indicates that "information [provided by NASA] may be made public and included in the CMP."


In review of the 1974 sublease agreement, it is clear subparts "VII SURRENDER," and "XII TITLE TO FACILITIES, ALTERATIONS, [etc]" are applicable to the potential termination or abandonment by NASA of the Mauna Kea/IRTF site.

Since at this time NASA has no plans for termination or abandonment of the IRTF and no studies have been done related to such action, NASA is not in a position to provide any information about the potential costs in the event of termination because such costs have not been quantified. NASA also points out that, consistent with language in subpart XII of the

sublease, financial obligations associated with the IRFT are "subject to the availability of appropriated funding," in other words, congressional approval for the expenditure of taxpayer dollars.

Nonetheless, NASA does represent that it will honor the terms of the sublease in the event of termination or abandonment of the site.

Sincerely,

  
James L. Green, Director  
Planetary Division

cc: Alan Tokunaga, Philippe Crane, Richard McCarthy



Dr R-P Kudritzki, Director,  
Institute for Astronomy,  
by email.

22 July 2008

Dear Professor Kudritzki,

#### Mauna Kea Comprehensive Management Plan

Thank you for your letters dated 16th July, pertaining to the eventual dispositions of JCMT and UKIRT. I appreciate fully the CMP team's need for visibility of these arrangements and it is my pleasure to provide you with the following information.

Both telescopes are managed by the Science and Technology Facilities Council (STFC) of the United Kingdom. I hereby confirm that STFC is fully cognisant of its obligation, should none of the other options specified in the sub-lease prove possible, to remove the facilities and restore the properties. Although neither of the facilities is scheduled for closure within the current planning horizon, STFC has nevertheless made advance provision for these decommissioning costs. I can state unequivocally that STFC will, consistent with the requirements of the sub-lease, meet the full cost of removing the observatories and restoring the sites.

The amount of this provision is based on a quotation which was provided to us in 2006 by a private contractor following a tender exercise. I am regrettably unable to provide you with public details of the expected cost since this quotation was provided to us on a commercial-in-confidence basis. I can nevertheless offer you my complete assurance that STFC has made provision for the costs of decommissioning based on a sound engineering assessment of the requirements.

I trust this information will satisfy your requirements. Please do not hesitate to contact me should you require anything further.

Kindest regards,



Professor Gary Davis,  
Director JAC.

## Joint Astronomy Centre

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Hilo, Hawaii 96720-2700, USA

<http://www.jach.hawaii.edu/>

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**Professor Gary R. Davis** BSc MSc DPhil  
Director, Joint Astronomy Centre  
James Clerk Maxwell Telescope  
United Kingdom Infrared Telescope

Tel: +1 808 969 6504 (Direct)

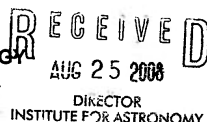
Email: [g.davis@jach.hawaii.edu](mailto:g.davis@jach.hawaii.edu)





CALIFORNIA INSTITUTE OF TECHNOLOGY

GEORGE W. DOWNS LABORATORY OF PHYSICS 320-47  
PASADENA, CALIFORNIA 91125-4700



August 21, 2008

Rolf-Peter Kudritzki, Director  
Institute for Astronomy University of Hawaii at Manoa  
2680 Woodlawn Drive  
Honolulu, HI 96822

Dear Dr. Kudritzki:

This letter is in response to your letter dated July 16, 2008 regarding the Mauna Kea Comprehensive Management Plan. You requested that we provide you with certain information regarding the removal of the facilities and restoration of the property at the termination or expiration of the Sublease between University of Hawaii and Caltech.

As you correctly point out, Caltech has a sublease with the University of Hawaii for the site of the Caltech Submillimeter Observatory, and that sublease contains provisions regarding the disposition of the facilities in the event of termination or expiration of the Sublease. Caltech also signed an operating agreement with the University of Hawaii in which the parties agree that the facilities are to be disposed of according to the provisions of the sublease. One option in the event of termination or expiration of the sublease is the removal of the facilities and restoration of the property.

We confirm that we are aware of the technical and financial implications of the removal/restoration option in the event of termination or expiration of the sublease. Consistent with Caltech's legal obligations set forth in the sublease and the operating agreement, if the removal/restoration option becomes necessary, we are able to guarantee its implementation. Caltech will be the source of funding for the removal of the facilities and restoration of the property.

