STATE OF HAWAI‘I

DEPARTMENT OF LAND AND NATURAL RESOURCES

COLLABORATIVE WORKING GROUP TO SURVEY, IDENTIFY, AND MONITOR CULTURALLY SENSITIVE SHORELINES IMPACTED BY EROSION

HOUSE CONCURRENT RESOLUTION 122 HD 1

REPORT

DECEMBER 2025

SUBMITTED TO THE

THIRTY-THIRD STATE LEGISLATURE

INTRODUCTION/BACKGROUND:

The Legislature of the State of Hawai‘i, during its Regular Session of 2025, passed House Concurrent Resolution (HCR) 122 HD 1 which specifically requested the Department of Land and Natural Resources (DLNR) to establish a collaborative working group to survey, identify, and monitor culturally sensitive shorelines impacted by erosion.

HCR 122 HD1 notes that the State of Hawai‘i recognizes the cultural and historical significance of Native Hawaiian burial sites and the need to protect these sacred places. HCR 122 HD1 further notes that Native Hawaiian iwi kūpuna were historically interred along sandy shoreline areas, which are now increasingly threatened by coastal erosion. Indeed, multiple culturally sensitive shoreline areas across the State, including Lahilahi Beach Park in Wai‘anae, Kaulahao Beach in Hamakuapoko, and the Old Kona Airport Beach Park in Kailua-Kona, have experienced ongoing coastal erosion, resulting in the continuous exposure of iwi kūpuna.

To address these concerns, HCR 122 HD1 specifically requested the following four tasks of DLNR and the working group:

1. *The collaborative working group* is requested to determine a process to address iwi kūpuna exposed along shorelines, ensuring their protection from adverse impact.

2. *The collaborative working group* is requested to assess public lands near culturally sensitive areas where iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites.

3. The *Department of Land and Natural Resources* is requested to consider the appropriate methods of funding to support the collaborative working group, including for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kūpuna.

4. The *collaborative working group* is requested to submit a report of its findings and recommendations, including any proposed legislation, to the Legislature no later than twenty days prior to the convening of the Regular Session of 2026.

Working Group Composition: (as listed in HCR 122 HD1)

HCR 122 HD1 requested that the collaborative working group include a specific list of members. Letters were sent to the named working group members as listed in HCR 122 HD 1 in June of 2025, inviting them to participate in the working group and/or name a designee. By the end of July 2025, all members/their designees were confirmed and their contact information received by DLNR's Outreach Coordinator. Accordingly, the working group members are:

- DLNR Chair: **Dawn Chang** *(Working Group Chair)*
- Office of Hawaiian Affairs Chair Representative: **Kūʻikeokalani "Kūʻike" Kamakea-ʻŌhelo,** OHA ʻŌiwi Wellbeing and ʻĀina Momona Director
    - Alternate: Kamakana Ferreira, Compliance Archaeologist
- State Historic Preservation Division (SHPD) Designee: **Jordan "Kea" Calpito,** SHPD History & Culture Branch Chief
- Office of Conservation and Coastal Lands (OCCL) Designee: **Kimberly** "**Tiger" Mills**, OCCL Staff Planner
- Island Burial Councils Representative: **Scott Fisher,** Hawaiʻi Land Trust Director of ʻĀina Stewardship and currently serving as Chair of the Maui/Lānaʻi Island Burial Council
- City and County of Honolulu Representative: **Michael Kat**, Historic Preservation Planner, Department of Planning & Permitting
- County of Hawaii Representative: **Laura Acasio,** Administrator of the Office of Sustainability, Climate, Equity, and Resilience
- County of Maui Representative: **Layne Krause**, County of Maui GIS Analyst in the Department of ʻŌiwi Resources
    - Alternate: Ms. Kadian Shaw, Executive Assistant (Office of the Mayor)
- County of Kauai Representative: **Mauna Kea Trask**, private attorney and former member of the Kauaʻi/Niʻihau Island Burial Council from 2012 to 2014

Working Group *Meetings:

The working group met five times via Zoom with most members/designees in attendance:

- Meeting #1 August 21, 2025
- Meeting #2 October 2, 2025
- Meeting #3 October 29, 2025
- Meeting #4 November 21, 2025
- Meeting #5 December 10, 2025

* Meeting agendas and notes are enclosed.

Working Group Recommendations Based on Tasks Outlined in HCR122 HD1:

Task #1 "determine a process to address iwi kūpuna exposed along shorelines, ensuring their protection from adverse impact".

For this task, the working group identified specific concerns and recommendations:

- *Delayed Notification of Inadvertent Discoveries* -- timely action is needed to protect iwi kūpuna from imminent harm. The number of agencies who might be notified of inadvertent discoveries potentially delays SHPD learning of the discovery and ability to respond.
    - ***Recommendation*** -- signage at identified hotspot locations informing the public to notify SHPD directly.

- *Accelerated Erosion* -- the removal of iwi can lead to accelerated erosion.
    - ***Recommendation*** -- for a more solution-oriented approach, it was suggested the Group consider ecosystem-based strategies, to include erosion bio shields such as native plants, that could reduce the rate of erosion and keep iwi together.

- *Limited Capacity to Manage the Process* -- it could be helpful to take a more proactive approach given the limited capacity across the State to address iwi kūpuna.
    - ***Recommendations*****:**
        - Create tailored site-specific preservation plans to minimize erosion at identified hotspots to reduce the demand placed on the SHPD team.
        - Address seasonal influx, such as winter high surf periods, with increased capacity for SHPD and its partners to be able to respond in a timely manner.

- *Improved Response Process* -- Working group members identified the need for an improved response process.
    - ***Recommendation --*** Island Burial Councils should pre-create Permitted Interaction Groups (PIGs) or other type of subcommittee pursuant to HRS §92-2.5 that can be available to meet quickly and assist in facilitating an improved response process. These groups may use GIS overlay maps and other resources, such as Sam Gon maps, to allow for more proactive planning and permitting. Such a group could also be called to action when SHPD must determine the disposition of an inadvertent discovery, so a decision isn't made unilaterally, and they have resources.

Task #2 "assess public lands near culturally sensitive areas where iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites".

Working group members reviewed GIS Maps of Burial Site Hotspots across the state provided by SHPD. The maps represented hotspots of areas that include a combination of interred and disinterred iwi kūpuna, where burial site specialists have identified exposed remains, that are within 3.2-foot sea level rise projections and would be subject to complete erosion. Although the maps are not 100% reliable due to missing GPS data, unrecorded burials, or other factors, the maps did provide working group members with an idea of where the hotspots are along with a visualization of the number of iwi kūpuna being exposed as a result of coastal erosion.

The working group identified specific concerns and recommendations:

- ***Recommendations from/for SHPD on Mapping Hotspots:***
    - Instead of using the broader 3.2-foot Sea Level Rise Exposure Area (SLR-XA), which includes passive flooding (still water high tide flooding), annual high wave flooding, and coastal erosion hazard areas in a combined area, the analysis should use only the coastal erosion hazard areas to more accurately identify areas impacted by erosion.
    - *Establishment of a Map Repository maintained by SHPD* -- given the usefulness of the maps produced by SHPD for this Working Group, it was suggested that a repository be an output of this Working Group, serving as a resource to counties and others addressing inadvertent discoveries of iwi kūpuna that others might also help to build. SHPD will confer with the Attorney General's Office on the legality of sharing maps that may contain sensitive issues including locations of iwi kupuna.
    - Identify locations of existing interment vaults to ensure sufficient coverage around the state and to avoid duplication.

- ***Recommendations for Identifying Appropriate Interment Locations:***
    - Proper treatment of iwi kūpuna is a very localized issue with different traditions and practices depending on lineal and cultural descent, and a "one size fits all" solution is unlikely.
    - Burial vaults may be situated in a location closest to the concentration of iwi kūpuna exposed due to coastal erosion, within the same ahupuaʻa, and on public/government land. Suggested use of state mauka lands that are not affected by shoreline erosion and sea level rise as reinterment locations. Access could be provided through area trails, which would minimize reinterment costs, and could potentially be executed through Aha Moku and other native Hawaiian agencies, community groups and non-profit organizations.
    - Lineal and cultural descendants should be consulted before any decisions are made by the State and there should be options for each community to determine what is best for them.
        - Including allowing for the iwi to erode naturally into Kanaloa (to be cared for by the god of the ocean). If that is the choice of the descendent community, exploring options and mitigation remedies for the state/county to take to allow for that to occur without disturbance by foot traffic or recreation needs to be further explored.

Task #3 "consider the appropriate methods of funding to support the collaborative working group, including for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kupuna."

Working group members discussed various types of vault construction, costs and methods of reinternment along with reviewing current examples of vaults currently being used in areas across the state. Members noted that the cost of constructing individual vaults can be relatively low (approximately $5,000), and that suitable land for reinterment locations is already owned by the Counties or the State, which helps reduce overall project costs. The group also recognized that community stewardship partnerships could help further lower long-term costs by supporting ongoing care and maintenance.

Working group members agreed funding for any reinterment locations would need to support:

- *Community Outreach and Communication* -- to ensure the community is aware of and comfortable with the sincere work being done across the State to care for iwi kūpuna.
- *Acquisition & Construction* -- for any acquisition and construction of secure and culturally appropriate reinterment vaults.
- *Staff & Long Term Maintenance* -- to ensure the respectful and permanent protection of iwi kūpuna.
- *Burial Treatment Plans* -- to ensure that the long-term management and protection of iwi kūpuna is clearly defined and that future decision-makers have a clear reference for appropriate stewardship.

- ***Recommended Funding Source*** -- Working group members agreed funding for this should be a **State Budget line item**. Iwi kūpuna will continue to be disturbed and legislative mandates mean nothing unless it is funded, and capacity is built in.

  The working group strongly supports SHPD's funding request for **$500,000 for burial vaults in the state budget**. While one-time funding could allow for initial vault construction, members emphasized the importance of planning for long-term responsibilities so that the counties are not burdened once funding runs out. This includes defining agency roles clearly and affirming that continued support from SHPD is expected to ensure proper stewardship and maintenance over time through the coordination and/or facilitation of discussions and agreements with relevant stakeholders. The working group notes that, given the current capacity at SHPD, **the need for additional staff positions should be explored. The working group also discussed the possibility of OHA or private landowners sharing in the cost of installation and maintenance of burial vaults.**

Additional Recommendations from Working Group Members:

- While HCR 122 HD1 specifically noted that this working group "assess public lands" the topic of navigating the processes for inadvertent discoveries on privately owned land continued to come up.
    - ***Recommendation*** -- create a streamlined process so when excavation is necessary, a burial site has already been identified for repatriation to occur. This might also include a template for drafting a burial treatment plan (BTP) to facilitate the process of getting burials in approved designated areas. This might also be applicable to identified hotspots on State-owned land.

- Though beyond the scope of HCR 122 HD1 the working group notes that **dune restoration** has the potential to stabilize the shoreline and therefore could be a good strategy to help protect iwi, particularly on lower-energy coastlines. Because dune restoration is most effective when the vegetation is planted as far mauka as possible and allowed to migrate and propagate themselves to their maximum makai extent, if there are places where iwi are already exposed by active erosion, then dune restoration may not be the best option. In places where there are known iwi which are not being actively eroded (mauka of the regular reach of the waves) dune restoration with the appropriate endemic plants can help to both stabilize the sand and to build the dune by capturing windblown sand to raise the profile of the beach beneath the plants.

- The working group also acknowledged the need for additional time to more thoroughly survey, identify, and monitor culturally sensitive shorelines impacted by erosion (HCR 122 HD1).

  HCR 122 HD1 was adopted in final form on April 17, 2025. The measure listed specific topics to be addressed by the working group with the 4th task calling for a "report of its findings and recommendations, including any proposed legislation, to the Legislature no later than twenty days prior to the convening of the Regular Session of 2026".

  At the end of the 2025 Legislative session, DLNR worked diligently to identify the unfunded legislative mandated tasks requested of the Department. With the Department's current resources and following the directives of HCR 122 HD1, the Chair and DLNR staff worked to establish the working group, plan meetings and facilitate discussions amongst working group members to provide the recommendations in this report given the timeline provided.

  Due to the sensitive cultural components needing to be considered by HCR 122 HD1 working group members acknowledge the need for greater discussions that involve community input.

  The task force believes these discussions should be initiated within the community and driven by cultural practitioners. The DLNR as a resource could provide alliances to ensure proper protocol and respectful reinternment should there be no intermediary.

