Cindy Freitas Amended Written Direct Testimony

I am a Native Hawaiian, descended of the native inhabitants of Hawai'i prior to 1778 and born and raised in Hawai'i my entire life.

I learned my cultural traditional customary religion practices though my families Lineage.

My grandmother and grandfather is the strongest mentor for me in my growing up and raised me in a traditional cultural way. We would go to the mountain and do prayers ("Pule") for many different things. Also I have witness things beyond my understanding till I got older and mostly my grandparents also made sure that we do not desecrate any thing on land, ocean or any were else to be respectful of your surroundings.

My grandparent would speak the manaleo style (Old Hawaiian language) which tried to teach the next generation but because of the influence of time we only learn a little of the language. She would take us to the mountain and learn to plant our food, raise our livestock and take care of the land so that the land would take care of the people in their culture practices.

We were thought in the Ahupua'a style (from the ocean to the mountain). While we work mostly in the middle of the Ahupua'a we would also go to the ocean and fish as well. My grandparents would always tell us to pule first before we fish and also give a ho'okupu (is a gift of abundance of mountain food that we bring) and leave it on a rock at the ocean shore line and ask for permission to fish and be safe. Then our catch would be a bounce so that we share with the people that live close to us. We also leave a fish on a rock when we get to the mountain for ho'okupu as well.

As I grew I never forgot my upbringing. Now with a family of my own I teach them also the cultural customary traditional religion practices as well and we as parents learn though our children.

I have enrolled my 2 girls as Kula Kaiapuni O Kona in the early 2000 and we grew with the school with all kinds of chants, pule and protocols. Today the school is name Ehunuikaimalino and located at Konawaena location. Though this school I have learn also so much cultural customary religion practices as well.

As for Mauna Kea and everywhere else in the world I have deep respect for the natural resources and the native plants and things that live within the earth. Today because of the fast development we as people need to keep our natural resources and help to save what is there.

Common Knowledge

I have visit Mauna Kea for years in the past as well as other places on the island for culture customary religion practices and continue to visit places on this island.

Around or about January 2015 till the present I have been visiting Mauna Kea more often to do culture customary religion practices as well as protecting the scared Mauna. It has been very emotionally for me to see what was happening up on Mauna Kea.

I have been witnessing a lot of mankind desecration and an overwhelming flow of

visitors that come to Mauna Kea. It saddens me to see that mankind has not taking care of the significant places on the island and especially Mauna Kea.

The machines that was park on the submit of Mauna Kea has been leaking oil (Exhibits S-14c;S-14d;S-14e;S-14f;S-14g;S-10;S-11;S-12;S-30a) also the holes in the ground that has cement (Exhibits S-7;S-8)on it has never been put back to its natural state. Also a complaint was filed via email to DLNR about the spill with no respond (Exhibit S-14b; S-15). It was reported to the news at Khon2. (Exhibit S-16).This has cause a substantial adverse impact to existing natural resources within the surrounding area and will be detrimental to the public health, safety, and welfare. (Exhibit S-30)

The Caltech Submillimeter Observatory ("CSO") has also leak 22.7 gallons of hydraulic fluid in 2009 and pass hydraulic leaks. (Exhibit B.o3al;S-3;S-30a;). It has cause substantial adverse impact to existing resources within the surrounding area and is a detrimental to the public health, safety, and welfare.(Exhibit S-30)

Professor of Zoology, Mr. William Alanson Bryan who has been appointed by the Board of Regents who discovered the traces of ancient glacial on the northeast and northern sides of the Mauna Kea Submit (Exhibit S-28;S-28a;S-6) Building the TMT on the northern side will cause a substantial adverse impact to the existing natural resources within the surrounding area and will be detrimental to the public health, safety, and welfare.

As the story was told by Kupuna that on the 13,000 feet level there is a burying ground, where ancient chiefs were laid to rest. (Exhibit S-28d;S-28e) All the Telescope on the Mauna kea has cause great pain to me to know that the chiefs are laid to rest and adding another telescope will be cumulative to the submit.(Exhibit S-30a;S-30)

I also did the Site Visit on September 26, 2016 with some of the petitioners as well as Hearing Officer, DOCARE officers, OMKM officers and council and others. The transportation was provided by Arnott's Hiking Adventures in a 15 passenger van and the driver to our van was Ikaika. (Exhibit S-29;S-29a;S-29b;S-30)

The Site visit was so fast all I saw was the beauty of the land and some of the helium balloon.

The Manitowoc 2250 Crane with 300 ton lifting capacity in combination with a 200 ton hydraulic assist crane which will have a substantial adverse impact to existing natural resources with in the surrounding area and will cause a detrimental to the public health, safety, and welfare.(Exhibit S-27 page 18; S-30;S-30a)

There spring water under Mauna kea which it records in the Basic Water Resources (Exhibit S-18b) Building the TMT on Mauna Kea will destroy the aquifer and cause a substantial adverse impact to the existing waters that flows down the mountain.

The Access Road will have to be modified to move the crane and the telescope which weight tons to get to the submit. The access road will have a 30,000 cubic yards of material remove only 3,000 will be fill back into the access road.(Exhibit S-31b;S-31c;S-30;S-30a)) Road designs should minimize slope cutting.

The Design of the TMT does not meet the 2000 Master Plan. Section X1 of the 2000 Master Plan provides design guidelines to direct development for both renovations of existing facilities and new construction and it addressed the facility siting, scale, height and width, color, surface texture and material, roofs, fences, roadways and parking. (Exhibit S-31)However Comprehensive Management Plan ("CMP") states as the CMP maintains consistency with the 2000 Master Plan, future updates to that plan should be consistent with the CMP.(Exhibit S-31a) All design guidelines in every document that is written in this preceding does not meet the 2000 Master Plan.(Exhibit S-31a) There for it does not meet the eight Criteria. (Exhibit S-30)

I have watch a fast pace of development and it is getting to the point that the developers and foreign investors are not of our island who don't understand the cultural part of our heritage and will pay big monies to destroy our natural resources and our culture customary religion practices in our own home lands which it is scared to the people of the land.

As a native Hawaiian I will stand strong for the land and our people and to teach the next generation to hold on to their cultural part of there heritage as well as the natural resources of the land.

CULTURAL SIGNIFICANCE OF MAUNA KEA

Sacredness of Mauna Kea

'O Mauna Kea ko kākou kuahiwi la'a (Mauna Kea our sacred mountain) expresses the feelings that modern day Hawaiians and non-Hawaiians alike have for this wahi pana, or legendary place. As with other cultures throughout the world, early Polynesians believed their highest points of land were the most sacred.

Of the four major islands in the Hawaiian group, tradition tells us that the highest and most sacred places were Mauna Wai'ale'ale on Kaua'i; Mauna Ka'ala on O'ahu; Mauna Haleakalā on Maui; and Mauna Kea on Hawai'i. Mauna Kea, being the highest point throughout Pacific Polynesia, has been considered by many Hawaiian practitioners to be the most sacred of all. Standing tall over the island of Hawai'i, Mauna Kea was host to early Hawaiian traditions that included, among other things, religious practices, study of the heavens, and tool making in the Keanakāko'i Adze Quarry.

The Highest Portal to the Hawaiian Universe

Mauna Kea is the mountain altar of Wākea, also known as the celestial father. Wākea is the sire of the indigenous Hawaiian race. The tallest mountain in the world, Mauna Kea is the highest portal to the Hawaiian Universe, and is therefore the pillar of native consciousness. Additionally, Mauna Kea is a Ko'a, the magnet through which all life flows. Like the fishing ko'a (traditional fishing grounds), ko'a Mauna (mountain ko'a) are shrines that are fed and maintained over many generations to ensure that the links to all life are not threatened.

A Sacred Spiritual Burial Ground

Many traditional Hawaiian eulogies speak to the "ho'i i Ka-houpo-o-kāne," or returning into the heart of Kāne. Mauna Kea contains burials of the most sacred chiefs, known as the descendants of Wākea and Papahānaumoku - who gave birth to the islands. It is believed that Mauna Kea is where some of the spirits of the deceased returned. Specifically, Kahoupookāne, a female spring and rivulet, is the spirit entrance into the mountain's energy. Mauna Kea is known as the piko (umbilical connection to the Universe) of Hawai'i. Even today, many families continue to bury the umbilical cords of their children on the mountain as a way of certifying indigenous birth. Family shrines are also established on the mountain to serve as a portal for direct spiritual communication with Wākea.

The Source of Life

Mauna Kea makes up a large part of the island's aquifer; it is believed that Poli'ahu (snow), Lilinoe (mist) and Waiau (ice) are the female waters in perpetual intercourse with Wākea for the furtherance of all life.