Sincerely,

T. G. Phillips  
Director, Caltech Submillimeter Observatory

TGP:smc

xc: D. Currie, Vice President for Business & Finance  
B. T. Soifer, Director, Spitzer Science Center  
K. Dolan, Office of the General Counsel



W. M. KECK OBSERVATORY

On the summit of Mauna Kea, Island of Hawaii

August 22, 2008

Dr. Rolf-Peter Kudritzki  
Director, Institute for Astronomy  
University of Hawaii  
2680 Woodlawn  
Honolulu, Hawaii 96822

Dear Rolf,

This letter is in response to your letter dated July 16, 2008 regarding the Mauna Kea Comprehensive Management Plan. You requested that we provide you with certain information regarding the sublease between University of Hawaii and the California Institute of Technology (Caltech).

As you correctly point out in your letter, Caltech has a sublease with the University of Hawaii for the site of the W. M. Keck Observatory, and that sublease contains provisions regarding the disposition of the facilities in the event of termination or expiration of the Sublease. One option in the event of termination or expiration of the sublease is the removal of the facilities and restoration of the property within one year from the termination or expiration of the Sublease. Caltech and the University of California (UC) also signed operating agreements with the University of Hawaii in which the parties agree that the facilities are to be disposed of according to the terms of the sublease.

We confirm that we are aware of the technical and financial implications of the removal/restoration option in the event of termination or expiration of the sublease. Consistent with Caltech and UC's legal obligations set forth in the sublease and operating agreements, if the removal/restoration option becomes necessary, we are able to guarantee its implementation. Caltech and University of California will be the source of funding for removal of the facilities and restoration of the property.

Sincerely,

Taft Armandroff  
Director, W. M. Keck Observatory

cc:

Edward Stone, Chair, California Association for Research in Astronomy  
George Blumenthal, Vice Chair, California Association for Research in Astronomy

Tel: 808.885.7887 • Fax: 808.885.4464

Headquarters: 65-1120 Mamalahoa Highway, Kamuela, HI 96743 [www.keckobservatory.org](http://www.keckobservatory.org)



## Subaru Telescope

National Astronomical Observatory of Japan  
650 North A'ohoku Place, Hilo, Hawaii 96720, U.S.A.

August 18, 2008

Dr. Rolf-Peter Kudritzki  
Director  
Institute for Astronomy  
University of Hawaii  
2680 Woodlawn Drive  
Honolulu, HI 96822-1839

RECEIVED  
AUG 19 2008  
DIRECTOR  
INSTITUTE FOR ASTRONOMY

Dear Dr. Kudritzki:

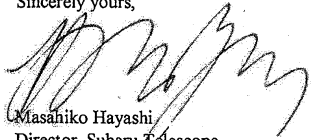
This is a reply to your letter regarding the "Mauna Kea Comprehensive Management Plan" dated July 16, 2008. You asked us to confirm that Subaru Telescope is aware of technical and financial implications in the event of termination or expiration of the sublease and that the National Astronomical Observatory of Japan (NAOJ) must remove the facilities and restore the property at its own expense within one year.

I have confirmed with the NAOJ administration that it is fully aware of its responsibility and it guarantees the removal of the facilities and restoration of the property, should the need arise at some point in the future.

Regarding the expected cost and source of funding, NAOJ will provide the funds for the necessary cost, which is expected to be more than US\$10M. Since this is a significant amount, we need to ask you to give us ample time for securing the funds prior to the implementation.

It is our pleasure that the Subaru telescope is producing world frontier scientific results and no one doubts that Mauna Kea is essential for our successful achievements. We would like to express, at this time, our sincere appreciation to the University of Hawaii and to the local community on the Big Island for making this happen.

Sincerely yours,

  
Masahiko Hayashi  
Director, Subaru Telescope  
National Astronomical Observatory of Japan

CC: Shoken M. Miyama, Director-General



## GEMINI OBSERVATORY

Office of the Director  
Gemini Observatory: Teaching Humanity about the Universe

Northern Operations Center  
670 N. A'ohoku Place  
Hilo, Hawaii 96720

Phone: (808) 974-2514  
Fax: (808) 974-2599  
Email: dsimons@gemini.edu

To: Rolf-Peter Kudritzki, Director, UH Institute for Astronomy  
From: Doug Simons, Director, Gemini Observatory  
Date: 12 August 2008  
Subj: Reply to your letter regarding the CMP

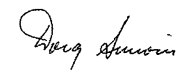
Dear Rolf -

I am writing in response to your letter to me dated 16 July 2008 regarding the CMP process and long-term plans for Gemini in the context of the expiration of our sublease on the summit of Mauna Kea. For reference, you noted 4 options in your letter including -