The HCR 122 HD1 working group members are thankful for the opportunity to serve in this capacity. Our participation led the way for increased opportunities for collaboration between counties and agencies who are actively addressing inadvertent discoveries of iwi kūpuna. We have been thoughtful, diligent and deliberate in our discussions and in our recommendations to protect our cultural resources in culturally sensitive shorelines impacted by erosion.

“I ulu no ka lālā i ke kumu”

The branches grow because of the trunk.

Without our ancestors we would not be here

[‘Ōlelo No‘eau #1261*]*

Enclosures:

- HCR 122 Meeting #1 Agenda 8.21.25
- HCR 122 Meeting #1 Notes
- SHPD PowerPoint Presentation (meeting #1)
- SHPD Memo from 7.21.25 "*Revised Descendancy Claim Application and Administrative Information and Clarification Regarding the Definition, Recognition, and Application Process for Cultural Descendants."* (meeting #1)
- "Malo_ Kamakau_ Beckwith_ and Pukui on Burials" for HCR 122 (meeting #1) shared by WG member M. Trask
- "Forested Bioshields and Tsunami Impact Mitigation in a Polynesian Setting" shared by WF member S. Fisher (meeting #1)
- HCR 122 Meeting #2 Agenda 10.2.25
- HCR 122 Meeting #2 Notes
- SHPD PowerPoint Presentation on Shoreline Inadvertent Discovery Process (meeting #2)
- HCR 122 Meeting #3 Agenda 10.29.25
- HCR 122 Meeting #3 Notes
- Burial Hotspot Island Maps (Hawaii Island, Maui, Molokai, Oahu, Kauai)
- HCR 122 Meeting #4 Agenda 11.21.25
- HCR 122 Meeting #4 Meeting Notes
- Iwi Kupuna (burial vault examples) from WG member T. Mills (meeting #4)
- Draft Burial Site Component - Kualoa Regional Park. Shared by WG member M. Kat (meeting #4)
- Summary of Discussions with DPR Staff (Kualoa Beach Park & Mauna Lahilahi / Pōkaʻi Bay) from WG Member M. Kat (meeting #4)
- HCR 122 Meeting #5 Agenda 12.20.25
- HCR 122 Meeting #5 Notes

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIA'ĀINA

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
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CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

AGENDA

HCR122 HD1
Working Group Meeting

August 21, 2025
12 noon – 1pm
Zoom Link: https://zoom.us/j/96214070369

HCR122 HD 1 (2025) Requests "The Department of Land and Natural Resources to Establish A Collaborative Working Group to Survey, Identify, and Monitor Culturally Sensitive Shorelines Impacted by Erosion"

1. **Welcome & Introductions**
2. **Overview of HCR122 HD1 requirements/instructions**
3. **Timeline for working group**
    a. Establish dates/times for future meetings
4. **Discussion**
5. **Adjournment**

Requirements listed in HR118 HD1/HCR122 HD1:

1. *The collaborative working group* is requested to determine a process to address iwi kūpuna exposed along shorelines, ensuring their protection from adverse impact.

2. *The collaborative working group* is requested to assess public lands near culturally sensitive areas were iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites.

3. The *Department of Land and Natural Resources* is requested to consider the appropriate methods of funding to support the collaborative working group, including for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kūpuna.

4. The *collaborative working group* is requested to submit a report of its findings and recommendations, including any proposed legislation, to the Legislature no later than twenty days prior to the convening of the **Regular Session of 2026** *(December 2025)*

Notes from
HCR122 HD1 Working Group Meeting on

August 21, 2025
12 noon – 1pm
Held via zoom

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HCR122 HD 1 (2025) Requests "The Department of Land and Natural Resources to Establish A Collaborative Working Group to Survey, Identify, and Monitor Culturally Sensitive Shorelines Impacted by Erosion"

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1. **Welcome & Introductions**

   Meeting started at 12:01pm. All 9 named working group members were present via zoom.

   Working Group Attendees:

   - DLNR Chair **Dawn Chang** *(Working group Chair)*
   - OHA Chair Representative: **Kūʻikeokalani "Kūʻike" Kamakea-ʻŌhelo,** OHA ʻŌiwi Wellbeing and ʻĀina Momona Director
   - SHPD Designee: **Jordan "Kea" Calpito,** SHPD History & Culture Branch Chief
   - OCCL Designee: **Tiger Mills** (Kimberly T. Mills), OCCL Staff Planner
   - Representative of the Island Burial Councils: **Scott Fisher,** Hawaiʻi Land Trust, Director of ʻĀina Stewardship and currently serving as Chair of the Maui/Lanai Island Burial Council
   - Representative from the City and County of Honolulu: **Michael Kat**, Historic Preservation Planner, Department of Planning & Permitting
   - Representative of the County of Hawaii, **Laura Acasio,** Office of Sustainability, Climate, Equity, and Resilience as Administrator
   - Representative of the County of Maui: **Ms. Kadian Shaw,** Executive Assistant (Office of the Mayor) attended on behalf of Layne Krause, County of Maui GIS Analyst in Department of ʻŌiwi Resources
   - Representative of the County of Kauai - **Mauna Kea Trask**, private attorney and former member of the Kauaʻi/Niʻihau Island Burial Council from 2012 to 2014

   Other Attendees:

- DLNR Staff: Rebecca “Becca” Crall, Outreach Coordinator.
    - Serving as working group support and meeting notetaker.

2. **Overview of HCR122 HD1 Requirements/Instructions (12:07pm)**

Chair Chang went over 4 specific tasks for the Working Group set forth in HCR 122:

1) determine a process to address exposed iwi kūpuna exposed along shorelines, ensuring their protection from adverse impact,

2) assess public lands near culturally sensitive areas were iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites,

3) consider funding methods for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kūpuna, and

4) prepare a report to the Legislature by January 2026.

Chair Chang further noted some other key points

- HCR 122 specifies looking at iwi kūpuna exposures along shorelines.
- HCR 122 specifies the assessment of “public lands” for suitable reinterment sites.
- There is a presumption of “relocation” of the iwi kūpuna, noting that recommending relocation is not the determination of the working group, but if that determination is made, to provide suitable locations to be considered.
- Identifying possible funding sources for reinterment sites.

3. **Timeline for Working Group (12:11pm)**

- Report due in January 2026, draft by December. This is August. We have 3 months, assuming we hold monthly meetings in September, October and November.
- DLNR will take the responsibility of preparing a draft report by December for the Working Group members to review and consensus for submission in January.

4. **Discussion (12:11pm)**

Chair Chang opened up the meeting for discussion amongst Working Group members.

- A presentation that provided an overview of SHPD’s kuleana with respect to HCR 122 topics, its jurisdiction, and its disposition and reinterment

responsibility was shared. The presentation identified hotspot locations of inadvertent discoveries on O‘ahu (Mauna Lahilahi), Hawai‘i Island (Old Kona Airport, also known as Old A’s) and Maui (corridor including Kaulahao/Kūau, Hāmākuapoko, and Hookipa). There is a GIS overlay which more thoroughly identifies hotspot locations. It was also acknowledged the highest number of inadvertent discoveries being exposed as a direct result of erosion occurs on Maui. *(presentation attached in meeting notes email).*

- Main Topics Discussed:
  - **Cultural Perspectives on Relocation vs. Preservation** -- while it was noted that it is not the purpose of the Working Group to decide on relocation versus preservation, the group discussed cultural perspectives of such once once a disposition is made.
    - The perspective of LaFrance Kapaka-Arboleda of Anahola, Kaua‘i, which was not always the presumption of “preservation in place,” was lifted along with her vision to have government entities set aside land within the ahupua‘a as a permanent reinterment site.
    - It was noted that protecting the bones should be primary, and that historically, Hawaiians did relocate iwi kūpuna when necessary. *(document will be attached in meeting notes email)*
  - **Preventing Disturbance of Iwi Kūpuna** -- suggestions made to take a more proactive approach to preventing the disturbance of iwi kūpuna include:
    - Identifying measures or practices to slow erosion. *(attached in meeting notes email)*
    - Creating greater opportunities for SHPD to meet with DPP and all Planning Departments to educate where there are regional areas of great sand, such as Kailua, O‘ahu and, generally, look at those departments that may have some authorizations that permit excavation.
    - Supporting shoreline restoration projects when possible.

- Projects and their permitting should be looked at differently to minimize disturbance of iwi kūpuna.
    - Cesspool conversion pollutes resources, should be approached differently from hotel or public access path

- **Improving Response Process** -- the need to improve the response process was identified by several Working Group members, including:
    - Standardized protocol is needed to improve the response to inadvertent discovery of iwi kūpuna across the State. Protocol would include efforts to ensure the respectful treatment of iwi kūpuna such as working at night with iwi kūpuna versus the daytime and ensuring iwi are always covered.
    - There is also a need for education on the proper response process, including educational educational materials (pamphlets/flyers) that can be distributed to the general public. SHPD has some educational material that could be updated.
- **Current Protocol for Inadvertent Discoveries** -- SHPD shared their current process begins with:
    - Immediately notifying the geographical representative when there is an inadvertent discovery.
    - The inadvertent discovery is put on the agenda for the next Burial Council meeting so all Council members are made aware of the discovery.
    - In the case of iwi discovered on the shoreline, only iwi on the surface is retrieved.
    - There are existing predetermined reinterment sites that include Board of Water Supply (Waikīkī), Howard Hughes areas in Kakaʻako, and PMRF (Navy). In these situations, landowners assume responsibility for placement and maintenance, with protocols in place for recognized descendents to have access to the site.

- **Current Efforts** -- members of the Working Group shared different efforts taking place across the State that include:
    - Maui's grassroots Aha Moku is active and working closely with SHPD
    - Hawaii County has applied for a NOAA grant to protect iwi and will be working with lineal descendents and cultural caretakers. Could be a good example of a funding source for the working group to consider.
- **For Future Consideration**
    - Recommendation was made to identify reinterment sites in each ahupuaʻa or moku for the preservation of iwi kūpuna as close to the place of discovery as possible. Need for proactive versus reactive approach, including a tiered system for preventive measures. In the case of discovery, have standardized protection of iwi kūpuna and working with County and State agencies for a more restorative approach to identify `āina or parcels of land for more permanent reinterment sites.
    - Suggestions for SHPD and Island Burial Councils to create a Permissive Interaction Group (PIG) or other type of subcommittee to identify burial sites, with the use of GIS overlay maps and other resources such as Sam Gon maps to allow for more proactive planning and permitting.
    - Such a group could also be called to action when SHPD has an inadvertent so a decision isn't made laterally and they have resources.
    - Creation of temporary curation vaults similar to the one established by Maui County's Department of ʻŌiwi Resources, used to temporarily reinter the iwi for the Hāmākua corridor.
    - Blanket determination or pre-determining disposition of burial sites for locations where iwi kūpuna have already been found so the Burial Council could prepare a burial plan for anything found so it could be treated proactively with a plan already laid out.

- While difficult to make blanket determinations, having a long term mitigation plan would be helpful so action can be taken immediately when iwi are discovered and SHPD may not be able to make it before the iwi is exposed to more danger.

- Rule amendment is planned and there was a suggestion for OCCL to consider how reinterment could be more easily accommodated.

5. **Adjournment/ Closing**

Chair Chang felt this first meeting was a good conversation with many topics identified for the working group to consider. She appreciated the spirit everyone brought to the meeting.