Archeological Sites Found on Mauna Kea

There are hundreds of archaeological sites (e.g., traditional cultural properties, shrines, burials and culturally significant landscape features) within the summit area of Mauna Kea. The State of Hawaii Historic Preservation Division has designated three areas as traditional cultural properties (TCPs): the summit (Kūkahau'ula) and Pu'u Lilinoe in the MKSR and Lake Waiau in the Mauna Kea Ice Age Natural Area Reserve. A large area on the summit of Mauna Kea has been determined to be eligible for listing on the National Register of Historic Places as a historic district.

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BOARD OF LAND AND NATURAL RESOURCES

FOR THE STATE OF HAWAI'I

IN THE MATTER OF	Case No. BLNR-CC-16-002
A Contested Case Hearing Re Conservation; Use Application (CDUA) HA-3568 For the Thirty Meter Telescope at the Mauna Kea Science Reserve, Ka'ohe Mauka, Hamakua, Hawai'i TMK(3)4-4-015:009	**SITE VISIT PROPOSAL** Certificate of Service

SITE VISIT PROPOSAL

I. Introduction

I Cindy Freitas, in the subject matter on the site visit to Mauna A Wakea which is scheduled for September 26, 2016.

I have deep respect for Mauna A Wakea and as well for my ancestors before me for thousands of generation. We are the living Native Hawaiian, descended of the native inhabitants of Hawai'i.

In all due respect I can only disclosed that what moves my na'au to inform you that the site of the proposed area is many generational of our culture customary traditional religious practices.

Proposal site visit at the 8.7 acre area were TMT will be built.

II. Request

I Cindy Freitas humbly ask for a request for site visit as followed:

Received
Office of Conservation and Coastal Lands
2016 Aug 17 3:55 pm
Depatement of Land and Natural Resources
State of Hawaii

1. Indications for the four corners of the 8.7 acres boundary's. (Red helium balloon to indicate boundaries).

2. Indications/or out line for a 5,000 gallon underground tank to store hazardous chemicals and the location and a visual debt (red helium balloon indicating the debt.)[1]

3. Indication of were will dynamite would be use on 8.7 acres if any.

4. Indication/or out line that can hold 1,728,000.00 cubic feet of ground material and using a red helium balloon for height that will be coming out of the earth to build this TMT.

III. Conclusion

I Cindy Freitas will be joining all parties on Site Visit proposal under my reserve right for my culture customary traditional religion practices.

Kailua Kona HI, August 17, 2016

Cindy Freitas Petitioner

Cc: Parties of Record (Certificate of Service)

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1. Coming from a background of License Masonry Contractors we know underground is a unforeseen sight of many recourses and rare endanger species as well as the aquifer. Therefore no one can predict what's under the ground until the contractors break ground.

BOARD OF LAND AND NATURAL RESOURCES

FOR THE STATE OF HAWAI'I

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CERTIFICATE OF SERVICE

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Date: 8/17/16

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BOARD OF LAND AND NATURAL RESOURCES

FOR THE STATE OF HAWAI'I

IN THE MATTER OF	Case No. BLNR-CC-16-002
A Contested Case Hearing Re Conservation Use Application (CDUA) HA-3568 For the Thirty Meter Telescope at the Mauna Kea Science Reserve, Ka'ohe Mauka, Hamakua, Hawai'i TMK(3)4-4-015:009	**MOTION TO AMEND DOC 274 SITE VISIT TO INCLUDE REQUEST IN DOC 220**
	Certificate of Service

MOTION TO AMEND DOC 274 SITE VISIT TO INCLUDE REQUEST IN DOC 220

I Cindy Freitas, "Petitioner", hereby Motion to Amend DOC 274 Site Visit to Include Request in DOC 220; these request are very pertinent to the contested case hearing.

1. Indication for the four corners of the 8.7 acres boundary's (Red helium balloon to Indicate boundaries.)

2. Indications/or out-line for a 5,000 gallon underground tank to store hazardous Chemicals and the location and a visual debt (red helium balloon indicating the Debt) [1]

3. Indication of where will dynamite would be use on 8.7 acres if any.

4. Indication/or out line that can hold 1,728,000.00 cubic feet of ground material and Using a red helium balloon for height that will be coming out of the earth to build This proposed TMT.

5. Private vehicle will be used to undo hardship and I will be riding with William Freitas and his Driver Walter Wong.

Kailua Kona HI. September 21, 2016

Cindy Freitas Petitioner

Cc: Parties of Records Certificate of Service

1. Coming from a background of License Masonry Contractors we know underground is a unforeseen sight of many recourses and rare endanger species as well as the aquifer. Therefore no one can predict what's under the ground until the contractors break ground.

BOARD OF LAND AND NATURAL RESOURCES

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BOARD OF LAND AND NATURAL RESOURCES

FOR THE STATE OF HAWAI'I

IN THE MATTER OF A Contested Case Hearing Re Conservation; Use Application (CDUA) HA-3568 For the Thirty Meter Telescope at the Mauna Kea Science Reserve, Ka'ohe Mauka, Hamakua, Hawai'i TMK(3)4-4-015:009	Case No. BLNR-CC-16-002 **OBJECTION TO SEPTEMBER 26, 2016 SITE VISIT ON MAUNA KEA; CERTIFICATE OF SERVICE**

OBJECTION TO
SEPTEMBER 26, 2016 SITE VISIT ON MAUNA KEA

On September 19, 2016 Minute Order No. 18 [DOC 274] was filed. The filing stated the following documents of the Site Visit Proposal was filed and granted [DOC 214, 215, 216, 217, 218, 219, 220, 255, and 260] and approved the following person in the DOC 274 for site visit and a requested to arrange for the illustration using a red helium balloon attached to a rope approximately 187 feet long was confirmed in DOC 274. But yet other parties have requested to illustrate other red helium balloon in other areas of the proposed TMT site. Neither there were no other illustrate red helium balloon that was requested by other parties nor were there any clarification in any way or form on any minute order. This red helium balloon would have illustrated the impact were the location of the TMT proposed telescope would be and also the 5,000 tanks that will be stored underground as well as the amount of material that will be unearth.

Therefore Minute order no. 18 violates the Due Process Rights of Cindy Freitas, "Petitioner" and other parties that submitted their proposal to Site Visit.

Site Visit on Mauna Kea was completely inadequate. I have requested in DOC 220 Site Visit proposal and in DOC 278 Motion to Amend DOC 274 to include request in DOC 220. Request as followed:

1. Indication for the four corners of the 8.7 acres boundary's (Red helium balloon to Indicate boundaries.)

2. Indications/or out line for a 5,000 gallon underground tank to store hazardous Chemicals and the location and a visual debt (red helium balloon indicating The debt.)

3. Indication of where will dynamite would be use on 8.7 acres if any.

4. Indication/or out line that can hold 1,728,000.00 cubic feet of ground material and Using a red helium balloon for height that will be coming out of the earth to build This proposed TMT.

The Site Visit on September 26, 2016 at 10:30 a.m. was done in a "fast track" order. I sat in the van and cried while we pass the AHU SITE (a place of worship) and I was told by the driver he was instructed that no one can come out of the van nor I could view the rope that holds the helium balloon, it did not seem to be a 187 feet it seems to be much shorter.

The Driver drove the van to the TMT proposed location and then to the summit loop road near the Keck Observatory and to the Batch plant were we could go out and use the bathroom and back into the van and back down to Hale Pohaku. It only lasted less than 2 hours.

Petitioner could not follow my own protocol in my culture and traditional and religion

practices. Therefore the right of my culture and traditional and religion practices as a practitioner is violated. The Scared Mountain of Mauna Kea is not to "fast track" it there is proper protocols that need to be address. The Hearing Officer had the opportunity first hand to observed in the spiritual and tradition function of the important of this significant impact of this TMT but yet did not give the Petitioner the opportunity to see the significant impact that will cause a substantial injustice and also the emotional and psychological of our culture and traditional and religion practices as a Native Hawaiian, descended of the native inhabitants of Hawai'i prior to 1778.

Therefore the right of my culture and traditional and religion practices as a practitioner is violated. The Scared Mountain of Mauna Kea is not to "fast track" it there is proper protocols that needs to be address and that the Hearing Officer had the opportunity.

My request in the DOC 220 and DOC 278 was not address therefore the contested case hearing has violated my Due Process Right and the right of my culture and traditional religion practices therefore this objection to the site visit on September 26, 2016 has shown good cause to be granted.