- 1) Removal of the facilities and restoration of the property at the expense of the NSF
- 2) Sale to UH
- 3) Sale to a third party, contingent upon the execution of a new Sublease and OSDA between that third party and UH
- 4) Surrender in place

It is important to emphasize that the agreement authorizing Gemini's use of a portion of the Mauna Kea science reserve for the Gemini-N telescope is formalized by our OSDA, which is an agreement between UH and our executive agency, the NSF. Upon receiving your letter I therefore contacted the NSF about your query and asked Gemini's engineering team for a rough estimate of the cost (2008 dollars) of deconstructing Gemini-N. Regarding the latter, we estimate a cost of USD9,000,000 to remove the entire facility from the summit and restore the original grade on the site. Of the options listed above, the NSF represented to me that option 4 is certainly the least desirable, given their sensitivities to Hawaiian interests and broader concern for the environment on Mauna Kea. Options 2 and 3 are somewhat speculative and certainly have not been explored in the relatively young lifetime of Gemini-N, which only entered science operations in 2000. Option 1 (removal of the facilities) would require consideration of all the Gemini Partner agencies, which are all stakeholders in the Gemini-N facility under our International Agreement. Any decision to execute option 1 would therefore be contingent upon those discussions and the availability of funds to conduct the deconstruction of Gemini-N. An absolute "guarantee" to execute option 1 is therefore not possible at this point as it would, at a minimum, require funding commitments that to date have not been sought from our funding agencies. Nonetheless I have confidence the NSF would work diligently on behalf of the Gemini partnership to find a mutually agreed solution, in the context of the current OSDA, in the event our sublease is terminated or expires.

Aloha,

  
Douglas A. Simons  
Director, Gemini Observatory

Cc: Wayne van Citters, Craig Foltz

Date: Fri, 15 Aug 2008 14:16:51 -0400  
From: Ray Blundell <rblundell@cfa.harvard.edu>  
To: Rolf Peter Kudritzki <kud@ifa.hawaii.edu>  
Cc: Dr. Ray Blundell <rblundell@cfa.harvard.edu>,  
Dr. George Nystrom <gnystrom@cfa.harvard.edu>  
Subject: Eventual clearing of the SMA site

Dear Rolf,

I discussed your request with Charles Alcock (SAO Director) and with Paul Ho (ASIAA Director) and subsequently asked George Nystrom to take a look at how we might remove the SMA from Mauna Kea should the need arise following eventual closure of the observatory. Below please find a draft summary of his findings. With regards to a source of funding for eventual removal of the SMA, Charles has contacted SI Washington for advice. However, we believe that SI (and ASIAA) will take any responsibilities they have in this regard very seriously. We are close to finalizing a cost estimate for complete removal

Sincerely,

Ray

Below we outline a number of possible options for property disposition of the Smithsonian Institution's Submillimeter Array in the event of eventual closure of the observatory. We are currently making cost estimates for we are currently costing all the options, starting with complete removal. We would appreciate guidance as to what other options might prove acceptable.

#### Antennas:

We have 8 antennas which will be dis-assembled one at a time and transported down to a holding area at sea level. The procedure will be the reverse of their construction and deployment.

#### Antenna Transporter Forklifts etc:

The transporter will be dis-assembled and transported down to a holding area at sea level. The forklifts and other heavy equipment will also be transported down to a holding area at sea level and would likely be

placed on the government surplus property list.

#### Antenna pads:

##### Complete removal:

The Antenna Pad removal will require excavation, demolition and transport of debris to a refuse site. There are 24 pads all of which have up to 20-30 tons of subsurface concrete. The removal all this material will cause a significant environmental impact and the need to bring new material to back fill and restore the pad area along with its access road.

##### Optional approach:

The Pads have an approximate above ground projection of about one foot, over a diameter of about nine feet. As an alternative to complete removal, we recommend demolishing the above ground projection to a subsurface level of 2 feet. Removing all the debris and filling and grading the pad area to the natural terrain.

#### Pad cable runs:

Each Pad location has an underground conduit and a subsurface power cable. The conduit is used for sensitive fiber optic cables and other electrical lines. The power cables are copper wire with protective shields for sub-surface burial. The conduit is buried 3-4 meters below grade and has several junction boxes to allow distribution to several locations. The junction boxes are above ground. The power cables have been buried in a simple trench system.