Next steps include:

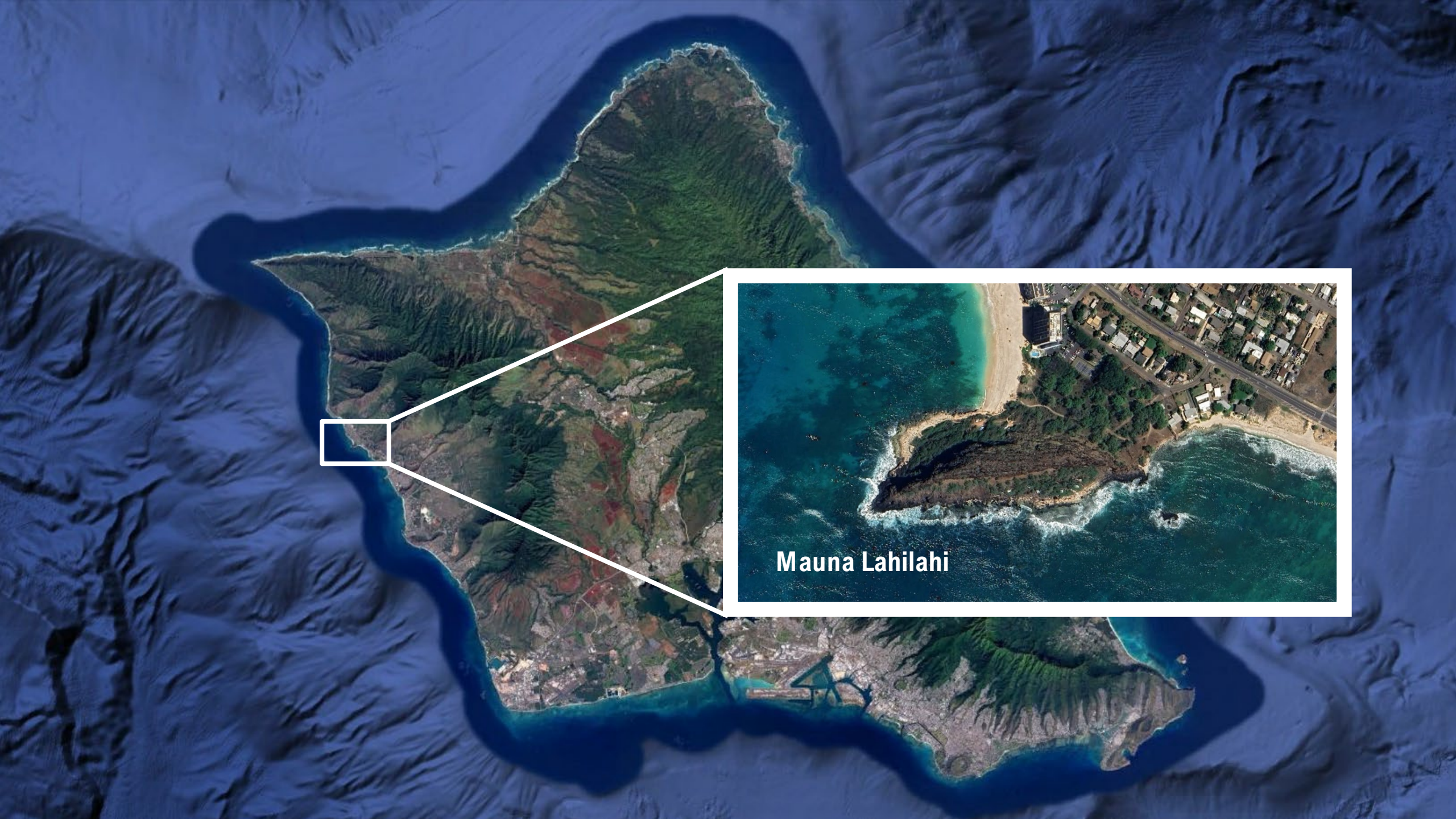
- Members to share with Becca any resources or materials they'd like distributed to Working Group members
  - Forested Bioshields and Tsunami Impact Mitigation in a Polynesian Setting -- A journal article regarding forested bioshields as a way to address erosion, provided by Scott Fisher.
  - Malo_ Kamakau_ Beckwith_ and Pukui on Burials for HCR 122 (M. Trask Notes) -- A document compiling mana'o from Hawaiian scholars about traditional practices regarding iwi kūpuna, provided by Mauna Kea Trask.
- Kea's presentation to be distributed (Becca/DLNR)
- Meeting notes to be distributed (Becca/DLNR)
  - Notes will be used to craft the next meeting agenda.
- Potential meeting dates/times to be identified (Becca/DLNR)
- Sharing of presentation and articles that might include SHPD's existing education materials on how to handle inadvertent discoveries (who to contact, what to do, and what not to do when finding iwi on the shorelines). (Becca/DLNR)

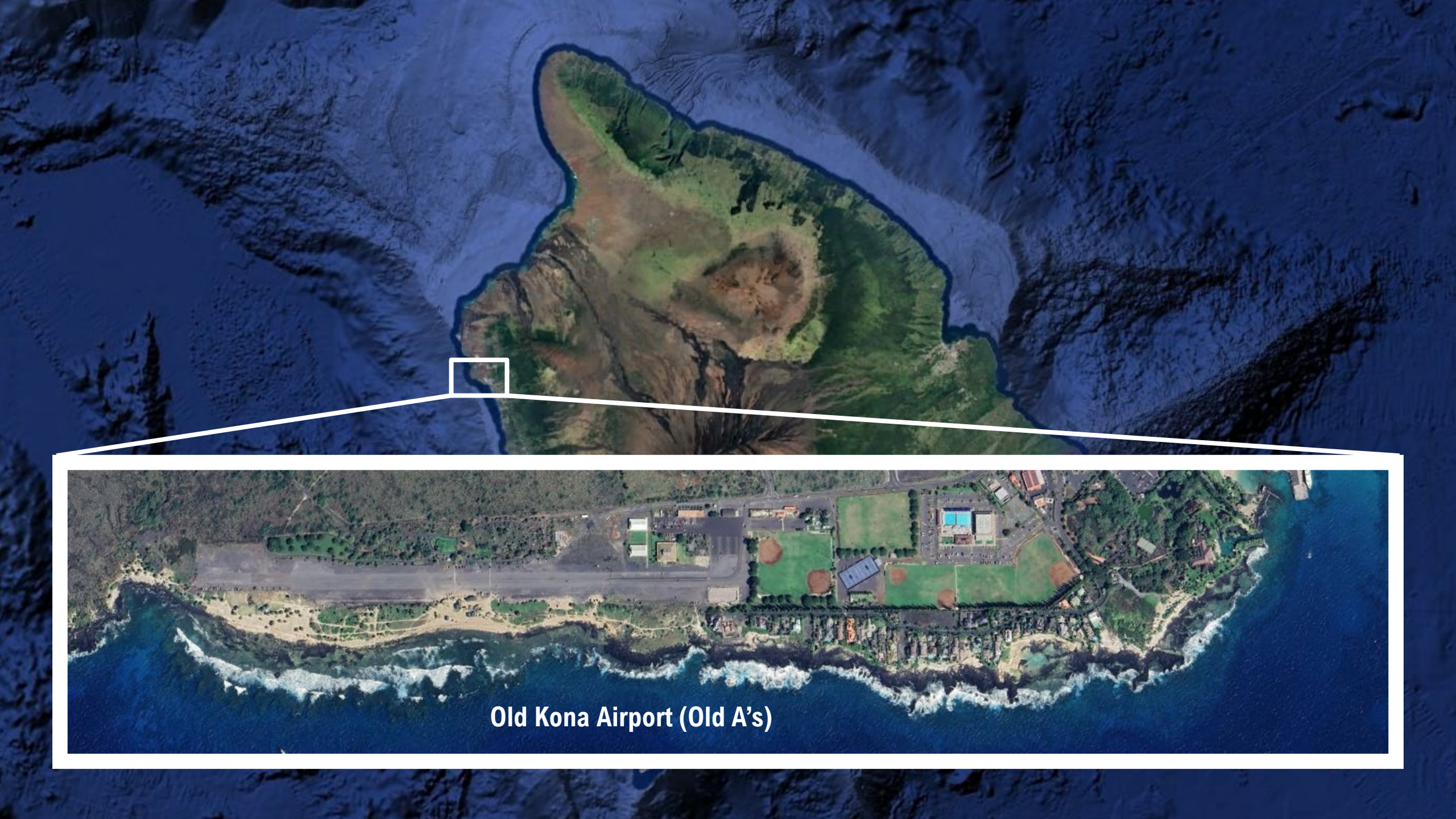
Meeting adjourned at 12:59pm.

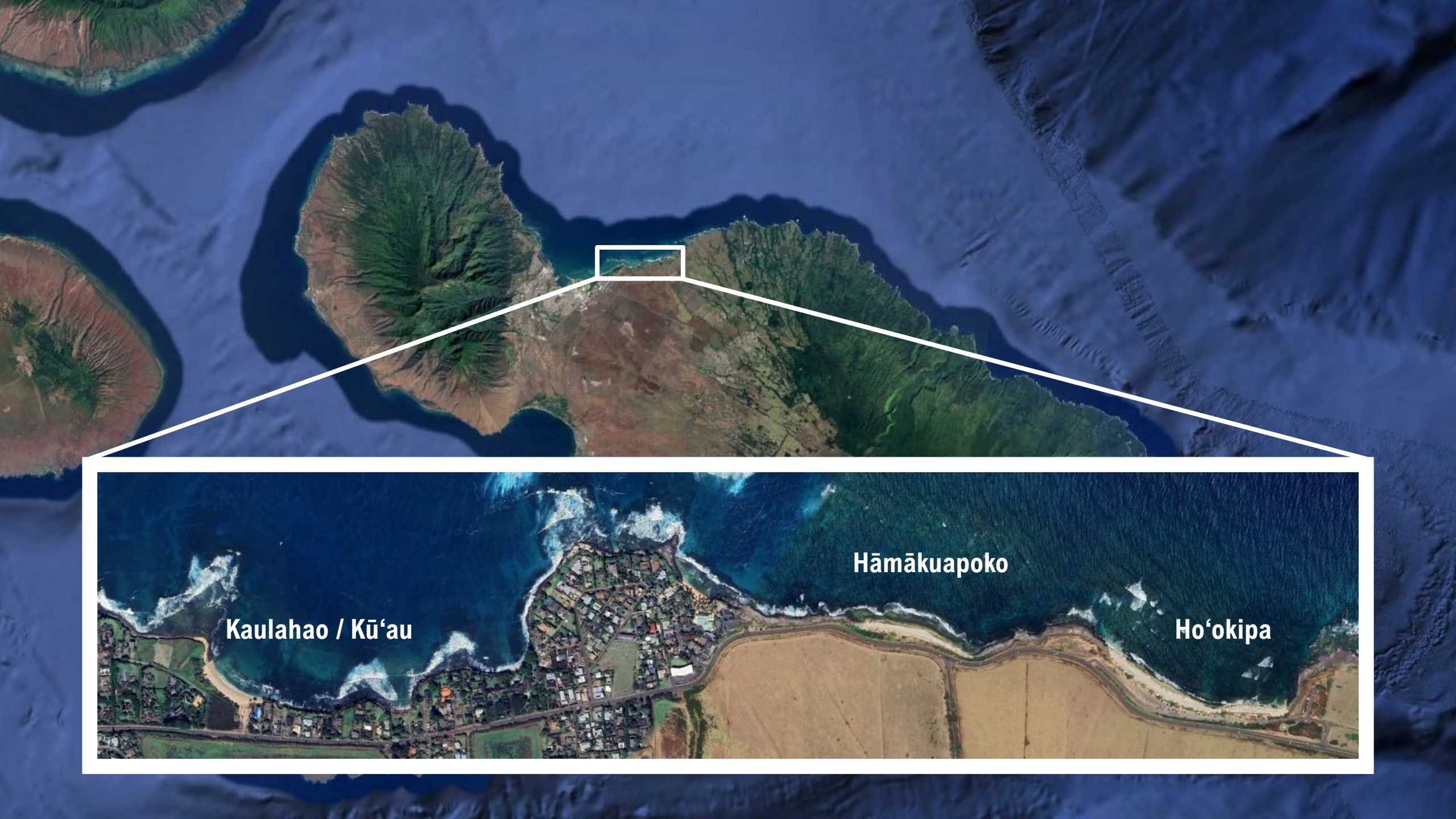
SHPD synopsis

hotspot identification

high density culturally sensitive areas


Mauna Lahilahi


Old Kona Airport (Old A's)


Kaulahao / Kūʻau
Hāmākuapoko
Hoʻokipa

jurisdiction

private property

public + government

- county
- state
- federal
  - military
  - national parks
  - DHHL

disposition

determination

preserve | relocate

where do the iwi go?

reinterment

who is responsible?

mahalo

STATE OF HAWAII | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

July 21, 2025

TO: Chairs of the Island Burial Councils

THRU: Kea Calpito, History & Culture Branch Chief

FROM: Jessica Puff, SHPD Administrator

SUBJECT: Revised Descendancy Claim Application and Administrative Information and Clarification Regarding the Definition, Recognition, and Application Process for Cultural Descendants.