Kailua Kona HI. 9/27/16

TDC

Cindy Freitas Petitioner

Cc: All Parties on the Certificate of Service

BOARD OF LAND AND NATURAL RESOURCES

FOR THE STATE OF HAWAI'I

IN THE MATTER OF A Contested Case Hearing Re Conservation; Use Application (CDUA) HA-3568 For the Thirty Meter Telescope at the Mauna Kea Science Reserve, Ka'ohe Mauka, Hamakua, Hawai'i TMK(3)4-4-015:009	) Case No. BLNR-CC-16-002)))))) Certificate of Service))	

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Witness List

Signature: TDC

Name (Print): Cindy Freitas

Date: 7/27/14

(c) In evaluating the merits of a proposed land use, the department or board shall apply the following criteria:

(1) The proposed land use is consistent with the purpose of the conservation district;

(2) The proposed land use is consistent with the objectives of the subzone of the land on which the use will occur;

(3) The proposed land use complies with provisions and guidelines contained in chapter 205A, HRS, entitled "Coastal Zone Management", where applicable;

(4) The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community, or region;

(5) The proposed land use, including buildings, structures, and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels;

(6) The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable;

(7) Subdivision of land will not be utilized to increase the intensity of land uses in the conservation district; and

(8) The proposed land use will not be materially detrimental to the public health, safety, and welfare.

The applicant shall have the burden of demonstrating that a proposed land use is consistent with the above criteria. [Eff 12/12/94; am and comp] (Auth: HRS §183C-3) (Imp: HRS §§183C-3, 183C-6)]

Note: For regulation of activities in:
State Parks; see Chapter 13-146.
Forest Reserves; see Chapter 13-104.

§711-1107 Desecration. (1) A person commits the offense of desecration if the person intentionally desecrates:

(a) Any public monument or structure;

(b) A place of worship or burial; or

(c) In a public place the national flag or any other object of veneration by a substantial segment of the public.

(2) "Desecrate" means defacing, damaging, polluting, or otherwise physically mistreating in a way that the defendant knows will outrage the sensibilities of persons likely to observe or discover the defendant's action.

(3) Any person convicted of committing the offense of desecration shall be sentenced to a term of imprisonment of not more than one year, a fine of not more than $10,000, or both. [L 1972, c 9, pt of §1; gen ch 1993; am L 2002, c 198, §1]

operating definition considers construction activities – including excavation or the construction of new buildings – to be "major projects," while considering "minor projects" to be small structures such as a weather tower on a previously modified surface, or an emergency staircase. The 2000 Master Plan established separate review processes for minor and major projects. Minor project review ends with the University President, while major projects require formal approval by the Board of Regents. OMKM functions as a liaison to ensure consistency in the project review process.

As the local management body for the UH Management Areas, OMKM will assess proposed land uses to ensure compatibility with recommendations in approved management plans, with the goal of protecting cultural and natural resources. During the review process, OMKM will have to work with other entities, including DLNR.

There is also a need, during the project design review process, for OMKM to provide clear facility planning guidelines to project proposers that address siting and design considerations, and to enforce them, so that proposed facilities result in minimal impacts to cultural and natural resources and the astronomical qualities of the Science Reserve. Many of these considerations have been developed in the 2000 Master Plan, although there are additional management needs set forth in this CMP. Adequate bonding may be required for to ensure site restoration.

There are two aspects of facility planning location and design that need to be considered in order to protect cultural and natural resources. Location refers to the siting of facilities, while design refers to characteristics of the physical structure, and both of these must be directed at minimizing impacts to resources. Section XI of the 2000 Master Plan provides design guidelines to direct development for both renovations of existing facilities and new construction in a manner that would integrate development into the summit environment. Topics addressed include: facility siting, scale, height and width, color, surface texture and material, roofs, fences, roadways and parking.

The 2000 Master Plan divided the UH Management Areas into two areas, the Natural/Cultural Preservation Area, which encompasses 10,760 acres, and the Astronomy Precinct, which is 525 acres. New observatory development will be allowed only in the Astronomy Precinct, except on the undisturbed summit *pu'us*. Section XI of the 2000 Master Plan contains design guidelines for facilities that reflect the sensitivity of Mauna Kea's cultural and natural resources (Group 70 International 2000). These guidelines should be used in association with this CMP. As new information becomes available, the criteria against which to evaluate a project may need to be expanded. Specific siting criteria for locating facilities within the Astronomy Precinct include:

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 Precinct boundary on the northern slope.[31]
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.

[31] This setback distance is 10 times the setback distance required by the Hawai'i Island Burial Council for development near existing burials. The buffer zone could be larger, depending on the design plans.

shall approve a comprehensive management plan that considers multiple uses as a precondition for any future development on Mauna Kea (see Section 3.2).[1] This CMP is being prepared in accordance with Judge Hara's decision.

2.1.3 Approval of the Comprehensive Management Plan

This CMP will be submitted to the BLNR for approval. Once approved, the CMP will be the controlling management plan for the UH Management Areas; it will supersede and replace the 1995 Management Plan (see Section 2.1.2 and Section 3.2). The CMP will be the "approved management plan" for any future land use. Accordingly, all activities and uses within the UH Management Areas will be consistent with the management actions described in the CMP. This will provide consistency and long-term viability of the management objectives.

The CMP will not replace the 2000 Master Plan, which continues to serve as the University's development planning framework for the responsible stewardship and use of the UH Management Areas. As the CMP maintains consistency with the 2000 Master Plan, future updates to that plan should be consistent with the CMP. In addition, the proposed CMP provides a process through which it can be regularly updated as part of an adaptive management strategy. That process will allow the BLNR and the University to evaluate and modify management approaches over time based on new information (see 7.4.2) that may become available.

2.1.4 Issues and Concerns Beyond the Scope of the CMP

Through the extensive community outreach that took place during the preparation of this CMP (see Section 4), it became clear that the community had a number of issues and concerns related to past and future activities on Mauna Kea and specifically within the UH Management Areas that were beyond the scope of this CMP. These issues and concerns are listed below and policy makers are urged to consider them in their broader decision making related to Mauna Kea.

- Termination of the State Lease between the University and the BLNR
- Use of ceded lands for $1 a year or nominal consideration
- Subleases between the University and the observatories
- Extension of the State lease beyond 2033
- Proposed new development on Mauna Kea, including the Thirty Meter Telescope (TMT) and Pan Starrs
- Community benefit package with increased educational benefits
- Guaranteed employment opportunities for Native Hawaiians and the people on the Island of Hawai'i

2.2 Management Approach

The establishment and evolution of the UH Management Areas, support facilities, and related management entities recognizes the unique values, global significance, cultural sensitivity and ecological vulnerability of the summit region of Mauna Kea. OMKM is the local management authority for UH Management Areas (see Section 3.1.1). OMKM's mission, as an organization, is:

[1] *Mauna Kea Anaina Hou, et al v. Board of Land and Natural Resources*, Civ. No. 04-1-397, Decision and Order dated January 19, 2007 (Hara 2007).

Appendix B. Construction Plan

This Construction Plan covers the three Project components to be built within the Conservation District: (1) the Access Way, (2) the TMT Observatory, and (3) utility extensions and upgrades. It outlines the anticipated construction schedule and the methods to be employed to complete the work are also described.

The contractor(s) selected to build the TMT Observatory and Access Way will be required, in its contract documents, to comply with the mitigation measures outlined in the Final EIS. This will entail complying with (and in some cases preparing) the following:

- Reporting Plan. A Reporting Plan will be developed by TMT and their contactor and implemented in coordination with OMKM to provide information from construction activities to OMKM. This plan and its implementation will comply with CMP Management Action C-4.
- Project-specific Safety and Accident Prevention Plan. TMT's contractor will prepare this plan.
- Cultural and Archaeological Monitoring Plan. A draft of this plan is provided as a component of the Draft Historic Preservation Mitigation Plan (Appendix A of the TMT Project Management Plan). This plan will be refined as the design and schedule for TMT construction is finalized; the plan will then be submitted to SHPD for review and approval. The plan requires an independent construction monitor who will have oversight and authority to insure that all aspects of ground based work comply with protocols and permit requirements. This plan and its implementation will comply with CMP Management Actions C-1, C-5, and C-6 plus HAR section 13-279.
- Cultural and Natural Resources Training Program. This program will be developed by OMKM in coordination with TMT and other stakeholders. Construction workers will be required to receive annual cultural and natural resources training in compliance with CMP Management Actions C-7 and C-8.
- Invasive Species Prevention and Control Program. This program is described in Section 1.6 below and will be further refined by TMT and their selected contractor in coordination with OMKM. This plan will comply with CMP Management Action C-9.
- Waste Minimization Plan. TMT's contractor will prepare this plan as it relates to the construction phase of the Project.
- Ride-Sharing Program. TMT's contractor will prepare the construction phase part of this plan based on the framework provided in Section 3.15.2 of the Final EIS.
- Fire Prevention and Response Plan. TMT's contractor will prepare this plan based on the framework provided in Section 3.15.2 of the Final EIS, if applicable.
- Rock Movement Plan. TMT and their contractor will prepare this plan in coordination with OMKM based on the framework provided in Section 1.2.1 below. This plan will comply with CMP Management Action C-3.