##### Complete removal:

Complete removal will require extracting the conduit and demolishing the junction boxes and back filling and grading to the natural terrain. This is true also for the power cables.

##### Alternative option:

Leave the subsurface conduit and power lines in place and remove only

the junction boxes. This option will have significantly less environmental impact on the summit.

Control building and high bay:

Complete Removal:

This would include removal of all contents, demolishing the structures, foundations and pavement.

Alternative Option:

A property transfer to a federal or state agency. The building contents could be discussed with the recipient and their proper transfer or disposal could be arranged. The high bay building is ideal for storing HP summit equipment (road grader, snow equipment and safety vehicle). The control building could be used as a Ranger station and emergency response area.

## **Appendix C. All Appropriate Inquires Documentation**

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# EPA Brownfields Grants, CERCLA Liability, and All Appropriate Inquiries



**To be eligible for an EPA brownfields grant** to address contamination at brownfields properties, eligible entities must demonstrate that they are not liable under CERCLA for the contamination at the site. Accordingly, eligible entities who may be considered “potentially responsible parties” under CERCLA must demonstrate they meet one of the liability protections or defenses set forth in CERCLA by establishing that they are (1) an innocent landowner, (2) a contiguous property owner, (3) a bona fide prospective purchaser, or (4) a government entity that acquired the property involuntarily through bankruptcy, tax delinquency, or abandonment, or by exercising its power of eminent domain.

To claim protection from liability as an innocent landowner, contiguous property owner, or bona fide prospective purchaser, property owners, including state and local governments, must conduct all appropriate inquiries prior to acquiring the property.

## What is CERCLA?

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as “Superfund,” was established to address abandoned hazardous waste sites. Among other things, CERCLA establishes a liability scheme for determining who can be held accountable for releases of hazardous substances. CERCLA also establishes the authority for EPA’s Brownfields Program and sets forth which entities and properties are eligible for brownfields grants.

## Can state and local governments be found liable for contamination at brownfields?

Yes. Under CERCLA, persons (including state and local governments) can be liable by virtue of property ownership, or by virtue of their actions with respect to a particular site. For sites from which there is a release or threatened release of hazardous substances, the categories of “potentially responsible parties” include any person or party who:

- Currently owns or operates the property, or owned or operated the property at the time of disposal of hazardous substances;
- Arranged for hazardous substances to be disposed of or transported to the site for disposal; or
- Transported hazardous substances to the site.

Applicants should note that CERCLA employs a “strict liability” scheme—that means it is without regard to fault. Accordingly, a person who owns a property from which there is a release of hazardous substances can be held liable just by virtue of ownership.

## If I am applying for a brownfields grant, do I have to worry about CERCLA liability?

Yes. Brownfields grantees are prohibited from using grant money to pay response costs at a brownfield site for which the grantee is potentially liable under CERCLA.

Therefore, all brownfields grantees who may be potentially liable at the site for which they are seeking funds must demonstrate that they are not liable for the contamination that will be addressed by the grant, subgrant, or loan. Applicants who own or operate the property for which they are seeking funding, or who may have owned or operated the property at the time of disposal of hazardous substances, must demonstrate they fall within one of the liability protections.

Cleanup grant applicants in particular should take note of this prohibition. Because cleanup grantees are required to own a site to receive brownfields funding—and because owners of contaminated property are liable under CERCLA—cleanup grant applicants **must** demonstrate they meet one of the liability protections described above. Some grant applicants who do not own the property for which they are seeking funding, or who are not seeking site-specific grant funds, may not fall within one of the categories of “potentially responsible parties,” and thus may not have to demonstrate they meet a liability protection.

Please contact your Regional Brownfields representative if you are not sure whether you will need to demonstrate a liability protection to be eligible for a grant.

## Who may be protected from liability under CERCLA?

The CERCLA statute provides protection from liability for certain parties, provided they comply with specific criteria outlined in the statute. Parties provided protection from CERCLA liability include:

- Innocent landowners (CERCLA §101(35)(A))
- Contiguous property owners (CERCLA §107(q))
- Bona fide prospective purchasers (CERCLA §§101(40) and 107(r))
- Units of state or local government that acquire ownership or control involuntarily through bankruptcy, tax delinquency, or abandonment (CERCLA §101(20)(D))

Government entities that acquire property by eminent domain (CERCLA §101(35)(A)(ii))

- Not be affiliated with any liable party through any familial relationship or any contractual, corporate or financial relationship (other than a relationship created by the instrument by which title to the property is conveyed or financed).