The State Historic Preservation Division (SHPD) has received inquiries regarding the definition of cultural descendants, their recognition status, and the circumstances under which individuals must go through the application process. To promote consistency and clarity in practice, SHPD will be revising its *Descendancy Claim Application* to include an option for applicants to indicate if they are seeking recognition only to the specific iwi kupuna listed in their application. Otherwise, the applicant, if recognized by the respective council as either a lineal or cultural descendant, would be considered a "known cultural descendant" to all iwi kupuna within the same ahupuaʻa as the iwi kupuna in which they are seeking recognition to and therefore, does not need to reapply to be recognized as a cultural descendant to subsequent iwi kupuna within that same ahupuaʻa.

The revised application will also include an option to indicate if an applicant has been "previously recognized" to iwi within an ahupuaʻa to help expedite the review process for those who initially opted to be recognized to specific iwi kupuna but wish to expand their recognition to additional iwi kupuna within that ahupuaʻa.

SHPD offers the following administrative information to explain the above changes.

Hawaiʻi Administrative Rules (HAR) §13-300-2 defines a "cultural descendant" as follows:

> "Cultural descendant" means with respect to non Native Hawaiian skeletal remains, a claimant recognized by the department as being the same ethnicity, or with respect to Native Hawaiian skeletal remains, a claimant recognized by the council after

> establishing genealogical connections to Native Hawaiian ancestors who once resided or are buried or both, in the same ahupua‘a or district in which certain Native Hawaiian skeletal remains are located or originated from.

This definition indicates that in the case of "cultural descendants," a genealogical connection does not need to be tied to any specific iwi kupuna, but instead, to an ancestor within the same ahupua‘a in which certain iwi kupuna are located. For that reason, once a claimant has been recognized by the council as a lineal or cultural descendant to iwi kupuna found within an ahupua‘a, recognition as a "cultural descendant" inherently extends to all iwi kupuna within that same ahupua‘a because the claimant has already satisfied the HAR requirement of demonstrating a genealogical connection to ancestors within the ahupua‘a in which iwi kupuna are located or originated from. Therefore, they meet the cultural descendant criteria for any additional iwi kupuna discovered in that same ahupua‘a since those iwi kupuna would fall within the same geographic and cultural context to which the original recognition applied.

This is also consistent with the terms "known lineal or cultural descendants" in HAR 13-300-40(e), where the unanticipated nature of inadvertent discoveries would mean that no descendants could have been recognized to those specific iwi kupuna at the time of discovery thus, descendants can only be considered "known" if they were previously recognized to other iwi kupuna within that same ahupua‘a.

SHPD notes that individuals seeking recognition as a "lineal descendant" to iwi kupuna must submit a new application each time, regardless of any prior recognition and in accordance with the below definition provided in HAR §13-300-2:

> "Lineal descendant" means with respect to Native Hawaiian skeletal remains, a claimant who has established to the satisfaction of the council, **direct or collateral genealogical connections <u>to certain</u> Native Hawaiian skeletal remains**, or with respect to non Native Hawaiian skeletal remains, a claimant who has established to the satisfaction of the department, direct or collateral genealogical connections to certain non Native Hawaiian skeletal remains.

SHPD recognizes that in some cases, descendants might only choose to apply for recognition to specific iwi kupuna rather than all iwi kupuna within that ahupua‘a. Those previously recognized as lineal or cultural descendants to iwi kupuna within a specific ahupua‘a will continue to be treated as cultural descendants for all iwi kupuna within that ahupua‘a in the notification and consultation process. However, if an individual prefers to be consulted only on the specific iwi kupuna for which they were originally recognized, they may either choose not to respond to unrelated notifications or inform SHPD that they do not wish to receive future notices for inadvertent discoveries or consultations outside of the specific iwi kupuna for which they were initially recognized.

On Iwi Kupuna

1. 1835-1836: David Malo, Mo'olelo Hawaii, Kamakau
2. 1866-1871: Samuel Kamakau, Ka Po'e Kahiko,
3. 1940: Martha Beckwith, Hawaiian Mythology; and
4. 1979: Mary Kawena Pukui, Nana I Ke Kumu on burials, and burial sites and their treatment and desecration in Hawaii.

I. Malo on Burials

Malo has a short treatment of burials. Nine pages total. The main points he makes concern huna kele (when a corpse was buried in such a secret place that it could not be discovered it was said to be), hale poki (hale within special heiau built upon the death of a chief where the bones were kept and worshipped as a god), and ho'o pa'a (keeping) (Malo does not use this word, but I thought it appropriate because he describes this situation as when the living would remove bones of their loved ones from their burials and keep them in remembrance until the love came to an end at which time they were abandoned. Pukui in Nana I Ke Kumu also describes the practice of "keeping" bones of loed ones, so thought to use a Hawaiian word to describe the same).

Malo makes it clear that it is the bones that are primarily important not the place they were buried.

CH. 23, page 82, para. 12.
Singular treatment of kahuna kuni/anaana. Text not related to burials or desecration of bones. "Those who practiced sorcery and praying to death or ana'ana worshipped Ku-koae, Uli and Ka-alae-nui-a-hina."

Chapters 27-29 (pages 96-107) contain the following topics: Concerning dead bodies, concerning the ceremony of kuni, and concerning the ceremonies on the death of the king. The themes and pertinent information relating specifically to bones, burials, their treatment and their desecration are all treated within these three chapters. It is as follows.

Corpses kapu. "ban of uncleanliness" chief kapu longer than commoner kapu. 10 days or longer. 3 days for one of ordinary distinction, 1 day for low class. When corpse buried out of site, period of kapu came to an end.

Ia loa. The long fish, detailed description of treatment of and ceremony surrounding preservation of dead bodies.

Burial and treatment. After the ceremony surrounding the body was pau the corpse was buried. "When a corpse was buried in such a secret place that it could not be discovered it was said to be "huna-kele". This was the favorite way to treat the bones of the high chiefs. For that reason sepulcures in caves and secret places were sought after.

Hu'e or exhuming. The living would remove bones from their burials and keep them in remembrance until the love came to an end at which time they were abandoned.

Hale Poki. Alii bones were sometimes ritually prepared and a new heiau was built for them. Within that heiau was built a hale-poki. Where the alii's bones were kept and worshipped as a god.

Index:

NO: Burials, bones, burial sites, disposal of corpses, corpses.

YES: burial, arrangement for 97; secret 98-99; dead bodies 96-99; dead, worship of 82; death of a king 104-107; disinterment 98-99, 105-106

Chapters: 23 (page 82), 27 (pages 96-99), 28 (pages 100-104), and 29 (pages 104-107).

II. Kamakau on Burials

Written during 1870. Possibly influenced by "foreign admixture".

Index topics;
1. burial places; 38-43
2. disposal of corpses; 38-43
3. preparation of corpses (bones); 33-34

15 pages total (33-48). Burials not consistently discussed throughout. Kamakau's exposition is comprised of a mixture of mana'o regarding death, disposal of corpses, desecration, etc..

On preparation of corpses for burial.
- There were many ways to treat and dispose of corpses.
- Corpses were defiling. There was much ceremony surrounding the treatment of the corpses and the conduct of those that attended to the corpses, usually the blood relatives or special companions.
- After death, bodies of those especially loved were turned to 'ia loa.
- Sometimes the living stripped the flesh and "kept" the femur, humerus and skull. The rest of the body, pela manaku, discarded in the deep ocean.
- After bones secreted, Kahuna huikala performed the ceremony of purification.

On Disposal of corpses.
- Kamakau tells a tale, likely influenced by foreign admixture, about the reason why burials were secret and hidden. In ancient times burial grounds were well known throughout the islands and bodies were laid out straight in wooden troughs, holowa'a and buried. Then in times of wicked chiefs desecration began being committed against the bones of the ancient ones. The desecration described took the form of; bones being dug up to be used as arrows for rat shooting and fish hooks, and the bones and bodies of the newly buried were dug up for food and bait for sharks. In response every family sought

places of concealment of the bones of their ohana. They searched for deep pits (lua meki) in the mountains, hiding pits (lua hema) and hiding caves (ana huna) along the deep ravines and sheer cliffs frequented by the ko'ae birds. There they deposited the precious bones.

- These places are well hidden from the eyes of men and unknown to the wizards of the night, ku pua o ka po, who might reveal them.
- burial places were kept secret so that kuni and ana'ana would not desecrate.
- "Since the main thing was to hide the bones, they were buried under new houses, in roadways, in banks of taro patches, or any place where they would be concealed." Ka Po'e Kahiko @43.

III. Beckwith, Martha. Hawaiian Mythology

Bones; inhabited by spirit after death, 144; desceration of, 344, 393, 415, 453, 460; care to preserve from desceration, 241, 249, 250, 259, 263, 265, 274, 346, 355, 358, 391; wagered, 424, 459, 460, 461; restored to life, 518

(144)Hawaiian philosophy of life tended to dissociate the 'uhane from the body (kino) and to think of it with a quite independent life of its own apart from the body, which is dead or inert without it.

The uhane can wander from the kino but habit of wandering is dangerous, lest the spirit be caught and prevented from returning to the body. The lapu is the visible form of a dead person. It has a human shape and speaks in the same voice as in life, but it has the power of enlarging or contracting at will, but cannot change into another shape. But the dead can enter an object, especially a bone, and hence it is that hawaiians fears to disturb human bones or to speak of sacred things lest they anger the spirits of the dead, who will then work their mischief. (bones as the home of uhane)

1. After Kapakohana killed the hairles cannibal (olohe) of Hanakapia of Oahu he used the olohe's bones to hang gourds upon. (Possession & Desecration of the bones of great slain enemies were a sign of dominion.)

1. While performing general displays of wit and talent to the credit of the chiefly house of Umi, Lonoikamakahiki displays a calabash containing the bones of the warring alii of Hawaii subdued and slain by his father and chants their names. (Possession & Desecration of the bones of great slain enemies were a sign of dominion.)

1. Palila the great warrior of Kauai, son of Kaluapalena ruler of Kauai, travels to Hawaii where he finds Kulukula of Hilo and Wanua of Hamakua at war. Palilia sides with Kulukulua. He slays the three great warriors of Hamakua with a single stroke of his club Huliamahi, with which he fells whole forests of trees at a stroke. After slaying these warriors he hangs their jaw bones on a tree called Kahakaauwe and becomes himself ruling chief of Hilo. (Possession & Desecration of the bones of great slain enemies were a sign of dominion.)

1. Lonoikamakahiki displays the bones of those 6 chiefs whom rebelled against, and were slain by, the alii Keawenuiaumi.

460 The legend of the Riddling chiefs of Kauai. Challenge them to a riddle contest and pay with your life they had houses and fences built with bones of everyone they beat.

IV. Pukui, Nana Ike Kumu Vol. I.

iwi—bone or bones; where any interpersonal or person-with-deity relationship is concerned, the word means human bones.

Deriv: unknown.

On March 12, 1970, Kolokea C , a 43-year-old Hawaiian woman, not, a Center client, related the following account to the Hawaiian Culture Committee. The events she described had taken place within the previous two weeks. As Kolokea spoke, Mary Kawena Pukui translated the older, often poetic Hawaiian phrases. Kolokea‘s narrative has been edited for brevity:

"When my brother died in California, I made the funeral arrangements because he had named me ‘next of kin.‘ So I called the mortuary and told them to cremate his body and have the urn sent here. I felt this was the best way...

a kauoha (command) forbade cremation

"Then I called my older sister [on Oahu]. As soon as she heard I was having the body cremated, all the *pilikia* [trouble] started. She got angry and nasty over the phone. She cursed me! She said she was given a *kauoha* [command] when she was very young...a *kauoha* that none of us in the family are to be cremated. She said this was handed down to her. I asked her what the reason was, but she was so angry by then she wouldn‘t even listen to me.

"She went on and said, you go ahead with this cremation and see what will happen to you from now on. You’d better heed this warning if you want your life to be pleasant! And then—BANG—she hung up the phone.

"I was so upset! I dropped tears. My tears fell for about two hours. At first, I didn’t know who to turn to. Then I called my great-great-grandaunt. She’s 73. But before I could tell her everything that happened, she said in Hawaiian:

"‘Auwe, noho‘i kaikamahine, honehone ke ala i ka moana.‘" (Alas, my child. The sounds of the sea have been heard faintly.)

In other words, ‘Yes, I have already heard the news.‘"—M.K. Pukui.

"Then I told her the whole conversation with my sister, and my grandaunt said, still in Hawaiian. Listen, and let me help you. Let me guide you before the trouble comes upon you. The first thing that has taken place between you and your sister—and it will entangle your other sisters and

brothers—is *hihia* [a network of spreading, worsening anger and hurt feelings] and *kūʻēʻ* [conflict].

