### Table 7-16. Management Actions: Monitoring, Evaluation, and Updates

<table>
<thead>
<tr>
<th>Management Action</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEU-1*</td>
<td>Establish a reporting system to ensure that the MKMB, DLNR, and the public are informed of results of management activities in a timely manner.</td>
</tr>
<tr>
<td>MEU-2*</td>
<td>Conduct regular updates of the CMP that reflect outcomes of the evaluation process, and that incorporate new information about resources.</td>
</tr>
<tr>
<td>MEU-3*</td>
<td>Revise and update planning documents, including the master plan, leases, and subleases, so that they will clearly assign roles and responsibilities for managing Mauna Kea and reflect stewardship matters resolved with DLNR.</td>
</tr>
</tbody>
</table>

2009 Maunakea Comprehensive Management Plan
Being public lands, UH must balance varied and conflicting interests the public holds towards Maunakea. Balancing these requires multiple management tools that need to align and work together. No one plan alone can address all of the interests and concerns expressed by the public but collectively they work together to comprise a comprehensive and integrated management approach.
COVID adjustments
Leadership transition
CMS reorg (on-going)
November 2021 - Nahualani Guilloz, Director of Stewardship Programs
July to Current – Refocus/Reopen VIS
Revamp administrative and financial reporting systems
Environment Committee expands membership
Kahu Kū Mauna revamps recruitment
December 2021 - MKMB recommends restructuring of itself to UH Administration

Hail/Snow, Mid Level Facilities, May 2021
Photo Credit: Maunakea Rangers
COMPREHENSIVE MANAGEMENT PLAN

- Step 1 in the update process
- Comprehensive assessment of the 103 management actions to determine the status of each
- Reviewed all previous annual reports to BLNR, all baseline and monitoring studies conducted since 2009; and collected input from staff, DLNR, and SME consultants; incorporated findings of DLNR independent review
- Submitted OAR to BLNR as our annual report
- CMP updating in progress
### Status of Management Actions by Category

<table>
<thead>
<tr>
<th>Category</th>
<th>No. of Actions</th>
<th>Status</th>
<th>Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Resources (CR)</td>
<td>14</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Natural Resources (NR)</td>
<td>18</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Education and Outreach (EO)</td>
<td>8</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Astronomy Resource (AR)</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Activities and Uses (ACT)</td>
<td>12</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Permitting and Enforcement (P)</td>
<td>8</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Infrastructure and Maintenance (IM)</td>
<td>14</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Construction Guidelines (C)</td>
<td>9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Site Recycling, Decommissioning, Demolition and Restoration (SR)</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Future Land Use (FLU)</td>
<td>7</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Operations and Implementation (OI)</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Monitoring, Evaluation, &amp; Updates (MEU)</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>All Actions</strong></td>
<td><strong>103</strong></td>
<td><strong>15</strong></td>
<td><strong>14</strong></td>
</tr>
</tbody>
</table>

Key: “C” = Completed, “C/O” = Program framework completed; implementation is ongoing; “O” = ongoing
ADDITIONAL PROGRESS

- Updated signage inventory for the MKSR
- Interpretive and safety signage at VIS is being updated
- Citation administrative system under development
- Ranger PD’s being updated
- 4 cesspool closures underway
- ‘Imiloa redesigned employee/vendor orientation

- Advisory groups have all evaluated their role and membership; all consulted with during MP and CMP updates
  - Environment Committee updated its membership and is supporting CMS in developing our 5-year research and monitoring plan
  - Kahu Kū Mauna updated recruitment materials and is actively recruiting
  - MKMB restructuring
“We heard many comments that the cultural and natural resources on the state conservation lands on Mauna Kea are some of the best managed and protected lands in the entire State.”

Ku‘iwalu Independent, BLNR Review of UH, 2020
“….the opinions of members of the public regarding UH stewardship of Maunakea has often depended upon whether they support or oppose telescope development on the mauna.”

Ku‘iwalu, Independent BLNR Review of UH, 2020
“Sustainably steward Maunakea for the benefit of our communities, Hawai‘i, and the world, as a publicly-accessible learning landscape where all who visit learn, and those who seek something more discover through rich multi-cultural experiences and engaging multi-disciplinary discourse. Provide equal opportunities across the schools of the UH system and community partners to engage with the mauna in ways that perpetuate and advance knowledge, wisdom, and values while fostering mutual understanding and respect.”
Current efforts (September – October 2021):

- US Mail 245 individuals, groups, and agencies
- Email to 596 individuals, groups, and agencies
- Press releases on September 12, October 3, and October 25, 2021
- Prominently featured on UH social media feeds, websites, and CMS e-newsletters
- Outreach to those that had participated in earlier reviews and leaders of the Hawai‘i Island Kia‘i
- Konveio website commenting tool: 473 comments/491 individuals
- Konveio commenting form: 363 submittals
- US mail/email: 17 submittals
- Toll-free hotline: 26
- 123formbuilder (not established by UH): 573
Voices