- National Pollutant Discharge Elimination System (NPDES) permit. The Project will obtain a Notice of General Permit Coverage (NGPC) for general construction activities. The contractor will prepare a Site-Specific Best Management Practice (BMP) plan and submit it to the State of Hawai'i Department of Health (HDOH) for review prior to construction. The BMP plan will include a Materials Storage/Waste Management Plan and Spill Prevention and Response Plan; the plan will include measures outlined in Sections 3.15.1 and 3.15.2 of the Final EIS, including measures related to Erosion and Water Quality, Solid and Hazardous Materials and Waste, Air Quality and Lighting, and Additional Disturbance and Encroachment. This permit and component plans will comply with CMP Management Action C-2.
- Noise permit and noise variance. TMT's contractor will obtain and comply with both a noise permit and a noise variance, as applicable.
- Oversize and Overweight Vehicles Permit (OOVP). TMT's contractor will obtain and comply with an OOVP, as applicable.

1.1 Schedule

The conceptual Project construction schedule is presented in Table B-1. Project construction could begin as early as 2011 and take approximately seven years to complete.

Table B-1: Anticipated Construction Timeline

Phase	Start	End
Grading and foundation	2011	2013
Access Way	2011	2012
TMT Observatory 13N Site grading	2011	2012
TMT Observatory foundation	2012	2013
Electrical upgrades	2012	2012
Observatory construction	2012	2017
Dome assembly (exterior cranes active)	2013	2015
Internal telescope assembly	2015	2017
Support building construction (including foundation)	2015	2017
Observatory finish	2015	2017
Batch Plant Staging Area restoration/naturalization	2017	2017
Telescope/instrument testing	2017	2018

Source: TMT Observatory Corporation, July 17, 2010.

Drawings illustrating the construction phasing are provided in Attachment A.

Construction activities will take place 12-15 hours a day, seven days a week; however, work times will vary depending on activities and some special operations or construction phases will require longer work hours. Winter weather conditions at the TMT Observatory site will interrupt construction at times, until the dome is completed.

1.2 Grading, Underground Utilities, and Foundation

This section discusses ground level and underground construction activities. The grading of the Access Way and TMT Observatory will take place first, followed by TMT Observatory

foundation work. Plans, which illustrate proposed changes in contours, are included in Attachment B.

1.2.1 Rock Movement Plan

Project construction will require the excavation of rock from the TMT Observatory site and along the Access Way. Along the Access Way, the need to excavate rock is primarily governed by the need to generate a smoothly sloping road and the need to bury utilities within the Access Way. At the TMT Observatory site, excavation is necessary to prepare a level work surface plus place a foundation for the telescope and the observatory dome. TMT and their contractor will prepare a Rock Movement Plan prior to construction in compliance with CMP Management Action C-3 and submit it to the Office of Mauna Kea Management (OMKM) for review and approval. The Rock Movement Plan will detail excavation and grading activities.

Preliminary engineering plans indicate that the total volume of excavated material ("cut" material) will be 64,000 cubic yards. These preliminary engineering plans, which illustrate proposed changes in contours, are included in Attachment B. The estimated cut and fill volumes are based on geotechnical assumptions concerning the subsurface in the area and could change following the completion of geotechnical borings. As summarized in Table B-2, roughly 32,000 cubic yards of the cut material will be reused at the TMT Observatory site or Access Way. An estimated 32,000 cubic yards of material will be excess cut and will be used to provide some restoration of the Batch Plant Staging Area and a portion of which will be stored at a location designated by OMKM for use as determined by OMKM. By using most of the material on the TMT Observatory site and Access Way, that material will be available for later use to restore the TMT Observatory site and the portion of the Access Way exclusively used by TMT during decommissioning.

Table B-2: Estimated Cut and Fill Volumes

Site	Cut (cubic yards)	Fill (cubic yards)
TMT Observatory 13N site	34,000	29,000
Access Way	30,000	3,000
Batch Plant Staging Area	None	30,000
Saved for OMKM Use	NA	2,000

Source: TMT Observatory Corporation, July 17, 2010.

No soil or cinder that originates off the mountain used as fill within the Conservation District. Some courser material from on-island quarries will be transported to the TMT Observatory site and used under concrete foundation slabs as "base course". Aggregate from on-island quarries will also be used to make the foundation concrete.

1.2.2 Batch Plant

TMT will re-establish a temporary concrete batch plant at the previously utilized "Batch Plant Staging Area". Prior to utilizing the Batch Plan Staging Area, the site will be cleared of invasive species to the extent practicable, if any are observed by a biologist inspecting the area prior to use. Best management practices (BMPs) will also be installed to (a) limit the potential for the later establishment of invasive species; (b) limit the production of dust and mud; (c) limit and

control stormwater run-on, runoff, and quality; and (d) prevent disturbance of undisturbed areas beyond the previously disturbed batch plant area.

The batch plant will be required to produce roughly 5,900 cubic yards of concrete for the TMT Observatory foundations. As discussed above, this volume is an estimate based on geotechnical assumptions concerning the subsurface in the area and could change following the completion of geotechnical borings.

No mass grading of the Batch Plant Staging Area is planned prior to use of the site as a batch plant other than the storage of excess material from the TMT Observatory site and Access Way within the area. The stored material will be placed such that the entire Batch Plant Staging Area can be utilized (i.e., it will be graded and compacted after placement so that it can be driven over rather than left in a pile). The Project will utilize the area using a layout similar to that used by previous projects that utilized the area as a batch plant. During the Project's use of the Batch Plant Staging Area there will be temporary stockpiles of soil and rock, a concrete batch plant, and construction materials staged within the area.

Once the Project's use of the Batch Plant Staging Area is complete, the stored excess material will be regraded. The excess material will be utilized to restore/naturalize the Batch Plant Staging Area to the degree practicable. A portion or all of the excess material will be spread over a portion of the Batch Plant Staging Area in such a way as to create a rough, more natural surface that could not be driven over. Some of the excess material may be left in a stockpile within the Batch Plant Staging Area depending on OMKM's desires. This restoration of the Batch Plant Staging Area would reduce the size of the Batch Plant Staging Area that could be used for parking and other uses following the construction of the TMT Observatory; however, the restored area could be temporarily reclaimed as a staging area by future projects, if needed.

1.2.3 Access Way

The Access Way has two distinct sections (1) the southernmost portion where the Access Way will follow existing roads on cinder, and (2) the rest of the Access Way where it will primarily follow existing roads on lava flows. These two sections are discussed below.

Southernmost Cinder Section

Generally, grading along the Access Way will be performed to achieve a smooth and level travel surface. In the cinder section, the existing 4-wheel drive road (the "jeep trail") travel surface has degraded over the years and no longer provides a level travel surface. Where the Access Way occurs on the cinder lower slope of Pu'u Hau'oki, the Access Way features will be as illustrated in Figure B-1 – a 12 foot wide paved travel way (1 lane), a four foot paved shoulder with drainage channel and guardrail, and slope graded to 2.5:1.