"As for this second thing your sister has said, about what will happen if you go ahead with cremation, this is *haʻawiʻ i ka aumakua*. This is *ʻānai* [a curse].ʻ

"And then Auntie said that cremation was *puhi i ka iwi* [bone burning] and my ancestors would not approve of this.
"Then she said, *ʻAole maluhia ka mea make.ʻ*
("The body will be without peace.)
"ʻE pono noʻoe e hoʻoponopono i ko ʻouko noho ana.ʻ
("Better hold a *hoʻoponopono* .)†
"ʻHoʻokuʻi kahi i loko o ka ʻohana.ʻ
("To make peace with the family.)
"ʻHolopono kau lawe hana ana no keia kino make.ʻ"

("Then your work for his body will be successful.")

"Then Auntie explained that the command not to cremate had come down from my great-great-grandfather. She told me that my brotherʻs body must be buried in the ground or in the deep ocean. She said the reason he could be laid with the sharks was because his *aumakua* [ancestor god] was the *manō* [shark]. She said to give him to the shark was *kākūʻai."*[1]

After this conversation, Kolokea had called the California mortuary, cancelled the request for cremation, and arranged to have her brother's body flown here for funeral services. With this done, she had time for personal grief, for thought, for questioning. Why was cremation so terrible? Was this merely a family prejudice? Or had she violated some widely accepted belief of old Hawaii?

The answers center around a single word: *lwi*. Bones.

Bones, sign of immortality

In the pre-Christian creeds of Hawaii, manʻs immortality was manifest in his bones. Manʻs blood, even bright drops shed by the living, was *haumia* (defiled and defiling). Manʻs body, when death made flesh corrupt, was an abomination and *kapu* (taboo). The *iwi* survived decaying flesh. The bones remained, the cleanly, lasting portion of the man or woman who once lived.

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[1] *Literally, "to give you to the god" so that the god *(akua)* or ancestor god *(aumakua)* can punish you.

† *hoʻoponopono,* a prayer-filled family gathering to restore harmonious relationships. Literally a "setting to rights." A major concept, discussed under *hoʻoponopono*.

*He died of measles during his visit.
**Defined in a following paragraph.

Even the bones of the living became symbols of the link between man‘s progenitors and his own eventual immortality. This symbolism is found in many of Hawaii‘s figures of speech. These and other *iwi* phrases are listed at the close of this section.

Respect shown bones of dead

The bones of the dead were guarded, respected, treasured, venerated, loved or even deified by relatives; coveted and despoiled by enemies.

Evidently, this respect was not limited to the bones of Hawaiians. When King Kamehameha II (Liholiho) was on his ill-fated trip to England* in 1824, he was taken on a tour of Westminster Abbey. There he refused to enter the chapel where the remains of Henry VII rested. Comments author Stanley Porteus, "...to a Hawaiian king used to the hiding of royal bones...the tomb...was not to be lightly profaned by the foot of a stranger."[1]

Reluctance to say final farewells to a beloved dead person often found expression in keeping the bones. At one extreme was *‘unihipili,* the deification of bones. In this, ritual practices kept the spirit of the dead alive in the bones. The *‘unihipili* spirit could be summoned to perform services for its *kahu* (master or keeper). This ritual and underlying concept are described under *‘unihipili*.

Verging on *‘unihipili* was the keeping of bones without deifying rites. David Malo provides the following account:

bones of loved secretly kept

"Sometimes a person would secretly exhume the body of a beloved husband or wife and remove the four arm and leg bones and the skull, washing them in water until they are clean. They were then wrapped up and enclosed within the pillow, and the friend [spouse] took them to bed with him and slept with them every night...These parts of the corpse were preserved by the fond lover until such time as the love came to an end..."[2]

Relatives might keep cleaned bones or perhaps the skull in a calabash hanging from the rafters, Mrs. Pukui adds.

bones emphasize individuality

This bone-keeping was one of several practices that indicate Hawaiian recognition of the uniqueness of the individual. Even bones of the dead retained individuality. The *‘unihipili* spirit was not an obscure, faceless mystical presence, but the spirit of a named and known person. To the bereaved lover, the bones in the pillow *were* the very personality of Aukele, she of the musical voice, or Kami, so stalwart and dignified. (Or, if one hated, he vented his spite-satisfaction by desecrating not merely "some bones" but the specific bones of Palakiko, sneering braggart, or of deceitful, wife-stealing Ahia.) Even in the role-conscious, family and group centered society of early Hawaii, individuality was strongly emphasized.

kākū‘ai sends dead to aumakua

In these bone-keeping, "I don‘t want to say Goodbye" practices, the living tried to prevent or delay the spirit‘s final entry into *Pō* (eternity). However, Hawaii also had a ritual to speed the spirit on its way. This was *kākū‘ai* (transfiguration). This ceremony not only sent the spirit to join its *aumakua* in *Pō;* it changed bones or body parts into shark or lizard or volcano flame of whatever form the *aumakua* might have. The dramatic ritual is described in the section, *kākū‘ai*.

It was this entrenched sense of *kapu* that Kolokea had offended when she ordered her brother‘s body cremated. Not only had she violated traditional ethnic beliefs about *iwi;* she had also disobeyed the handed-down edict of a family ancestor. Not all Hawaiians of the present run into such trouble. Today, one family may yet obey the old edicts. Another may have discarded or forgotten *kapus* against bone burning. The ashes of one Hawaiian surfer or fisherman may be scattered at sea; another‘s corpse may be dropped deep in the water.
How do family members decide what to do?

Mrs. Pukui outlines the custom generally accepted today:
"If a person specifies before his death that he wants to be cremated, then the family should follow his instructions. The wishes of the person who died supersede the old *kapus*. But if the person did not clearly specify cremation, then don‘t cremate.

"One reason Kolokea had so much *pilikia* with her family was because her brother didn‘t leave any instructions."

In Kolokea‘s case, bone burning or *puhi i ka iwi* merely incited the family quarrel. The basic causes were long-existing. One question the Committee asked was why the elder sister cursed Kolokea for breaking a *kapu* she did not know existed. Why did the sister refuse to explain or even listen to Kolokea?

Later, Kolokea had a talk with her sister and asked her this.

punahele treatment jealousy cause

This is what she learned:

Her immediate offense was failure to consult other family members, especially seniors, about funeral plans. This independent action flaunted the Hawaiian custom of family discussion and decision making. Also, said the elder sister, Kolokea had always been *hō‘oio* ("stuck up"). This feeling went back to the fact that Kolokea had been *hānai‘d* (given in the Hawaiian adoption practice) to her grandmother. Traditionally, the first born is *hānai‘d*. So, in all innocence, Kolokea had supplanted her sister. As the *hānai keiki* ("adopted" child), Kolokea had, in many ways, been treated as the *punahele,* the "favored child" of Hawaiian tradition. And to top off a jealousy-producing situation, Kolokea had enjoyed educational and economic advantages her siblings were not given.

So what seemed to be family discord over a *concept* was really based on both concept and total family situation.

Does *hihia* yet ensnarl the family? Is Kolokea yet under the *ʻānai* (curse) pronounced by her sister? How did this all end?

The ending is a happy one.

Kolokeaʻs anxiety about being cursed was lifted when the Committee reminded her that, traditionally, anyone innocent of wrong-doing need not accept and could not be harmed by a curse. (See *ʻānai*.)

hoʻoponopono modified

The talks Kolokea had with her sister led to frank exploration of longexisting differences between the two. The *hoʻoponopono* suggested by the great-great grandaunt was not held. However, the sistersʻ meetings incorporated some *hoʻoponopono* remedial measures: scrutinizing oneʻs own behavior and attitudes, forgiving and being forgiven, and making reparations for wrongs, or changing behavior. Kolokea is making an effort to be less impulsively independent and to become closer to her family. The sister and other siblings have indicated they will share the funeral expenses Kolokea had assumed. In Kolokeaʻs opinion, "My sister and I are closer than we have been for 25 years."
Kolokeaʻs persistence in arranging talks with her sister is interesting. At least three times the sister had refused to talk, even over the phone. Perhaps two other Hawaiian beliefs may have given Kolokea the impetus to mend this frayed relationship.

lawe i ka wa make

Kolokea tells of one such belief:

"When I was sitting there (by the corpse), my eyes went to my brother and I asked him to take everything away."

She was acting on the old belief that a recently deceased person can take away with him and, in effect, erase all family quarrels, curses, hurt feelings and even harmful *kapus*. This was called *lawe i ka wa make* ("take in time of death.")

quarrel ends over corpse

The other traditional practice was for family members to make up their differences before the funeral of a relative. The request that grudges be taken into eternity was traditionally spoken aloud. This and family peace-making were done over the dead body, before burial.
Kolokea followed both traditions in modified form. Yet the fundamental benefit of both remedial measures seems to have operated in this *iwi*-caused dispute of 1970.

phrases using or referring to bones

holehole iwi—stripping the bones of flesh. Once actually done, this "bone stripping" is now a figure of speech meaning to speak unkindly of relatives.
(see page 1 of *nīele*.)

iwi kanaka—human skeleton.

iwi koko—blooded bones; a living person.

iwi koko‘ole—bones without blood; a dead person.

iwi kua mo‘o—back bone or close relative; A chief‘s retainers were always relatives. Retainers guarded the chief from attempts on his life. Complete trustworthiness was required. Therefore, "back bone" took on the connotation of loyalty as well as kinship.

iwi loa—long bones; a tall person.

kaula‘i na iwi i ka lā—bleaching the bones in the sun. Such bleaching, literally done by an enemy or through carelessness, was an insulting practice. Figuratively, "mental exposure" or talking unnecessarily about relatives to non-family members. (see page 1 of *nīele*.)

kula iwi—literally, "land of bones." Used as birthplace, with the idea that "here my bones began."

"Na wai e ho‘ola i na iwi?"—literally "who will make the bones live?" By extension, "Who will take care of a senior relative?"

‘ōiwi—native son; native of the land. Very close to meaning of*kula iwi*.

"Ola na iwi"—"The bones live," or, figuratively, a senior relative is being given loving care by a family member. The phrase shows approval of the senior‘s condition or praise for the relative giving the care.

pela—the flesh and organs removed from a dead body and usually sunk in the ocean.

pūholoholo—in this context, steaming a corpse in a pit to facilitate removal of flesh from bones.

REFERENCES

1. Porteus. *A Century of Social Thinking in Hawaii,* p. 308.
2. Malo. *Hawaiian Antiquities,* pp. 98-99.
3. Kamakau. *Ruling Chiefs of Hawaii,* p. 217.
4. Fornander. *Collection of Hawaiian Antiquities,* Vol. 5, p. 212.

Pukui. "Featherwork."

Na Iwi Aumakua

“The morning star alone knows where Kamehameha’s bones are guarded.”

The desecration of the bones of Pae by ‘Umi. Kamakau, Ruling Chiefs of Hawai’i at 216. descendant of fishermen aumakua. Died and Umi wanted the bones for hooks. His sons hid them but ‘Umi got a kahuna from Kaua’i to find the bones. The kahuna found them and Umi used them for hooks and ‘Umi bragged to the sons. Feud ensued. Kahuna was Niho nui o Kua ka wai ea.

All desecration stories regard family members secretly hiding bones of loved ones so people wouldn’t use them as hooks, arrowheads for rat shooting, or other material. The Maui chief Kalaikoa built a house out of bones called kauwalua. People who would desecrate bones would often taunt the descendants of the bones.

There were thousands of chiefly lines in the time of Liholiho.

The general belief was that the bones of a ‘aia’ (irreligious) chief could never be hidden so that they could not be found. It was those who had not prayed to or worshiped the gods whose bones could not be hidden. Kamakau, Ruling Chiefs, 218.

When Kamehameha was on his death bed he commanded Ulumaheihei, whom he gave the name Hoapili, to secrete his bones in a place where they could not be found. Kamehameha’s bones by right belonged to the family of Keaweaheulu and therefore to the hidden burial places of its members, but Kamehameha doubted whether his family could keep the place secret, for the place where the bones of their father Keoua were hidden was pointed out on the cliffs of Ka’awaloa. In spite of the specialness of place and birth right considerations which were paramount in ancient Hawaii, Kamehameha knew that the successful hiding of the bones was even more important than an ohana’s burial site. Therefore he entrusted Ulumaheihei Hoapili to put his bones in a place which would never be pointed out to anyone. Kamakau, Ruling Chiefs, 215.