- Strengthen Connection to Place/Appropriation
- Yes/No Astronomy
- Yes/No TMT+UH
- Astronomy is State Policy/No Jurisdiction
- Extend the Reach/Don’t Increase Visitation
- Manage Access/Not Mine
- Reduce and Reuse/Don’t force us out
- Don’t force us out
Part 1: Foundations
- Mission
- Vision
- Values
- Goals
- Strategy

Part 2: Land Uses
- Decommissioning
- Reuse/Recycling
- Hale Pōhaku
- Managed access

Part 3: Implementation
- Project Review
- Design Guidelines
DRAFT MASTER PLAN HIGHLIGHTS

❖ Not advocating a grand vision for development of the mauna
  ➢ Make smart use of what we have

❖ Addresses a no TMT scenario

❖ Applicable if UH were replaced in its role of implementing State policy

❖ Commitment to maximum of 9 summit astronomy sites post Dec. 31, 2033

❖ Repurposing Halepōhaku to support UH’s broader education and research mission
Organizational Map:
Center for Maunakea Stewardship
August 20, 2020

Board of Regents

UH President

UHH Chancellor

Executive Director, CMS
- Manage policy and planning activities and ensure balanced consideration and integration of stakeholder interests
- Ensure ongoing regulatory and legal review
- Fiscal planning and management
- Project approval (selected)
- Government and community relations
- Non-astronomy research and academic coordination

IfA - Scientific Cooperation Lead
- Astronomy/IfA/UHH advocacy
- MKO collaborations
- Subleases, scientific cooperative agreements, other partner agreements
- Federal partnerships
- Co-PI for RCUH projects

'Imiloa – Culture-based Education Lead
- VIS (TBD)
- Curriculum and program development
- Educational outreach
- Orientation and training
- UH/MKO outreach coordination

Director, Stewardship Programs
- Oversees stewardship and support service operations
- Ensure implementation of master plan, CMP, and regulatory requirements.
- In collaboration with the ED, facilitate and support our advisory groups
- Co-PI for RCUH Projects

Permitting and Compliance*
- CMP and AR implementation
- Permit/Sublease compliance
- Project review/management

MKSS
- Administration
- Hale Pōhaku
- Food and lodging
- Facilities maintenance
- Roads and infrastructure
- VIS (TBD)

Maunakea Management Board

Kahu Kū Mauna

Environment Committee

MKO Partners Group (MK Users Group)

Maunakea Management Board

Kahu Kū Mauna

Environment Committee

MKO Partners Group (MK Users Group)

*Shown here for descriptive purposes. Organization of these functions to be finalized by Director of Stewardship Programs. See narrative.
2021: YEAR OF TRANSITION

- September 2020 to Current - Transition leadership
- February 2021 - Commenced recruitment for Director of Stewardship Programs
- July to Current – Refocus/Reopen VIS
- September 2021 to Current - Consolidated CMS financial statement (underdevelopment)
- October 2021 - Kahu Kū Mauna revamps recruitment
- November 2021 - Nahualani Guilloz Director of Stewardship Programs; fill Ranger vacancies
- December 2021 - MKMB recommends restructuring to UH Administration
- Current – June 2022 Revise Ranger and Staff PD’s; Recruit for vacant planning and cultural positions; Recruit agency stakeholders for MKMB

Hail/Snow, Mid Level Facilities, May 2021
Photo Credit: Maunakea Rangers
ʻImiloa is a place of life-long learning where the power of Hawaiʻi’s cultural traditions, its legacy of exploration, and the wonders of astronomy come together to provide inspiration and hope for generations.
“In collaboration with the Center for Maunakea Stewardship, the ‘Imiloa… shall develop and implement a suite of educational programs regarding Maunakea including but not limited to Native Hawaiian culture, history, environmental, and biological considerations designed for tour guides and drivers, employees, contractors, recreational users, scientists and observatory workers, and visitors, as required by the Management plans....”
<table>
<thead>
<tr>
<th></th>
<th><strong>UHH/HCC Student &amp; Faculty Programs</strong></th>
<th><strong>“High Touch” Intensive Educational Programs guided by staff</strong></th>
<th><strong>Local Public</strong></th>
<th><strong>General Public (Tourists)</strong></th>
</tr>
</thead>
</table>
| SHORT-TERM (On-going) | Content and program development support for ‘Imiloa/VIS  
Field study programs (UH and non-UH)  
MK oral histories/archives | On-going educational programs such as:  
  - A Hua He Inoa  
  - Maunakea Scholars  
  - Akamai Interns | Kama’aina Observatory Experience  
Improved VIS displays  
  - Adze Display  
  - Piko Journals  
  - AR Table | Improved VIS displays |
| MID-TERM            | Multiple day student/faculty research & field study programs  
UH affiliate partnerships for research and/or education outreach | Expand educational program offerings to build and diversify audiences at VIS and Hale Pohaku.  
Joint field trips between ‘Imiloa and VIS.  
  - Mid-High School  
  - 13+  
  - community groups/affiliates | Establish a reservation system for special educational programs that target Kama’aaina- workshops, stargazing, etc at VIS  
Establish a reservation system for tourist experiences at VIS  
Culturally grounded, consistent curriculum between ‘Imiloa and VIS  
Further Improvement to VIS displays.  
  - Wall Panels and Displays | |
| LONG-TERM           | Campus staff & faculty development focused on MK values | Established staff and infrastructure to support regular and on-going educational offerings at VIS and Hale Pohaku that integrate staff between VIS and ‘Imiloa. | Access Management  
Partnership and integration with ‘Imiloa | |
Multiple Site Filming
2-Minute Video Intro Preview
VIS Exhibit Enhancements