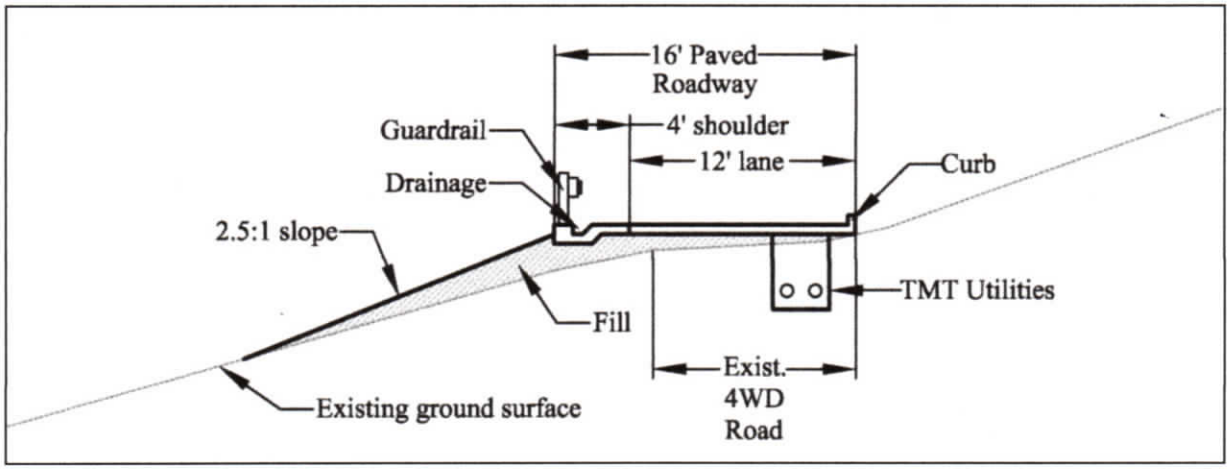

Figure B-1: Cross Section of Access Way in Southernmost Cinder Section Overlapping 4-Wheel Drive Road

Lava Flow Section

Generally, grading along the Access Way will be performed to achieve a smooth travel surface. In the lava flow section the Access Way will follow an existing SMA road and the 4-wheel drive road through Area E. Although the SMA road already provides a smooth travel surface, grading will be done to raise the grade of the travel surface in order to protect the SMA utilities under the roadway, as illustrated in Figure B-2. During early construction activities when sufficient material has not been cut to install the 18-inch cushion over the SMA utilities as shown in the figure, steel plates will be used to cover and protect the SMA utilities until sufficient material is available.

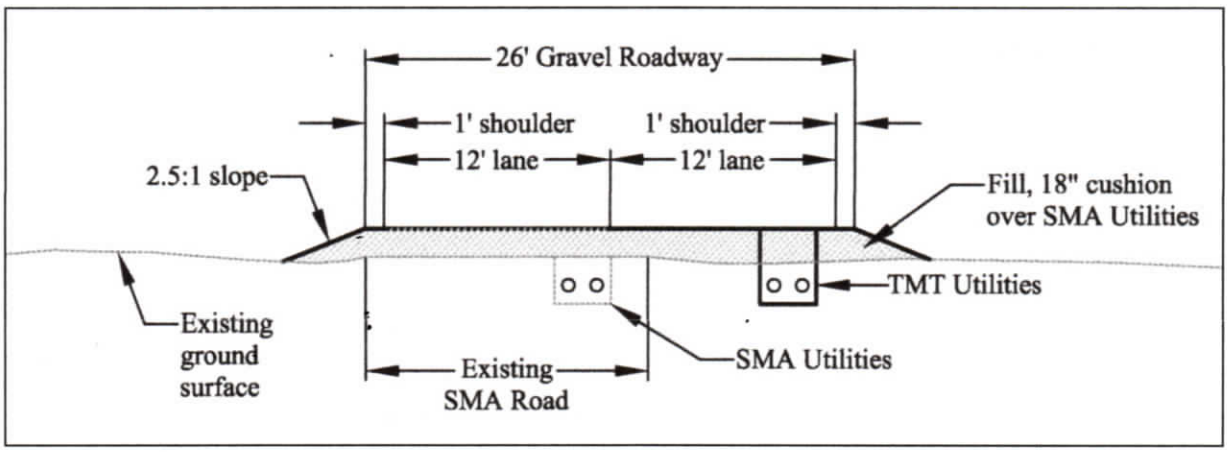

Figure B-2: General Cross Section of Access Way in Lava Flow Section Overlapping SMA Road

In addition to the steps discussed above to protect the SMA utilities where the SMA utilities and TMT utilities run parallel to each other, additional measures will be taken where they cross. They will cross at two points – (1) where the SMA road branches to a SMA pad on the east side

of the SMA Area near where the Access Way comes off the cinder cone, and (2) where the SMA road and the 4-wheel drive road split. At those locations additional measures will be taken to protect the SMA utilities, including the use of steel plates and additional cushion so that the TMT utilities can cross over the SMA utilities but still provide the necessary cover over the TMT utilities.

The 4-wheel drive road portion in the cinder cone section will have to be graded to a greater extent because it is not straight and the slope changes dramatically. Throughout the lava flow section, the Access Way features will be as illustrated in Figure B-3 – a 24 foot wide gravel travel way (two lanes), one foot shoulders, and slopes graded to 2.5:1. The slopes beyond the shoulder of the Access Way will vary depending on the topography and steeper embankment slopes may be used depending on geotechnical conditions encountered.

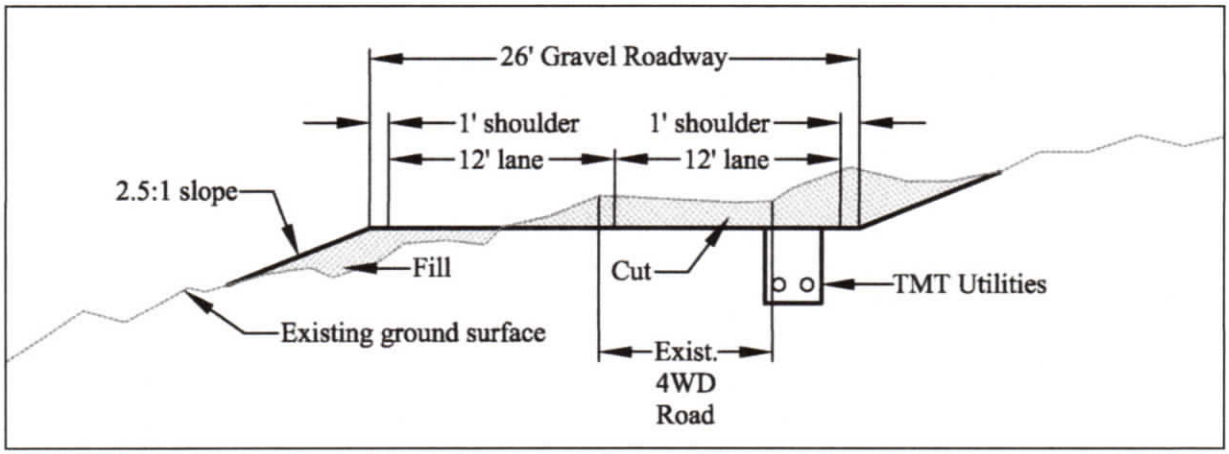

Figure B-3: General Cross Section of Access Way in Lava Flow Section Overlapping 4-Wheel Drive Road

Utilities

A trench for electrical and communications lines will be excavated along the Access Way on one side of the road as illustrated in Figure B-1, Figure B-2, and Figure B-3. The conduits will be encased in concrete per governing code requirements. Excavated material will be used to raise the Access Way road surface where required to improve grades on the road and to provide a smooth and level driving surface where a rough surface from excavation will otherwise be exposed.

1.2.4 TMT Observatory

The limits of grading activities (the area that will be affected by the cut and fill), the existing contours, and proposed contours at the TMT Observatory 13N site are shown in Figure B-4. Grading and foundation details are illustrated on preliminary plans included in Attachment A and B.