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Forested bioshields and tsunami impact mitigation in a Polynesian setting

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ABSTRACT

In the 21st century tsunamis have claimed the lives of over 250,000 individuals, and have caused extensive damage to vulnerable coastal ecosystems. This vulnerability continues to increase in many areas as human activity further degrades the coastal forests that once provided a degree of protection against storms and tsunamis, collectively known as high energy marine inundation events. This work presents a case study of the design and implementation of a forested bioshield established to protect a vulnerable wetland on Maui's south east coast. Although subject to coastal inundation, this ecosystem provides high quality habitat for numerous endangered species. Anthropogenic modifications around the wetlands, particularly the loss of the protective forest, have made this ecosystem vulnerable to future inundation events. Establishing an effective bioshield requires in-depth knowledge of both the frequency and intensity of inundation events, as well as effective tree species selection and their proper configuration within the bioshield. Here, we present palynological and archaeobotanical data from the studied wetlands, and combine this with local paleotsunami data, previously published data on forested bioshields, and traditional ecological knowledge to design, optimize and install an 8,000 m^2 forested bioshield, and review the wider benefits and limitations of this bioshield approach.

Introduction

In the aftermath of the CE 1998 Aitape, CE 2004 Indian Ocean and CE 2011 Tōhoku-oki tsunamis, there has been increasing interest in developing effective tsunami mitigation strategies. These three events caused loss of life exceeding 250,000 individuals, a dramatic reduction in economic productivity and extensive destruction to coastal infrastructure and ecosystems [1,2]. Nature based solutions (nbs), particularly reforestation in areas subject to inundation, provide significant promise in mitigating these and other high energy marine inundation (HEMI) events in the coastal zone [3,4,5].

Forested bioshields are a deliberately designed and created configuration of trees, shrubs and grasses aimed at slowing overland waves and bore velocity and reducing sediment transportation during HEMI events. Records of coastal communities planting forests to provide protection from HEMI events, which include storms and tsunamis, date to the Edo period (1603–1867 CE) in Japan [6,7]. Tsunami surveys in the aftermath of both the Aitape and Indian Ocean tsunamis provided critical data on the role that specific tree species and their configuration in the landscape played in mitigating tsunami impacts on coastal communities [8,9]. In addition to Japan, the countries of Thailand, India and Sri Lanka have now designed and planted coastal forests with the specific goal of reducing future tsunami impacts [10,11]. To date, these approaches have not been adopted in Pacific Island countries, despite historical evidence for extensive forested coastal areas [12,13,14].

Forested bioshields can play a key role in preserving and perpetuating coastal ecosystems in two related ways. First, bioshields can mitigate flood wave energy and impacts and contribute to the protection of coastal ecosystems during HEMI [12]. Second, bioshields provide habitat and can enhance biodiversity through the design of an appropriate species mix with indigenous and endemic species [6]. To date there are few studies that document the process of designing and implementing a forested bioshield.

This paper describes the process of developing an approximately 8000 m^2 coastal bioshield at the Nu'u Refuge on the island of Maui, Hawai'i. This bioshield consists of 5 distinct sections of coastal dry forest

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consisting of indigenous, endemic and Polynesian-introduced tree and shrub species. The lengths of each section are constrained by the local geography, but are generally between 75 m and 200 m. The Nuʻu wetlands, also known as the Pūpuka wetlands (Fig. 1), are vitally important to the preservation of endangered and threatened Hawaiian waterbirds in two ways. First, the wetlands serve as important habitat for endangered and threatened species with numbers increasing annually there through intensive management. Second, these wetlands provide a link to Hawaiʻi Island, 52 km across the ʻAlenuihāhā channel, helping to ensure populations on each island do not become genetically isolated. The

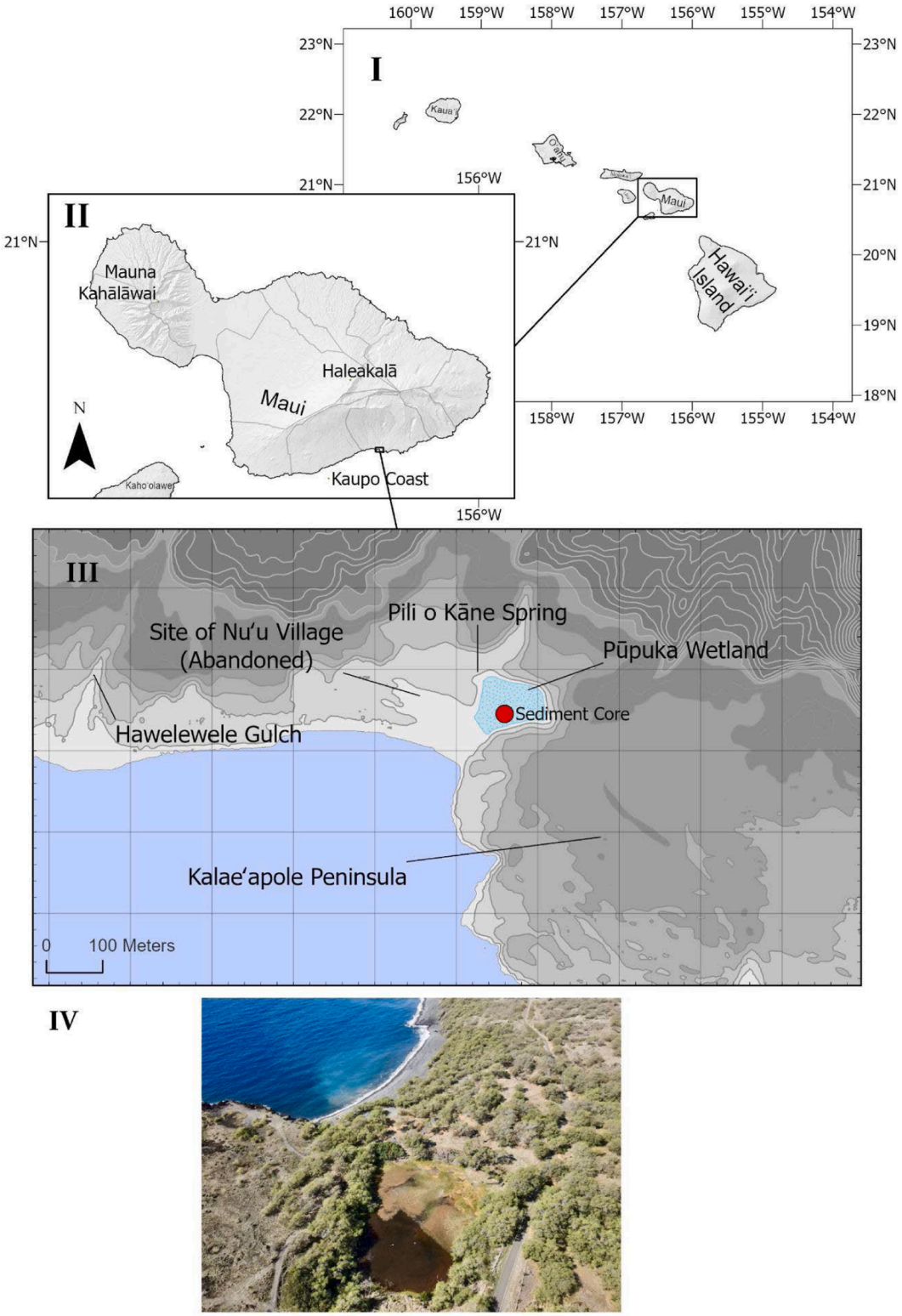


Fig. 1. Map of the Hawaiian Islands and the Nuʻu Refuge with sites mentioned in the text. The red dot in panel III indicates the sediment core extraction site for the pollen study. The Pūpuka wetlands are visible in the bottom center of panel IV. Note that the trees in this photo surrounding the pond are phreatophytic *Prosopis pallida* and are known to modify ecosystems and desiccate the landscape, and are not suitable bioshield trees Photo: Hawaiʻi Land Trust.

species composition of the bioshield drew on both paleoenvironmental research (described here) and from extant species in the area. Because coastal ecosystems in the Hawaiian Islands have experienced near-complete anthropogenic modification, paleoenvironmental data plays a key role in reducing the epistemological gap in forest restoration [15,16]. The use of these data sources ensured appropriate species composition and function and contributes to the ecological resilience of the restored ecosystem [17].

While field research at Nuʻu, covered in the methods section, provided insights into the candidate species for inclusion in the bioshield, traditional ecological knowledge provided important insights into the specific configuration of these species. Research data on the frequency and intensity of high energy marine inundation events also contributed to the specific design of the bioshield at Nuʻu. Additionally, aspects such as sediment transport rates, minimum flow velocities, inundation distances and minimum wave heights, derived from paleotsunami research, tsunami modelling and historical accounts, provided crucial data for designing the most efficacious bioshield configuration [18]. The results provide details on the design configuration of the bioshield, informed by previously-published numerical modeling and post-tsunami surveys (specific (numerical) modeling of the bioshield presented here lies beyond the scope of this paper, but is the subject of ongoing research at the Nu'u site).

Study area

The Nuʻu Refuge

The traditional Hawaiian land division, or *ahupuaʻa*, of Nuʻu lies along Maui's south east coast, at the foot of Mauna Haleakalā, an approximately 1.2 MA shield volcano which is the larger of Maui's two volcanoes (Fig. 1) [19,20]. The earliest evidence of human activity in the area dates to the 15th century, when the early community mainly practiced fishing and farming of sweet potato [21,22]. The 32-hectare Nuʻu Refuge was purchased by the Hawaiʻi Land Trust in CE 2011 in order to restore wetlands habitat in the refuge's Pūpuka wetlands, protect important cultural sites, and to provide educational opportunities to students of all ages [23].

The Nuʻu Refuge consists of three distinct sub-units. The first includes a 6.5 hectare coastal plain approximately 2 m above mean sea level (amsl) with the substrate made up primarily of waterworn cobbles, boulders, colluvial soils, and relatively abundant marine material, particularly coral clasts. Most of this area consists of the former site of Nuʻu village (Fig. 1). The majority of the forested bioshield discussed here lies within this coastal plain. A columnar basalt escarpment approximately 7–10 m amsl surrounds this coastal plain and separates it from the uplands above the Nuʻu Refuge. From the mid-19th century until April of CE 1946 the settlement of Nuʻu consisted of between 6 and 8 homes at various times. Residents of Nuʻu village participated in cattle ranching, fishing and salt production.

The second sub-unit includes the 2.5-hectare Pūpuka palustrine discharge (spring-fed) wetlands and lies immediately to the east of the coastal plain. A survey of this wetland indicated that it remains among the healthiest coastal wetlands in Hawaiʻi [24]. Indigenous and endemic flora and fauna continue to thrive in the wetlands, with indigenous flora, mainly consisting of sedges, dominating the wetlands. However, the riparian edge of the wetlands consists of highly aggressive invasive species such as the phreatophyte *Prosopis pallida*, locally known as *kiawe*, which tends to lower the water table through its deep tap roots [25].

The third unit, Kalaeʻapole, consists of a 20-hectare geologically young (ca. 1160 ± 50 BP) *aʻa* lava flow which lies to the east of the Pūpuka wetlands [26]. Vegetation on this unit remains relatively sparse due to the lack of adequate soil, although cultural features consist of two historically significant trails as well as permanent and temporary habitations. Kalaeʻapole also marks the highest point of the refuge, at approximately 20 m amsl.

The environmental and tsunami history of Nuʻu

Establishing an effective bioshield requires a detailed understanding of the disturbance history of a site to establish the relationship between past events and the potential for future inundation. For tsunami-affected areas the most critical information includes the intensity and frequency of inundation. Paleotsunami studies conducted at Nuʻu indicate that at least 6 tsunamis have impacted Nuʻu over the past approximately 350 years, with 5 of these significant enough to leave sedimentary and other signatures in and around the Pūpuka wetlands (Table 1). [18] The largest tsunami appears to have occurred sometime in the prehistoric period, likely between the late 17th and late 18th century. This event witnessed run-up heights exceeding 10 m and transported both coral boulders and clasts as well as water worn cobbles and boulders at least 251 m inland [27]. Additionally, calculations of minimum flow velocities based on the transportation of the coral boulders range between 1 m/s and 5.5 m/s. Modeling of this event suggests a local, as opposed to a trans-Pacific, source, most likely from a submarine landslide in the nearby ʻAlenuihāhā channel [27].