NOTE: Property acquisition includes properties acquired by gifts and zero price transactions.

## How can a state or local government demonstrate that it is not liable for contamination at a brownfield?

All state and local governments that may be potentially liable at a site for which they are applying for funding (including site-specific assessment grants, cleanup grants, or subgrants or loans from revolving loan funds), **must** demonstrate that they qualify for one of the CERCLA liability protections. All non-profit entities applying for brownfields cleanup grants also must make this demonstration.



Eastern Manufacturer Brewer, Maine, prior to cleanup (above) and after (right)



## What are the conditions for attaining liability protection under CERCLA?

To be eligible for liability protection under CERCLA as an innocent landowner, contiguous property owner or bona fide prospective purchaser, prospective property owners must:

- Conduct All Appropriate Inquiries in compliance with 40 CFR Part 312, prior to acquiring the property;
- Comply with all Continuing Obligations after acquiring the property. (CERCLA §§101(40)(C – G) and §§107(q)(A) (iii – viii)); and

To demonstrate that it qualifies as an innocent landowner, contiguous landowner, or bona fide prospective purchaser, the applicant must:

- Conduct All Appropriate Inquires prior to acquiring the property, **and**
- Comply with all Continuing Obligations after acquiring the property.

State and local governments that acquired a property involuntarily through bankruptcy, tax delinquency, or abandonment, or by exercising their power of eminent domain, do not have



to conduct all appropriate inquiries prior to acquiring the property, but must exercise “due care” after acquiring the property (CERCLA §101(35)(A) and §§107(b)(3)(a – b)). [Note: One threshold criteria for applicants seeking cleanup grant funding is that a Phase I must be conducted prior to application submission. Accordingly, although state and local governments that acquired property involuntarily are not required to conduct all appropriate inquiries for purposes of establishing a liability protection, they may have to conduct all appropriate inquiries anyway to be eligible for a cleanup grant.]

## What is “All Appropriate Inquiries”?

“All Appropriate Inquiries,” or AAI is the process of conducting due diligence or a Phase I Environmental Site Assessment to determine prior uses and ownership of a property and assess conditions at the property that may be indicative of releases or threatened releases of hazardous substances at, on, in, or to the property.

The standards and practices established as comprising “All Appropriate Inquiries” are set forth in regulations promulgated at 40 CFR Part 312.

EPA recognizes two ASTM International Standards as compliant with the AAI requirements: ASTM E1527-05 “Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process” and E2247-08 “Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland or Rural Property.”

## When must All Appropriate Inquiries be conducted?

- All Appropriate Inquiries must be conducted or updated within one year **prior to acquiring ownership of a property.**
- Certain aspects or provisions of All Appropriate Inquiries (i.e., interviews of current and past owners, the review

of government records, the on-site visual inspection, and searches for environmental cleanup liens) must be conducted or updated **within 180 days prior to acquiring ownership of a property.**

## Who can perform All Appropriate Inquiries?

The individual who supervises or oversees the conduct of the AAI investigation and signs the final report required in the AAI regulation must meet the definition of an “Environmental Professional” provided in the AAI Final Rule (40 CFR §312.10).

A person that does not qualify as an “Environmental Professional” as defined in 40 CFR §312.10, may assist in the conduct of the investigation if he or she is under the responsible charge of a person meeting the definition.

## What are “Continuing Obligations?”

After acquiring a property, to maintain the liability protections, landowners must comply with “continuing obligations” during their property ownership. The continuing obligations include:

1. Provide all legally required notices with respect to the discovery or release of a hazardous substance;
2. Exercise appropriate care with respect to the hazardous substances by taking reasonable steps to stop or prevent continuing or threatened future releases and exposures, and prevent or limit human and environmental exposure to previous releases;
3. Provide full cooperation, assistance, and access to persons authorized to conduct response actions or natural resource restoration;
4. Comply with land use restrictions and not impede the effectiveness of institutional controls; and
5. Comply with information requests and subpoenas.

## Where can I get additional information?

For general information, see the EPA Brownfields website at: [www.epa.gov/brownfields](http://www.epa.gov/brownfields)

For more information on the AAI requirements, see: <http://www.epa.gov/brownfields/regneg.htm>

For more information on continuing obligations, see:

<http://www.epa.gov/compliance/resources/policies/cleanup/superfund/common-elem-guide.pdf>

Contact Patricia Overmeyer at: [Overmeyer.patricia@epa.gov](mailto:Overmeyer.patricia@epa.gov)





# All Appropriate Inquiries Final Rule

## WHAT IS “ALL APPROPRIATE INQUIRIES”?

“All appropriate inquiries” is the process of evaluating a property’s environmental conditions and assessing potential liability for any contamination.