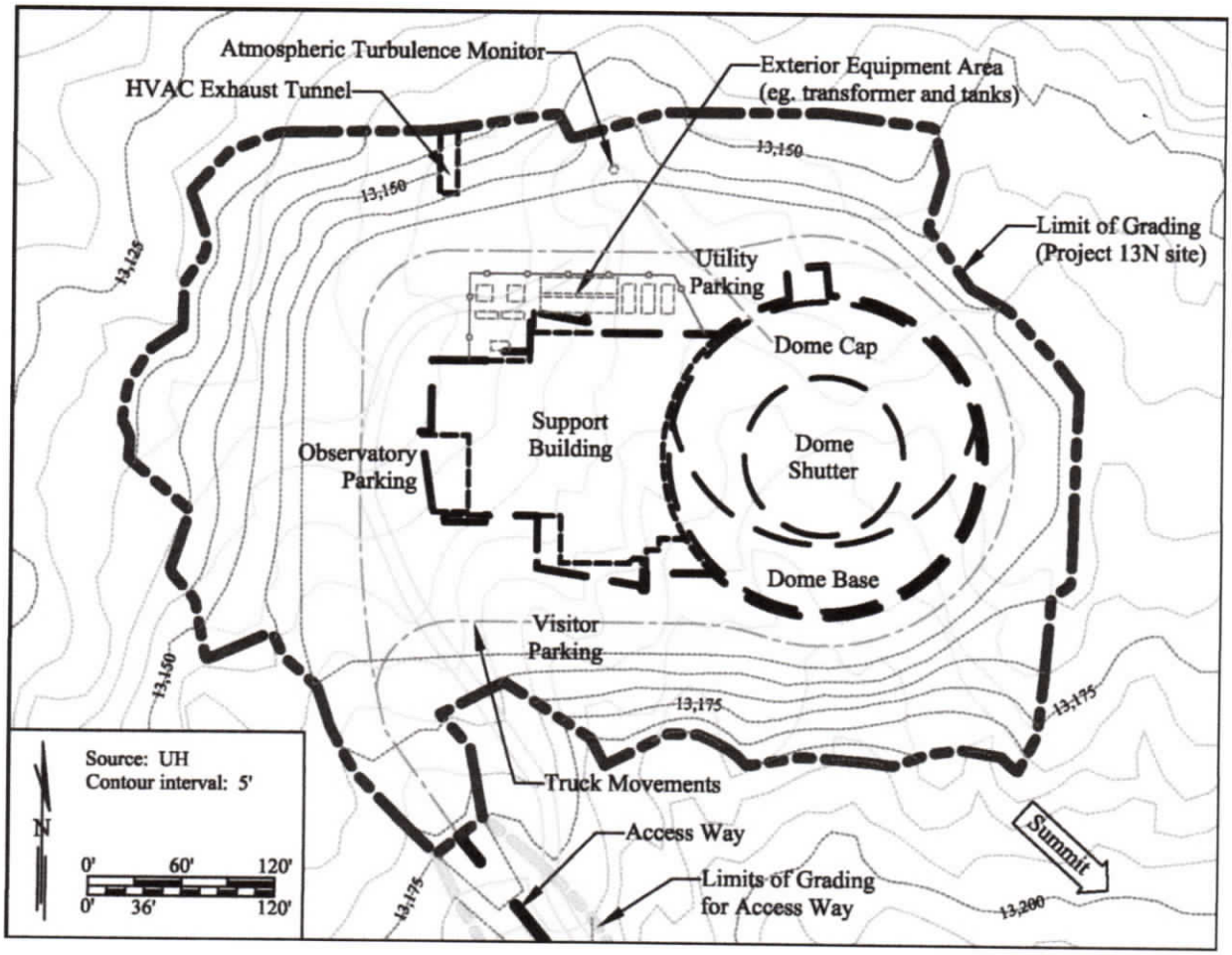

Figure B-4: TMT Observatory 13N Site Grading Plan

The construction at the TMT Observatory site will start with the rough grading of the 13N site, followed by the excavation for foundations, as depicted in the construction sequence drawings provided in Attachment A.

The TMT pier foundation will consist of a continuous, circular outer wall shallow concrete spread footing that will bear on the soil at a depth of approximately 20 feet below the finished floor grade. There will be a central shallow concrete pad for a pintle bearing, used to hold the center of rotation of the telescope in place when at rest, that will bear on the soil at a depth of 16 feet below finished floor grade. The central shallow concrete pad will be connected to the telescope pier outer wall and footing with six radial concrete spokes. A utility tunnel bearing on the soil at a depth of 21.5 feet below the finished floor elevation will connect the telescope pier with the mechanical equipment room on the utility level of the support building. A utility tunnel for venting warm air from the mechanical room out to the north side of the site will bear on the soil at a depth of 21.5 feet below the finished floor elevation.

The dome foundation will be shallow continuous spread footings bearing at a varying depth of 6 to 10 feet below finished floor grade, depending on the depth of original rock. Floors will be

concrete slabs-on-grade bearing on a six-inch layer of material obtained from excavated (cut) material. Some utility piping and conduit will be located below the concrete floor slabs.

The support building foundation will consist of shallow spread footings bearing at approximately 6 feet below the finished floor grade. Floors will be concrete slabs-on-grade bearing on a six-inch layer of material obtained from excavated (cut) material.

An electrical grounding system will be installed in the excavations for the dome and support building foundation footings. Beneath the dome footings, the grounding system will consist of a grid of #3/0 cables (10 feet by 10 feet cable grid spacing) will be placed prior to pouring the concrete. Beneath the support building footings, the ground system will consist of #3/0 cables placed at the bottom of the excavations prior to pouring concrete.

1.2.5 Utilities

As discussed in Section 1.2.3, electrical and communication utilities exclusively for TMT will be located under the roadway in the Access Way. Underground utilities from the HELCO electrical substation to the switch boxes near the SMA building (which are shared with other uses in the summit region), will also be upgraded. This activity will include the replacement of existing conductors in existing conduits. In order to avoid interruption of services to current observatories and uses in the summit region, this work will be performed using the following steps:

- Transition all existing electrical loads to one of the two existing transformers and conductors.
- Remove and properly dispose/recycle the unused transformer and conductor.
- Install a new, larger-capacity transformer within the HELCO compound and conductor in the recently vacated conduit.
- Transition all electrical loads to the new transformer and conductor.
- Remove and properly dispose/recycle the unused transformer and conductor.
- Install a new, larger-capacity transformer within the HELCO compound and conductor in the recently vacated conduit.
- Allocate the electrical loads between the two transformers and conductors as appropriate.

The removal and replacement of the transformers is discussed in Section 1.3.4. The removal and replacement of the conductor will be done by accessing the handholds along the conduit, which is within a 20-foot wide HELCO electrical easement within the Mauna Kea Forest Reserve, Mauna Kea Ice Age NAR, and MKSR. The handholds are spaced roughly 300 feet apart for the length of the conduit and will be accessed only by driving along the utility easement.

1.3 Above Ground Construction

Following foundation work, the dome, telescope, and support building will be built. All buildings and structures with indicated use, including floor plans, are illustrated on preliminary design plans in Attachment B. Table F-3 summarizes the buildings to be constructed at the TMT Observatory 13N site.

Table F-3: Summary of Buildings

Project Component	Gross Floor Area (square feet)	Net Floor Area (square feet)	Height (feet above finished grade)
Observatory Dome	34,304	31,400	26.5 (fixed enclosure) 183.7 (top of dome)
Support Building	18,376	15,961	26

Source: TMT Observatory Corporation, July 17, 2010.

1.3.1 Dome Construction

Crane Selection Process

Prior to determining how the dome would be built, the equipment that would be used to build it had to be selected. The biggest consideration is what type of crane will be used. Three crane options were considered: gantry type, tower type, and crawler type cranes.

The pros and cons of each viable option are outlined in Table B-4. Based on the review performed, a 300-ton crawler crane, in combination with a 200-ton assisting crawler crane, was selected to be used to erect the dome.

Table B-4: Crane Option Pros and Cons

Crane Option	Pros	Cons
Gantry Crane	• Can be custom-designed to take construction loads and wind loads and meet project specific needs with additional built-in safety redundancy. • Possibility with variation to lower crane when storms are forecast.	• Requires track and foundations be installed, which would be complex as it would have to be circular due to site restrictions. • Requires assist crane to erect and dismantle. • Need additional clearance around enclosure so there is space between gantry rail and the dome to transport large pieces. This would require a larger flat area around the dome and, therefore, result in a larger area of impact to the environment. • Serious safety issues with lifting large pieces right next to the crane supports, as these could collide with the crane during windy conditions. This could be mitigated by using widely spread columns; however, this would increase the impact to the environment.

Crane Option	Pros	Cons
Tower Crane	• Quick set up and erection time for this option. • Has the option of one tower crane in the center in order to perform all lifting operations from one point. • Has the option of having the crane on a track around the enclosure so the crane can maneuver. • Some tower cranes have been rated to work at 45 mile-per-hour winds. These are readily available.	• Additional cost and labor impacts for having an assist crane with enough boom and capacity to erect and dismantle the tower crane. • Cannot erect the whole enclosure using this option. An assist mobile crane with enough boom and capacity has to be used to install the shutter plug. • Has to be set up permanently and cannot be lowered during ice storms. • May not be safe during ice storms with the 40-meter boom hanging out over the enclosure at all times. • Possibility of frequent break downs and seize up of mechanical parts at higher altitudes due to ice storms.
Crawler Crane	• Can be assembled and disassembled without the aid of another crane. • Can maneuver around to perform lifts. • Boom can be readily lowered at the end of every shift and during heavy winds to reduce the risk of tipping due to heavy wind loads. • Main boom and jib can be assembled in various lengths; the boom can be lengthened at various stages to reach higher areas as the job progresses. • Easy access to mechanical parts as most are located near ground behind the operator cab. • Wind charts are available for most crawler cranes to use as guidelines.	• Susceptible to tipping during high wind loads. • Requires ground preparation around the enclosure to take the required bearing load.