- Adze Display
- Piko Journals
- Augmented Reality Table
Federal & International Attention

Hawaiian & Indigenous Community Engagement

- Astro2020 Decadal Survey
  - meaningful partnerships
  - culturally supported pathways for inclusion
  - sustainability, preservation, restoration of sites

- White House OSTP
  Elevating Indigenous knowledge in federal policy
INDIGENOUS ASTRONOMY
BEST PRACTICES AND PROTOCOLS FOR INCLUDING INDIGENOUS ASTRONOMY IN THE PLANETARIUM SETTING

By Annette S. Lee, Nancy Maryboy, David Rager, Wilfrid Bust, Yemin Carchana, Duane Hamacher, Janina Holtrak, Kyle Kimura, Carol Kreitkresse, To Kahuhina-Pinting, Maigaue Vargus

ABSTRACT
Indigenous people have maintained a critical relationship with the stars, the moon, observations and sustainable engagement to place-based customary practices, ceremony, navigation, and celestial architecture for tens of thousands of years. The Indigenous relationship and knowledge of the sky is embedded in their cosmogony, worldviews, identities, and spirituality. Our aims to observe the stars are not to know, but to feel. Indigenous knowledge is a lived experience, a way of knowing and being. This article presents an overview of the remarkable effects of Indigenous star knowledge in hope that the Planetarium community will nurture relationships with Indigenous peoples and leadership.

This paper is organized by the Indigenous Astronomers Working Group. It brings together Planetarium Professionals, Indigenous Knowledge Keepers, Indigenous Astronomy experts, Cultural astronomers, and allies of Indigenous STEM communities from Canada, the U.S., and internationally to discuss best practices for the dissemination of Indigenous astronomy particularly for science communication and the planetarium community.

1. Introduction
As we move forward into a future of interplanetary travel, it is critical that we share the knowledge and experiences of our ancient past. Indigenous astronomy has a responsibility to share this knowledge with the world.

2. Traditional Knowledge Keepers
Traditional Knowledge Keepers are the custodians of the knowledge passed down through generations. They are the keepers of the stories, the oral traditions, and the knowledge of the sky.

3. Cultural Astronomy
Cultural Astronomy is a way of understanding the world through the lenses of cultural and spiritual practices. It is a way of connecting with the natural world and understanding the cycles of the universe.

4. Conclusion
In conclusion, we must continue to learn from and honor the knowledge of our ancestors. We must continue to value the importance of Indigenous astronomy in the world.

I-WISE: A FOUNDATIONAL CONFERENCE ON INDIGENOUS WORLDVIEWS IN INFORMAL SCIENCE EDUCATION

By Nancy C. Maryboy, Isabel Hawkins, Laura Petrasits, Jill Stein, Shelly Velez, and Ka’i Kinsury

This material is based on work generously supported by the National Science Foundation under Grant No. 1220011. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

INTRODUCTION
Land Acknowledgement
We gratefully acknowledge the ancestral homelands of the Puebla and Algonquin Peoples on whose sacred lands we gather. We acknowledge the homelands of the Indigenous peoples from around the world.

I-WISE—Indigenous Workshops in Informal Science Education—is a two-part conference in 2022-2023 (https://www.i-wise.org). In light of the current discussions around Indigenous Education (https://www.iedc.org) and the convergence of Indigenous Knowledge and Western Science in informal STEM education, Indigenous leaders from the Béluga Astronomy Center of Haskell and the Indigenous Education Institute (IEI) convened two gatherings to put the seed for relationships and building among diverse worldviews.