## WHY IS EPA ESTABLISHING STANDARDS FOR CONDUCTING ALL APPROPRIATE INQUIRIES?

The 2002 Brownfields Amendments to CERCLA require EPA to promulgate regulations establishing standards and practices for conducting all appropriate inquiries.

## STAKEHOLDER COLLABORATION

A Negotiated Rulemaking Committee consisting of 25 diverse stakeholders developed the proposed rule. Following publication of the proposed rule, EPA provided for a three month public comment period. EPA received over 400 comments from interested parties. Based upon a review and analysis of issues raised by commenters, EPA developed the final rule.

## WHEN IS THE RULE EFFECTIVE?

The final rule is effective on November 1, 2006—one year after being published in the Federal Register. Until November 1, 2006, both the standards and practices included in the final regulation and the current interim standards established by Congress for all appropriate inquiries (ASTM E1527-00) will satisfy the statutory requirements for the conduct of all appropriate inquiries.

## WHO IS AFFECTED?

The final All Appropriate Inquiries requirements are applicable to any party who may potentially claim protection from CERCLA liability as an innocent landowner, a bona fide prospective purchaser, or a contiguous property owner. Parties who receive grants under the EPA’s Brownfields Grant program to assess and characterize properties must comply with the All Appropriate Inquiries standards.

## WHEN MUST ALL APPROPRIATE INQUIRIES BE CONDUCTED?

All appropriate inquiries must be conducted or updated within one year prior to the date of acquisition of a property. If all appropriate inquiries are conducted more than 180 days prior to the acquisition date, certain aspects of the inquiries must be updated.

## WHAT SPECIFIC ACTIVITIES DOES THE RULE REQUIRE?

Many of the inquiry’s activities must be conducted by, or under the supervision or responsible charge of, an individual who qualifies as an environmental professional as defined in the final rule.

The inquiry of the environmental professional must include:

- interviews with past and present owners, operators and occupants;
- reviews of historical sources of information;
- reviews of federal, state, tribal and local government records;
- visual inspections of the facility and adjoining properties;
- commonly known or reasonably ascertainable information; and
- degree of obviousness of the presence or likely presence of contamination at the property and the ability to detect the contamination.

Additional inquiries that must be conducted by or for the prospective landowner or grantee include:

- searches for environmental cleanup liens;
- assessments of any specialized knowledge or experience of the prospective landowner (or grantee);
- an assessment of the relationship of the purchase price to the fair market value of the property, if the property was not contaminated; and
- commonly known or reasonably ascertainable information.

## HOW DOES THE FINAL AAI RULE DIFFER FROM THE INTERIM STANDARD?

The final All Appropriate Inquiries rule does not differ significantly from the ASTM E1527-00 standard. The rule includes all the main activities that previously were performed as part of environmental due diligence such as site reconnaissance, records review, interviews, and documentation of recognized environmental conditions. The final rule, however, enhances the inquiries by extending the scope of a few of the environmental due diligence activities. In addition, the final rule requires that significant data gaps or uncertainties be documented.

Under the final All Appropriate Inquiries rule, interviewing the subject property's current owner or occupants is mandatory. The ASTM E1527-00 standard only required that the environmental professional make a reasonable attempt to conduct such interviews. In addition, the final rule includes provisions for interviewing past owners and occupants of the subject property, if necessary to meet the objectives and performance factors. Under the ASTM E1527-00 standard, the environmental professional had to inquire about past uses of the subject property when interviewing the current property owner.

The final rule also requires an interview with an owner of a neighboring property if the subject property is abandoned. The ASTM E1527-00 standard included such interviews at the environmental professional's discretion.

The final rule does not specify who is responsible for performing record searches, including searches for use limitations and environmental cleanup liens. The ASTM E1527-00 standard specified that these record searches are the responsibility of the user and required that the results be reported to the environmental professional.

Unlike the ASTM E1527-00 standard, the final rule requires the examination of tribal and local government records and more extensive documentation of data gaps.

The final rule includes specific documentation requirements if the subject property cannot be visually inspected. The ASTM E1527-00 standard did not include such requirements.

## WHO QUALIFIES AS AN ENVIRONMENTAL PROFESSIONAL?

To ensure the quality of all appropriate inquiries, the final rule includes specific educational and experience requirements for an environmental professional.