Analysis of sedimentary deposits in the Pūpuka wetlands revealed evidence of HEMI impacts (likely tsunamis) in CE 1837, CE 1891, CE 1946 and CE 1960 [18]. Although these appear to have been substantially smaller than the local event described above, collectively they have deposited approximately 114 cm of sediment into the Pūpuka wetlands since CE 1837. Tsunami deposits from the CE 2022 Hunga-Tonga Hunga Haʻapai were also recorded along the shoreline, although waves from this event did not reach the Pūpuka wetlands [28].

Damage at Nuʻu in the aftermath of the April 1st CE 1946 Aleutian Islands tsunami precipitated the abandonment of the village. Additionally, the river mouth of the nearby intermittent Hawelewele stream avulsed during this tsunami, pushing cobbles and boulders towards Nuʻu causing the shoreline of Nuʻu bay, including the area fronting the Pūpuka wetlands, to accrete by an area of about 2.4 hectares and approximately 60 m seaward since CE 1946 (Fig. 2, Table 1).

Maui has a well-documented history of both tsunami impacts and regular intense seasonal storms. While the last hurricane to impact Maui directly occurred in CE 1871, and a tropical depression in CE 1980 caused severe damage along many coastal areas, their impacts at Nuʻu remain unclear (Table 1) [29]. Regular southerly (*kona*) winds and seasonal storms passing nearby are known to impact Maui's coast, including around Nuʻu. The extent of sedimentary deposition or geomorphological changes along the Nuʻu coast due to these events remains unknown.

The preservation of healthy coastal reefs, common along the majority of Maui's coast, represents one of the most effective means of enhancing the efficacy of a terrestrial bioshield. Although it lies beyond the scope of this study, numerous researchers have provided a coherent justification for the maintenance of healthy coral reefs for wave energy dissipation and coastal protection [30,31]. However, due to its geological youth, Nuʻu lacks a fully developed fringing reef which might provide protection to the Pūpuka wetland.

Justification and goals

Forested bioshields represent a cost-effective and ecologically appropriate means of protecting coastal ecosystems, particularly wetlands, from HEMI events, with the estimated establishment cost of the Nuʻu bioshield ranging from just over $212,000 to approximately $290,000, or under $37.00/m^2 (Sup. Table 1, estimated in 2025 US dollars) [32]. The strategy adopted here applies a process-based approach for the protection of wetlands ecosystems. Process-based strategies focus on the root-causes of degradation and habitat loss [33]. While HEMI are important ecosystem modifiers, their impact can be exacerbated by anthropogenic pressures and disruptions: the reality of anthropogenic modifications to coastal ecosystems, particularly wetlands, both across the Hawaiian Islands, and at Nuʻu underlies the

Table 1
Anthropogenic changes and natural disasters at Nu'u, 16th century to present.

Date	15th-17th c.	18th c.	19th c. (1800–1850)	19th c. (1850–1900)	20th c. (1900–1950)	20th c. (1950–2000)	21st c.
Tsunami	post-1671		November 1837	June 1891	April 1946	May 1960	January 2022
Storm (tropical depression or hurricane)				August 1871		January 1980	
Headland Avulsion					Post-1946	➡➡➡➡	➡➡➡➡➡➡
Shoreline accretion					Post-1946	➡➡➡➡	➡➡➡➡➡➡
Anthropogenic modifications	Arrival of humans in the Kaupō district; preliminary cutting of forest begins	Ungulate introduction (cattle and goats); intensification of forest clearance		Construction of the ship landing at Nu'u; commercial production of salt for shipment		Use of Pūpuka wetlands by Kaupō Ranch to water cattle prior to off-island shipment	January 2011 The Hawai'i Land Trust purchases the Nu'u Refuge. Bioshield implementation begins October 2022

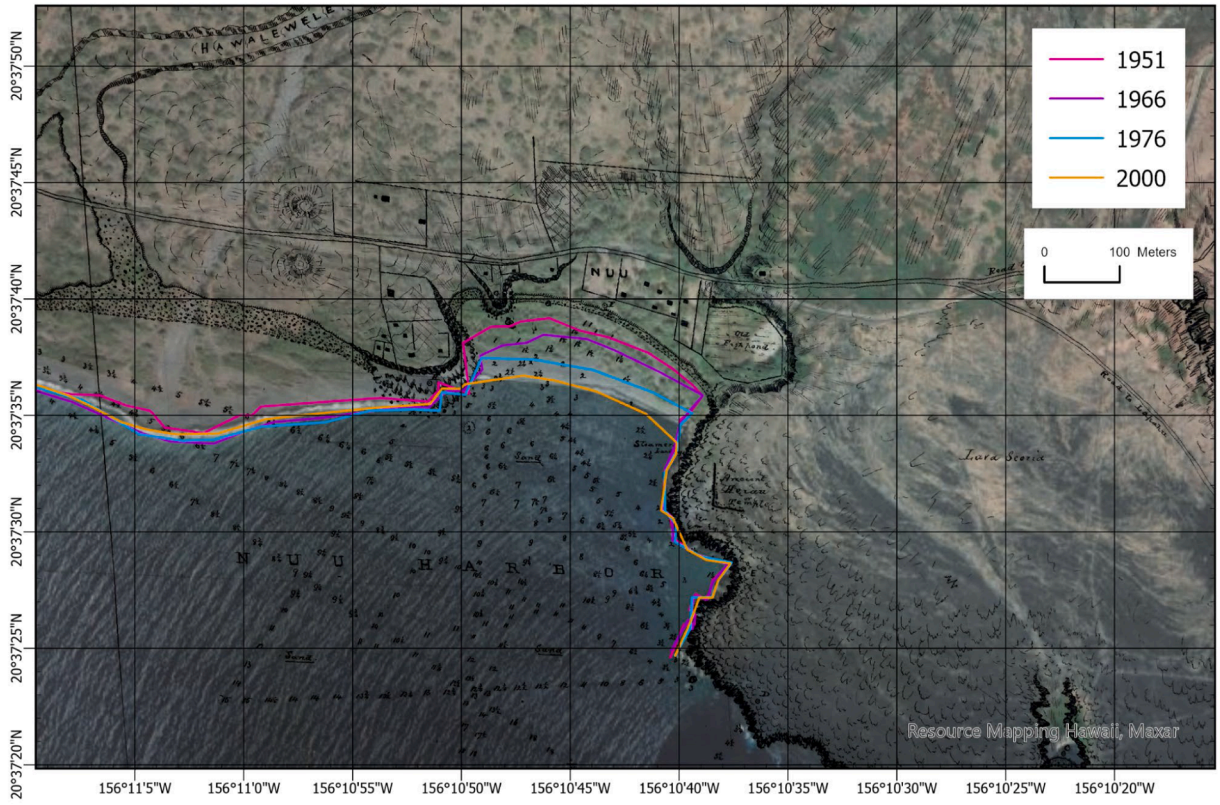


Fig. 2. 1882 Jackson Map of Nu'u, Kaupō, overlaying a contemporary Google Earth image showing geomorphological changes along the coast. Colored lines indicate decadal intervals showing coastal accretion by year. Google Earth v. 7.3 20° 37' 25″ N 156° 10′50″ W°.

need for ecological restoration [34].

The necessity of protecting these vulnerable ecosystems through the establishment of forested bioshields derives from three related anthropogenic conditions found in Hawai'i today. Specifically, the loss of forests that once provided a measure of protection to coastal ecosystems by reducing sediment transportation into these systems; the transformation and loss of coastal wetlands in Hawai'i over the past 200 years; and the resulting steep decline in waterbird numbers which has resulted in 6 of Hawai'i's 7 waterbird species designated as threatened or endangered [14,35].

Over the past 200 years, anthropogenic modifications to coastal wetlands in Hawai'i, including vegetation changes, infilling, and nearby urban development, have degraded these ecosystems making them especially vulnerable to coastal inundation events [36,37]. Coastal wetlands also provide critical habitat for Hawaiian waterbirds, and their modification and loss has contributed to steep declines in waterbird populations [36]. Coastal inundation from HEMI events, although they are natural, pose a threat to these vulnerable ecosystems at a time when the cumulative impacts of anthropogenic modifications to coastal wetlands necessitate the protection of the healthiest of these remaining ecosystems. At Nu'u specifically, the ecological health and integrity of the Pūpuka wetlands, including its resident and visiting population of endangered Hawaiian waterbirds, the cultural significance of Nu'u, and the role of the wetlands as a transit point between Maui and Hawai'i Island, make its protection from HEMI events a high priority, driving the design and planting of the forested bioshield.

The goal of this research lies in the establishment of a forested bioshield at the Nu'u refuge in order to enhance the protection of critical

habitat at the Pūpuka wetlands from HEMI events. Anthropogenic modifications of the former diverse and extensive coastal forest at Nuʻu has made the Pūpuka wetlands particularly vulnerable to future HEMI events. The bioshield design employs the species that once thrived in this area, while configuring them in a specific format to maximize protection of the Pūpuka wetlands. The specific structure of the bioshield includes design considerations such as vertical layering, forest width and planting density, arboreal characteristics and aspects of species selection. Forest width, planting density and vertical planting dimensions in particular are informed by previously-published numerical modeling for HEMI events at various coastal sites, while the employment of specific arboreal characteristics derives from post-tsunami surveys carried out at other relevant sites.

Establishing the design pattern described below involved two primary strategies. The first included the structural design of the bioshield given both the stated goals and the inherent limitations of nature-based disaster risk reduction strategies. Bioshield design limitations include both the physical terrain and topography as well as social-ecological aspects, as discussed below. Methods employed in this research included an extensive review of the published literature on both bioshield design and the arboreal characteristics of candidate tree species for inclusion in the bioshield. The second research strategy involved the collection of field data at Nuʻu. Field research consisted of investigations into both the paleotsunami/storm history of the site, as well as research into the historical ecology of Nuʻu. The former strategy was used to characterize anticipated tsunami and storm frequency and intensity and the latter to establish a list of candidate species for inclusion in the bioshield.

Ecological restoration involves the process of restoring the structure, function and composition of an ecosystem through the use of reference ecosystems to determine the historical trajectory of a site [38]. The goal of these practices, among others, lies in enhancing the productivity, biodiversity and resilience of the ecosystem. Forested bioshields in coastal areas provide restoration practitioners an opportunity to enhance the resilience of a restored ecosystem by manipulating the structure (and possibly function) in order to prevent damage to adjacent ecosystems. In this case, the restoration and creation of the forested bioshield at Nuʻu enhances the resiliency of the nearby Pūpuka wetlands. The research presented in this work provides a method for using paleobotanical data (in the form of pollen assemblages and recovered archaeobotanical samples) to select the species used to populate the bioshield. The precise location these trees and shrubs occupy within the bioshield requires detailed knowledge of the arboreal characteristics of these trees.

This study is limited by the relatively small area covered by the bioshield (approximately 8000 m^2) relative to the total area impacted by HEMI events. The relatively small size of the Pūpuka wetlands, as well as its disproportionate importance, make it an ideal location to research the efficacy of coastal bioshields as well as the economic feasibility of such work at sites of ecological importance across Hawaiʻi, and small islands more broadly. While numerical modeling of tsunami impacts on the Nuʻu bioshield lies beyond the scope of this paper, research is currently underway to gauge the efficacy of the configuration presented here. However, it should be noted, however, that numerical modeling informed the design of the bioshield based on the specific characteristics of the tree species used to populate the bioshield [4,7,13]. While this is a limitation, this paper focuses on the conceptual and design approach which in later research will be tested by numeral modeling.

Methods

Literature review

With the increase in interest in tsunami mitigation strategies, a substantial body of literature has emerged describing the necessity of understanding both the goals and the limitations of bioshield establishment [3,5]. Much of the published literature addresses specific elements of bioshield design and the incorporation of topographical features on the landscape which might enhance the efficacy of the forest [39,40]. Data sources included results of numerical modeling of bioshields and the inundation response of specific tree species [9,12].

The survey of the relevant numerical modeling literature facilitated the creation of a specific design pattern for the Nuʻu bioshield. Additionally, the design of the bioshield derived from reports of post-tsunami surveys of affected forests (and individual tree species response to inundation), as well as models of forest-wave interactions conducted under laboratory conditions [9,10]. This pattern addressed issues with the vertical dimensions of the bioshield as well as design considerations such as forest width and planting density, the desired arboreal characteristics for inclusion in the bioshield and the selection of ideal species for Nuʻu [41].