After a thorough review, it was concluded that an assist crane with considerable boom reach would be required to erect and dismantle both of the tower crane options. Also, the tower crane option does not provide any advantage in terms of wind safety; the tower crane could be considered even less safe than the crawler crane option since it cannot be lowered during strong winds. This is particularly important at Mauna Kea where strong winds are frequently combined with ice storms, which greatly increases both the weight on the crane structure and the wind cross section. The gantry crane option does not provide any advantage over the crawler crane option, and would require a larger area to be disturbed, increasing the Project impacts to the environment. This leaves the crawler crane option as the preferred crane option for construction of the TMT Observatory at the 13N Site.

Crawler Crane Construction Plan

A Manitowoc 2250 crane with 300 ton lifting capacity in combination with a 200 ton hydraulic assist crane, or similar, will be used to erect the enclosure and telescope structures. The

following subsections discuss the construction plan for the crawler crane option at the 13N site, including topics such as site layout and crane maneuvering.

Site Layout and Crane Access

It is envisioned that the crawler crane would be transported to the 13N site via transport trailers and assembled on site. An advantage of this type of crane is that is can be assembled without assistance from a second crane.

The width of the 300-ton crane is approximately 27 feet. The required minimum crane access width is roughly 33 feet around the whole enclosure, and about 40 feet where the crane will be setup for lifting; this yields a minimum clearance of approximately 11 feet between the boom and the enclosure.

Ground preparations must be made to take the full bearing load of the crane out to the 40-foot width in the specified setup areas. The crawler crane has a pressure on the ground of 3,400 psf with no load. With a 45 ton load (the likely maximum during this project), the pressure on the ground is 5,600 psf. Ground preparations to handle this load can be achieved by (1) preparing the soil, but this may not be possible and will only be known once the geotechnical studies have been completed, (2) temporary foundations, or (3) crane mats that spread the load further than the track widths.

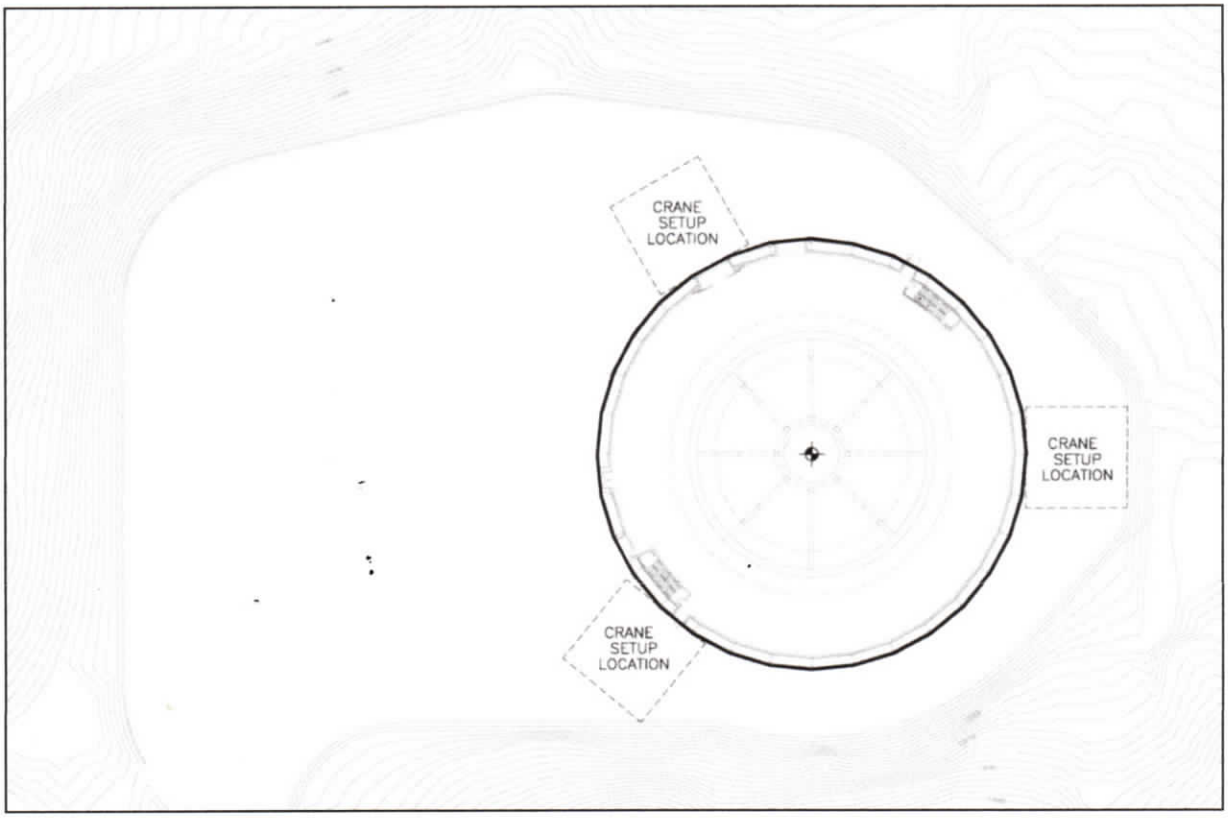

Figure B–5: 13N Site Crane Layout Plan View

As shown in Figure B–5 , the crane will sit at three strategic positions to cover all areas around the enclosure. A good crane layout results in the least number of moves or crane repositions to complete all lifts. Figure B–6 below shows an elevation view layout with the crane next to the enclosure.

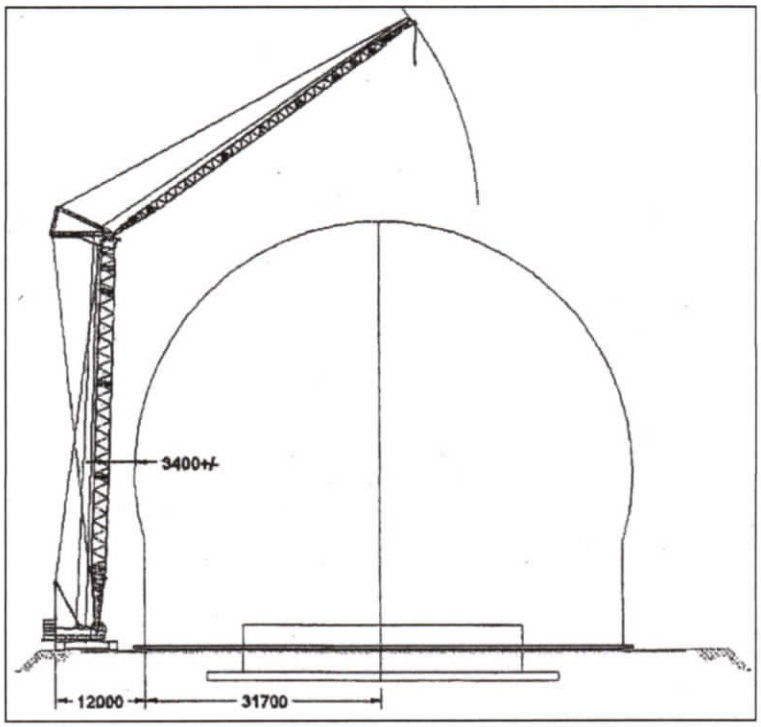

Figure B–6: 13N Site Crane Layout Elevation View

Dimensions in millimeters; 304.8 millimeters = 1 foot.

Figure B–7 below shows the boom lay down scenarios for the crawler crane at the 13N Site.