A first conference in Albuquerque, NM, brought together more than ten prominent interdisciplinary investigators, educators, scientists, tribal knowledge holders, Indigenous youth, education researchers, and Indigenous community grass-roots participants from around the world (fig. 1). Two months later, at a gathering in Washington, DC, I-WISE conference organizers, homeland leaders, and knowledge holders synthesized the origins of critical issues and emerging research questions with more than thirty agency program officers, participants, and other science questions. The 3G gathering was held over two days at the National Museum of the American Indian and the National Museum of Natural History.

Keynote speakers included Tonya Ippolito, Liz (Takila) Johnson of the Blackfoot Confederacy, Native American Scientists of the NSES, and Elizabeth C. Sharpless and Kea L bombed. Badesch (Science). Together, they discussed and advocated for the importance of Indigenous worldviews to enhance public science literacy and improve STEM education, career opportunities, and lifelong learning for Indigenous youth.

The goals of I-WISE were to:
- Identify, leverage, and facilitate shifting efforts to embed Indigenous worldviews in informal STEM learning.
- Strengthen the interconnection between Indigenous worldviews and informal science education.
- Formulate emerging research questions.
- Establish next steps in science communication, knowledge access, and leadership.

"INDIGENOUS PEOPLE HAVE THE RIGHT TO MAIN-HOLD, CONTROL, PROTECT, AND DEVELOP THEIR CULTURAL HERITAGE, TRADITIONAL KNOWLEDGE, AND TRADITIONAL CULTURAL EXPRESSIONS, AS WELL AS THE MANIFESTATION OF THEIR SCIENTIFIC, TECHNOLOGIES, AND CULTURES. THEY ALSO HAVE THE RIGHT TO MAINTAIN, CONTROL, PROTECT, AND DEVELOP THEIR CULTURAL HERITAGE, TRADITIONAL KNOWLEDGE, AND TRADITIONAL CULTURAL EXPRESSIONS."

(ARTICLE 13D, UDHR 2007)
A Missing Piece of the Moon May Be Following Earth Around the Sun

New data suggest an object known as Kamoʻoalewa was shorn off the moon by a meteor impact before becoming a quasi-satellite of our planet.

Published Nov. 11, 2021 Updated Nov. 14, 2021

NASA astronaut Alan Shepard on the surface of the Moon during the Apollo 14 mission. Data suggests the space
CALTECH SUBMILLIMETER OBSERVATORY (CSO) DECOMMISSIONING

- September 2021 Draft EA published and CDUA submitted; CDUA accepted by DLNR
- December 2021 Final EA published
- January 2022 (tentative) BLNR Hearing
- Summer 2022 Start of construction
- Fall 2022 Deconstruction completed
- 2025 Restoration monitoring complete

FINAL ENVIRONMENTAL ASSESSMENT & FINDING OF NO SIGNIFICANT IMPACT, CALTECH SUBMILLIMETER OBSERVATORY DECOMMISSIONING

Prepared For: California Institute of Technology
Prepared by: PLANNING SOLUTIONS

DECEMBER 2021
HŌKŪ KEA DECOMMISSIONING

- 2015 – Decision made to cease operations
- September 2019 – MKMB Approval of NOI; Decoupling of project with UHH NET
- March 2022 – Final SDP
- June 2022 – Final EA
- July 2022 – CDUA
- January 2023 – CDUP
- December 2023 - Deconstruction completed
UH HILO NEW EDUCATION TELESCOPE (NET)

- September - November 2020 Public Outreach
- March – September 2021 Advisory Group Consultation
- December 2021 – Final Design and Management Plan
- January 2022 Cultural Impact Assessment
- May 2022 MKMB Draft EA Review; Publish Draft EA
- September 2022 Final EA
- January 2023 Submit CDUA
- August 2023 CDUP
2022 LANDSCAPE

- Without new land authorization all MKOs have an operational lifetime of ~5 years
  - Impacts short-/long-term planning of MKO and their funding agencies
- By this time next year
  - Outcomes from MKWG will be better understood
  - Draft MKO Terms completed, we will have a better idea about which telescopes will seek new agreements
  - Master Lease components done
MKO TERMS

❖ Form of Agreement
  ➢ Access, termination, use rights, etc.

❖ Commitments and Fees

❖ Community Benefits

❖ Decommissioning

❖ Shared Services

❖ Summit-wide shared infrastructure removal

❖ Near/mid-term infrastructure CIP

❖ UH Observing Time

❖ Roles and Responsibilities

❖ Phasing in/out new/old subleases
LAND AUTHORIZATION SCHEDULE

- Master Plan: January 2022, BOR
- CMP Update: May 2022, BOR, BLNR
- EIS: August 2022, BLNR
- MKO-UH Negotiations

BLNR Land Authorization Consideration

2021 | 2022