The final rule defines an environmental professional as someone who possesses sufficient specific education, training, and experience necessary to exercise professional judgment to develop opinions and conclusions regarding conditions indicative of releases or threatened releases on, at, in, or to a property, sufficient to meet the objectives and performance factors of the rule, and has: (1) a state or tribal issued certification or license and three years of relevant full-time work experience; **or** (2) a Baccalaureate degree or higher in science or engineering and five years of relevant full-time work experience; **or** (3) ten years of relevant full-time work experience.

For more information on the environmental professional definition, please see EPA's Fact Sheet on the Definition of an Environmental Professional.

## WILL THERE BE AN UPDATED ASTM PHASE I SITE ASSESSMENT STANDARD?

Yes. ASTM International updated its E1527-00 standard, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process." EPA establishes that the revised ASTM E1527-05 standard is consistent with the requirements of the final rule for all appropriate inquiries and may be used to comply with the provisions of the rule.

## CONTACT INFORMATION

Patricia Overmeyer

U.S. EPA's Office of Brownfields Cleanup and Redevelopment

(202) 566-2774

Overmeyer.Patricia@epa.gov

Also, please see the U.S. EPA's web site at [www.epa.gov/brownfields](http://www.epa.gov/brownfields) for additional information.

## Appendix D. Factors for Limiting Development

Guidelines for limiting development of observatories on Mauna Kea are provided in the 1983 Complex Development Plan (CDP), by policy described in the 2000 Mauna Kea Science Reserve Master Plan, as limitations associated with cultural and natural resources, and as observatory siting criteria (Group 70 1983; Group 70 International 2000). The latter evaluates locations for observatories based on scientific feasibility of astronomy operations. These guidelines are essential for developing a long-term strategy for observatory siting as there are inherent constraints based on the combination of factors.

### Past Planning for Observatory Siting

In the 1983 CDP, the observatory planning process first considered the technical and physical / environmental criteria, then evaluated sites for potential impact on recreational resources, and finally evaluated the distance and cost to extend basic infrastructure (e.g. roads and power). As described in the 1983 CDP, siting of major telescopes requires years of testing in order to find a suitable site. The 1983 CDP contains an analysis that was conducted to identify general areas that might be suitable for future telescopes.

**Technical Criteria.** Technical criteria evaluated in the 1983 CDP formed the basis for future planning of observatory siting with respect to astronomical quality. Areas in the summit region were assessed for:

*Wind Direction.* Optical and infrared telescopes are sensitive to atmospheric turbulence and must be sited where laminar air flow is not disturbed by turbulence generated by cinder cones or other telescopes. Millimeter-wave telescopes should be sited where the natural topography provides a shield against the wind. Outcome from wind direction testing at the summit provided information about which types of telescopes should be considered for different areas.

*Obscuration.* Obscuration relates to the ability of telescopes to view the sky without being blocked by natural or man-made features – cinder cones and other telescopes in the summit region. Telescopes on Mauna Kea must be able to view all parts of the southern and northern sky down to 12 degrees above the horizon. If the horizon is obscured observing time could be lost or some objects might not be observed at all. Computer analysis identified sites with minimal obscuration by testing obscuring features against potential site locations.

**Physical and Environmental Criteria.** Physical and environmental criteria evaluated in the 1983 CDP formed the basis for the environmental impact analysis that accompanied the document. Potential telescope siting areas were assessed for:

*Geological and soil characteristics* in relation to foundation loads, potential for dust and erosion, and possible disturbance of underground water tables

*Slope,* to eliminate steep areas that would be difficult to construct on

*Botany and biology,* in order to minimize disturbance to endangered or rare species

*Presence of archaeological sites,* which may preclude siting in a specific location

*Visibility,* to determine from where on the Island of Hawai'i telescopes would be seen.

## 2000 Master Plan Guidance on Observatory Siting

The 2000 Master Plan updated the information in the 1983 CDP on designated telescope siting areas for existing observatories, proposed redeveloped facilities, and potential new facility sites based on current analyses and refined criteria. The location of cultural and natural (biological and geological) resources played a part in dividing the Science Reserve into two areas, the 10,760 acre Natural/Cultural Preservation Area, and the 525 acre Astronomy Precinct. The Astronomy Precinct is an area where development is to be consolidated to maintain a close grouping of astronomy facilities, roads and support infrastructure, while the Natural/Cultural Preservation Area was designated to protect natural and cultural resources (Group 70 International 2000).