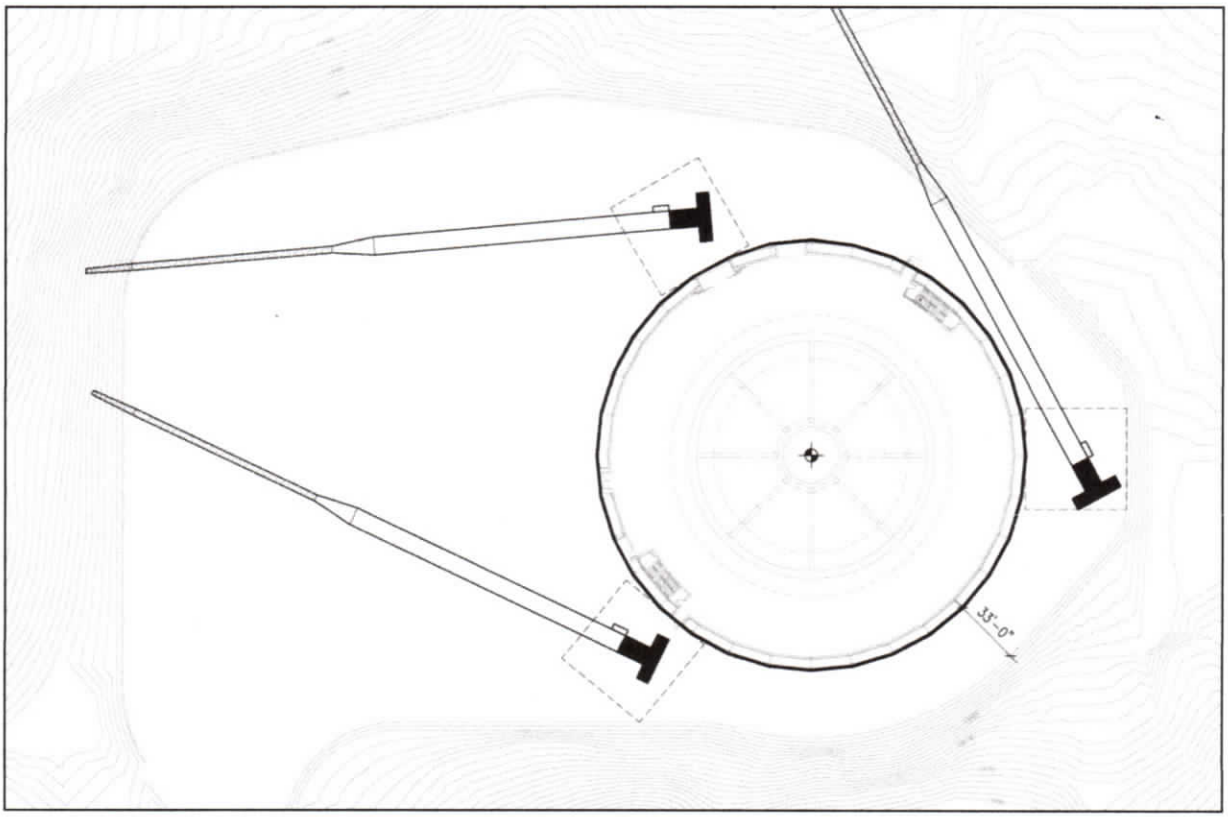

Figure B–7: Crawler Crane Boom Lay Down Scenarios

The enclosure structure will be built in two phases. The first phase involves building the enclosure structure to the point where the enclosure is fully enclosed. The second phase involves all work with regards to the mechanical setup, electrical install, insulation install, commissioning, and testing. Materials staging will be performed in the flat graded areas around the work area; during dome construction this is primarily the area west of the dome.

Crane Maneuvering

The crawler crane can readily maneuver around the site with minimum effort. Repositioning of the crane does not require it to boom down or be dismantled. To move the crane, all that needs to be done is to boom up and move to the desired location. That it requires minimum effort to reposition is another advantage of having a mobile crane onsite.

Observatory Dome Specifications

The dome will be a Calotte type enclosure with the following dimensions:

- Exterior radius: 108 feet (33.0 meters)
- Interior stay-clear radius: 95 feet (29.0 meters)
- Aperture (a.k.a. shutter, door, etc) diameter: 102 feet 6 inches (31.25 meters)
- Aperture pointing: 0 to 65 degrees zenith

Mauna Kea Management Board

1. ***Appoint Management Board:*** Members will be recommended by the UH-Hilo Chancellor and appointed by the Board of Regents. Terms and responsibilities will be detailed in administrative rules. The Board should be appointed and organized concurrently with the establishment of the UH MKM.

2. ***Establish Administrative Rules:*** The Board should adopt formal rules within one year of its formation. Procedures for public participation should be included in the adopted rules.

3. ***Kahu Kūpuna Council***: The Board should organize the Kahu Kūpuna Council to assist in deliberations of cultural and community values. This committee should be formed soon after the adoption of this Master Plan.

Design Review Committee

This Committee should be appointed with the adoption of the Master Plan. It should include design professionals such as architects, landscape architects and civil engineers.

DESIGN GUIDELINES

The purpose of the design guidelines is to direct development in a manner which integrates it into the summit environment. The design guidelines would apply to both renovations of existing facilities as well as new construction. General goals include the following:

Facility Siting: Siting decisions are the first steps in design and often determine the range of options that are available. Siting of various facilities are identified in the Physical Planning Guide. Candidate sites for recycling, expansion and new facilities are designated. New facilities are sited generally. Individual instrument locations are not specified. The NGLT and facilities on new site locations may require adjustments after viewing tests and archaeological inventory level surveys are conducted. The following siting criteria should be considered early in project development:

- Site facilities to avoid negative visual or functional impacts to existing facilities.
- Where known archaeological, cultural and natural resources exist the following sequence of evaluation is to be followed: 1) avoid disturbance of the resource, 2) minimize impact if unavoidable and 3) mitigate impact as needed. Natural resources include biological populations and geo-morphological features and geo-chemical resources.
- Set sufficient buffer distances between the facility and the cultural or natural resource. Buffer distances should be assessed individually based on the feature and the proposed facility.

- Site facilities to minimize visual impact from both the summit areas and off-mountain locations such as Hilo, Hāmākua and Waimea.
- Cluster facilities for proximity to roadway and utility lines. This should reduce site development costs and minimize visual impacts and unnecessary disturbances of the natural environment.
- If possible, avoid steeper areas and drainage paths.

Scale: Facilities should be scaled to minimize their impact on the natural landscape of the summit area. As much as practical, telescope enclosures should be designed to minimally accommodate the instrument. Where the size of the enclosure is necessarily large, strategies should be considered to blend it into the surrounding landscape. The following are some strategies for reducing apparent scale:

- Bury portions of the structure as practicable.
- Place berms against the building to reduce visible areas.
- Shape superstructures using natural and curved forms which blend into the environment rather than orthogonal geometries.
- Color surfaces to blend into the landscape.
- Design exterior articulations and changes in color and texture to break up large continuous surfaces.
- Use materials that blend into the natural landscape.

Heights & Widths: Heights and widths of ridge facility designs should seek to minimize visible heights above existing ground as much as practicable. The following are maximum dimensions established to guide the design of facilities and to regulate the impact of new development.

- Facilities developed on ridge sites may be developed to a maximum height of approximately 130 feet measured from finished grade, and a maximum width of 130 feet.
- Support facilities in the astronomy precinct should be designed to reduce the height of vertical planes on exterior walls.
- Facilities that can be built underground are encouraged to do so to reduce the part that must remain above grade.
- Mounding cinders around telescope bases could be considered to reduce visible heights.
- Where practical, build into existing slopes to reduce the visible height.
- Facilities at Hale Pōhaku should be a maximum of two stories and designed to look like one story structures by techniques such as building into attic spaces as per the existing buildings.

Colors: Color plays an important part in visibility and thermal impacts. Color choices should seek to minimize the visual impact of the facility from surrounding areas. While it is understood that the mitigation of thermal impacts on observatory functions is an

important consideration, domes should be colored to aid in masking and blending facilities into the natural landscape. The following strategies are to be employed:

- For ridge facility domes, a combination of detailed geometrical design, surface treatment (i.e. reflecting vs. non-reflecting) and color (blues and grays) to minimize visibility against the daytime sky.
- For base sections, use browns and other earth colors to blend facilities with the natural cinder cone surroundings.
- For off-ridge facility enclosures use colors and patterns such as the mottled brown tones of the surrounding lava landscape.
- Color concrete utility pull boxes installed along underground utility routes, antennae pads and miscellaneous structures with mottled brown tones to blend with the surrounding lava landscape. No raw, uncolored concrete surfaces are to be allowed.

Surfaces, Textures and Material: Surfaces, textures and material used for construction in the Science Reserve should seek to blend the facility into the landscape. Selection criteria are as follows:

- As much as possible, surfaces should be non-reflective in the visible spectrum to minimize glare and visibility from distant areas.
- Wood and other native plant materials may be used, as appropriate, at lower elevations near Hale Pōhaku or for support facilities that relate to natural and cultural programs. Natural materials are suggested for walls and surfaces as much as possible.

Parking: Parking areas should be designed with sensitivity to existing topographic contours and fitted into the existing landscape. Parking layouts should be designed to retain natural landforms and vegetation as much as possible.

Roadway and Utility Development; Minimize roadway development in the Science Reserve to what is needed to support functions approved in the master plan. Follow existing road and utility corridors and alignments as much as possible. Utility lines should be buried. Accessory utility structures will be screened or designed to blend into the natural terrain. Road designs should minimize slope cutting.

Roofs: Roof design and material and color selections in conventional structures should merge the facility into the natural landscape. Reflective materials are to be avoided. At Hale Pōhaku, roof designs, colors and materials should be compatible with those of the existing mid-elevation facilities.

Fences, Walls, and Barriers: Fences, walls and barriers will generally be designed to fit into the landscape. Where possible, alignments should follow natural contours. Grading cuts and fills should be minimized. The use of locally available construction material is encouraged.