The 2000 Master Plan limited new observatory development to the Astronomy Precinct, except on the undisturbed summit *pu'us*. Specific siting criteria in the 2000 Master Plan for locating facilities included:

1. Minimal impact on existing facilities, including maintaining a clear line of site to approximately 12 degrees above the horizon in a full circle.
2. Minimum impact of wēkiu bug habitat; only the existing disturbed locations on *pu'u* or areas outside of the wēkiu bug habitat will be considered as potential siting areas.
3. Avoidance of archaeological sites, including at least a 200 foot buffer from the clustered group of shrines found outside the Astronomy Precinct boundary on the northern slope.
4. Suitability for observations, including acceptable obscuration and wind flow conditions.
5. Minimum visual impact from significant cultural areas, including no interference with the visual connections between the major *pu'u* and the shrine complexes.
6. Avoid or minimize views from Waimea, Honoka'a and Hilo.
7. Close to roads and existing infrastructure, to minimize disturbance to the natural terrain.

The 2000 Master Plan summarized the five types of facility development projects for astronomy facilities and their proposed locations as outlined in IfA's Research Development Program (2000-2020).<sup>25</sup>

1. Type I. Redevelopment of Existing Observatory Sites on the Summit Ridge
2. Type II. Expansion of Existing Observatories
3. Type III. New Conventional Optical/IR Telescope
4. Type IV. Next Generation Large Telescope (NGLT)
5. Type V. Optical/IR Interferometer Array Site

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<sup>25</sup> The University is no longer pursuing options 3 and 5.

## Current Thinking on Observatory Siting

Current strategies for protecting cultural and natural resources emphasize recycling sites whenever possible in the siting of any new observatory facilities. As new information on resources becomes available, the criteria against which to evaluate a project may need to be expanded. In addition, detailed information on resources will provide guidance for site-specific siting, including information that can be used in environmental analyses. All future siting of observatories should be based on the best available information on resource inventories, with site-specific studies conducted as needed.

The Mauna Kea CMP emphasized the importance of considering potential impacts to the cultural landscape, which includes both landforms and the recognized cultural significance of the summit region, during any potential siting of new observatories in the summit region (see Mauna Kea CMP Section 5). In addition, archaeological fieldwork of the UH Management Areas has been completed, including the Astronomy Precinct, identifying specific sites and resources. A buffer of 200 feet from archaeological sites may be used as a setback guide. This is based on the 2000 Master Plan that states any new facility will be setback 200 feet from a cluster of a group of shrines located just outside the Astronomy Precinct boundary. However, preservation buffers for the protection of archaeological sites will be established on a case-by-case basis and would need to be approved by SHPD pursuant to HAR §13-300-38.

Baseline inventories for flora and fauna in the summit region are proposed in the NRMP. The reasoning behind this is that there is currently little known about the distribution of flora and fauna on the summit, or habitat requirements for most of the species found there. The purpose of conducting baseline inventories in areas of proposed development is to determine if the area contains sensitive resources such as protected species or unique geological resources, which need to be protected or mitigated for. However, without conducting baseline inventories in other portions of similar habitat on the mountain, it is difficult to know whether the proposed project area is more or less important or unique than surrounding areas. Thus, it is important to understand the distribution of natural resources over a larger area, rather than simply studying the area of proposed impact. Although some limited surveys have been conducted in the past (Smith et al. 1982; Char 1990, 1999), they were restricted in area covered and most were simple presence/absence records. Quality data on species distribution, abundance, densities, and microhabitats utilized will enable planners to determine which areas are high quality habitat and which are lower quality habitat for the summit flora and fauna. This will allow planners to fine tune the placement of new development to minimize habitat destruction or other potential impacts on the natural resources.

As stated in the 2000 Master Plan, all major undeveloped cinder cones and their intervening areas will be protected from future development by astronomical or other interests. These include the following *pu'u*: Ala, Hoaka, Kūkahau'ula, Līlīnoe, Māhoe, Mākanaka, Pōepoe, Poli'ahu, and Ula. In addition, UH has committed to no new development on undisturbed areas on Pu'u o Kūkahau'ula.<sup>26</sup> The most probable scenario for new development, other than recycling and expansion of existing facilities, is off the summit pu'u in the area within the Astronomy Precinct referred to as the northern plateau.

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<sup>26</sup> Pu'u o Kūkahau'ula is the traditional name of the summit cluster of cones on Mauna Kea (Maly and Maly 2005).

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