The literature survey also included compiling information on traditional Hawaiian uses of candidate bioshield species in order to characterize the relative strength (or flexibility) of various tree species. [42] This application of traditional ecological knowledge also proved important for better understanding how particular trees would withstand HEMIs. Data derived from this literature review were then used to establish the placement of particular tree species within the bioshield complex.

Field data

Field work focused on three primary tasks. The first involved the use of multi-proxy strategies to establish both the recurrence interval and the intensity of tsunamis at Nuʻu [18]. The second involved the recovery of palynological and archaeobotanical data to assist in the reconstruction of prehistoric floral species composition of plant communities at the site, as described below. The third component of field work involved identifying the most appropriate species for inclusion in the bioshield as a function of stem diameter. This last step required the collection of average tree diameter at breast height (dbh) for candidate species.

Due to the near complete transformation of low elevation Hawaiian ecosystems since the arrival of humans to the Hawaiian Islands there are significant gaps in our understanding of the historical ecology of Nuʻu [15,16,43]. Similarly, nbs involving the restoration of natural processes requires an effort to understand the pre-disturbance structure, composition and function of the pre-modified environments. Typically, this involves identification of a reference or pre-disturbance state to guide restoration work [38]. In areas lacking reference ecosystems, such as coastal Maui, paleoecological research provides important insights into past species composition [38,44]. For the Nuʻu bioshield both palynological and archaeobotanical data proved critical in determining the optimum bioshield composition.

Pollen analysis

Seven sediment samples were sub-sampled from a 54 cm long sediment core extracted from Pūpuka wetlands (Fig. 1), and prepared for pollen analysis at the Palynology Laboratory, Texas A&M University, College Station, Texas, USA. After thoroughly mixing the sample bag contents,10 gram subsamples were taken. 18,500 grains of *Lycopodium* were added to estimate pollen concentration. Treatment with 10 percent hydrochloric acid to reduce carbonates was followed by a swirl-and-decant step to reduce the heavier matrix fraction of greater than 180 μm. This was followed by a reduction with a hydrofluoric acid treatment lasting approximately 20 h in order to reduce silicate content. Subsequent steps included heavy liquid flotation in zinc bromide (with a specific gravity of 1.9) followed by acetolysis to reduce organics in the samples. The remaining residues were washed with water and alcohol, stained with safranin, and suspended in glycerol prior to mounting on slides for counting with a viewing power of 1000X on an Olympus BHTU compound microscope.

Archaeobotany

A total of 21 wood samples collected from the Pūpuka wetlands were analyzed at the International Archaeological Research Institute, inc. (IARII) in Honolulu, Hawai'i. The freshly fractured transverse, tangential, and radial facets of the archaeobotanical fragments were examined with the aid of a dissecting microscope at magnifications of up to 90X. Taxonomic identifications were made by comparing observed anatomical characteristics with those of woods in the IARII reference collection.

Data collation and integration

The tsunami chronologies which established the tsunami recurrence interval used a variety of dating methods, including U-Th, [14] C, ^{210}Pb and ^{137}Cs as well as historic accounts. [45,46] Characterizations of tsunami intensity included sediment transportation and deposition, run-up heights, inundation distances and minimum flow velocities [18, 27]. Both the pollen and archaeobotanical analysis of wood samples collected from the six trenches dug at various locations around the Pūpuka wetlands contributed to the establishment of the past floral composition of the Nu'u Refuge. The collection of pollen and wood fragments in the wetland sediment at Nu'u contributed to re-establishing the historical floral composition of tree and shrub species and contributed to an expansion of appropriate species for inclusion in the bioshield (Tables 1 and 2). The palynological surveys and the archaeobotanical analysis of wood fragments from the Pūpuka wetlands revealed 21 species that do not currently occur around the Pūpuka wetlands today but did so in the past.

Tree and shrub inclusion in the bioshield was determined using five criteria. First, all bioshield species were required to be indigenous, endemic or Polynesian introduced, in order to avoid the inadvertent introduction of invasive, ecosystem-modifying species [47]. Second, in order to maximize survivability and to ensure ecological appropriateness, species must have occurred at Nu'u in the past, or be extant within 10 km of the Refuge. The third criterion considered the arboreal characteristics of wood and leaf density as well as tree main stem flexibility. These criteria were often determined by cultural practices or observations associated with a tree or shrub species, as described in Tables 3 and 4. A fourth closely related criterion was based on the ability of a candidate tree or shrub species to capture and retain sediment and reduce flow velocity through the bioshield [5,48]. The fifth criterion included the stature of candidate tree species. This step required the compiling of data on the average mature height and diameter of extant individuals of candidate species on the island of Maui, as described in Table 3.

Results

Structural design of the bioshield

Maximizing the efficacy of a forested bioshield falls into two broad categories, specifically abiotic and biotic design considerations. Abiotic factors include such dimensions as the local bathymetry, coastline profile and headland geomorphology [49,50]. Bioshield design seeks to protect, rather than relocate (which is typically not possible or practical), certain assets from HEMI events. While coastal bathymetry or geomorphology may change over time, typically such geomorphological shifts take decades to centuries, and are both stochastic and relatively unpredictable. Considering this, abiotic dimensions are best understood as a set of independent variables which influence the efficacy of bioshield design but remain difficult to prepare for, or predict. One challenge of bioshield design at Nu'u stems from the known geomorphological changes along the coast at Nu'u (Fig. 2). While the coast has accreted over the past 78 years, bioshield design considerations should allow for the possibility of a reversion to erosional processes.

Table 2
Pollen present in sediment cores from the Pūpuka wetlands. Note that both Casuarina and Prosopis are historical introductions arriving in Hawai'i in the 19th century [25]. *Cocos nucifera* arrived with the early Polynesian community, likely after CE 1000. The remaining species are indigenous or endemic.

Stratum	Depth (cmbs)	Grains per gram	Types per sample	Percent		Trees							Herbs and Shrubs																Ferns	
				Degraded	Unknown	*Acacia*	*Casuarina*	*Cocos nucifera*	*Myrsine*	*Prichardia*	*Prosopis*	Asteraceae, high-spine	Asteraceae, low -spine	Brassicaceae	Cheno-Am	Cyperaceae	Euphorbiaceae	Fabaceae	Liliaceae	Malvaceae	*Nama*	Poaceae	Poaceae, large	Solanaceae	Triletе spore	Monolete spore
II	11-14.5	370,000	14	5.5			0.5		2.0		5.0	0.5	4.0	1.5	9.0		0.5	52.5		0.5		15.0	2.5	0.5		0.5
III	20-26	12,759	12	6.0	0.5				1.5		1.0	3.5	4.0		11.5		1.0	9.0		0.5		51.0	2.0		3.5	5.0
III	26-33	14,800	10	7.0	2.0				0.5	1.0		3.5	4.0		10.0			5.0				50.0	7.5		4.5	5.0
IV	34-39	14,800	15	8.5	2.0	0.5		1.0	2.0	0.5		4.0	5.0		11.5		0.5	3.5	0.5	0.5		47.0	1.5		2.5	9.0
IV	39-43	12,759	12	14.5	2.0	0.5			1.5			4.5	4.5		11.0	0.5	2.5	1.0			0.5	48.0			3.0	6.0
V	46-51.5	24,667	9	9.5								0.5	15.0		51.0	0.5	3.0	2.0		1.0		16.5		1.0		
VI	51-54	41,111	9	5.5								3.0	8.5		56.0	1.0	3.5	1.0		0.5		20.5			0.5	

Table 3
Wood specimens recovered from tsunami debris in the Pūpuka wetlands.

Test Unit	Depth	Species	Notes
Nu-5	76 cm	Possibly *Psydrax odorata* (*alahe'e*)	indigenous
Nu-5	80 cm	*Antidesma pulvinatum* (*hame*)	indigenous
Nu-5	80cm	*Artocarpus altilis* (*'ulu*; Breadfruit)	Polynesian introduced
Nu-6	80 cm	*Metrosideros polymorpha* (*'ōhi'a*)	endemic
Nu-6	76cm	Indeterminate, likely *Cordia subcordata* (*kou*) or *Broussonetia papyrifera* (*wauke*)	indigenous (*kou*) or polynesian introduced (*wauke*)
Nu-6	99 cm	*Metrosideros polymorpha* (*'ōhi'a*)	endemic
Nu-6	103 cm	*Coprosma* spp. (probably species *sandwichiana; Mai'a pilo*)	endemic; currently found at Nu'u
Nu-6	103 cm	Euphorbia celestroides (*'ākoko*)	endemic
Nu-7	27 cm	*Artocarpus altilis* (*'ulu*; Breadfruit)	Polynesian introduced
Nu-7	76 cm	*Nothocestrum* cf. *latifolium* (*'āiea*); other samples indeterminate	endemic
Nu-7	87 cm	*Metrosideros polymorpha* (*'ōhi'a*); Lagenaria siceraria (*ipu*)	endemic
Nu-7	103 cm	*Lagenaria siceraria* (*ipu*); Indeterminate	Polynesian introduced
Nu-7	103 cm	*Lagenaria siceraria* (*ipu*); Syzigium malaccanse (*'ōhi'a 'ai*), k*auila* (*Alphitonia ponderosa*), indeterminate	*ipu*-Polynesian introduced; *'ōhia 'ai*-endemic, *kauila*-endemic
Nu-7	113 cm	*Euphorbia celestroides* (*'ākoko*); *Artocarpus altilis* (*'ulu*); indeterminate;	*'akoko*-endemic; 'ulu-Polynesian introduced
Nu-7	113 cm	*Chenopodium oahuense* (*'āweoweo*)	endemic, currently found at Nu'u
Nu-7	124 cm	*Euphorbia celestroides* (*'ākoko*); Indeterminate, possibly *Coprosma sandwichiana* (*mai'a pilo*); Indeterminate possibly *Polyscias sandwicensis* (*'ohe makai*); indeterminate	all endemic
Nu-7	112 cm	*Euphorbia celestroides* (*'ākoko*)	endemic

Biotic considerations constitute the dependent variable in bioshield design. Researchers have identified three primary biotic considerations in forested bioshield design. These include considerations of 1) the vertical dimension (i.e. how the structure and function of the bioshield changes as it matures); 2) forest width and planting density; and 3) arboreal characteristics of candidate bioshield tree and shrub species, especially foliage density, tree diameter and stem strength and flexibility [51]. Other factors which can influence the efficacy and durability of a bioshield over time include its compatibility with the values and needs of the community as well the overall goals of the site [3]. Communities who find little or no value in the bioshield are unlikely to take measures to maintain it over the course of generations, particularly as memories of a destructive event fade, an important consideration with infrequent, stochastic events such as tsunamis. Bioshield species which provide multifunctional uses such as material for weaving or which have medicinal value, are likely to receive additional care and attention from the nearby or local community.

Vertical dimensions of bioshield design

Optimal performance of a forested bioshield reduces both wave velocity and sediment transportation. Forests with only sparse undergrowth and branches permit both, requiring the inclusion of high density vegetation throughout the bioshield [5]. Anjum and Tanaka note that both wave height and flow velocity increase as the wave contacts the leading edge of the forest and water begins to cascade over the tree canopy [12]. Establishment of vertical double layered vegetation (VDLV) helps to avoid the scouring and sediment transportation that occurs in this process.

While Anjum and Tanaka noted a 5 % reduction in flow velocity between VDLV and vertical single layered vegetation (VSLV), a reduction from 45 % to 40 %, Rashedunabi and Tanaka note that VDLV reduced the fluid force between 23 % and 29 % compared to VSLV [12, 52]. The importance of VDLV is highlighted by the various functions different parts of the trees and shrubs play in the reduction of flow velocity. As Nomura et al. note, tree trunks perform an important role in reducing flow velocity during relatively slow flow regimes, while the canopy structure, particularly the drag caused by leaf density, tends to increase in importance during instances of faster flow [48].

Forest width and planting density

Forbes and Broadhead identified the vital role that forest width plays in dissipating energy through the generation of increased drag as water moves through the forest, noting it as the most important factor in bioshield design [5]. They note that simulations of waves moving through a 200 m forest reduced the hydraulic force of a 3 m tsunami by at least 80 % and the flow velocity by 70 % [5]. Harada and Imamura echo the importance of forest width, noting that it contributes to the reduction of inundation depth and current as well as the hydraulic forces associated with both [53]. Maximizing both trunk width and leaf density throughout the entire bioshield, by promoting horizontal density, contributes to this process. Tanaka reports a greater than 90 % reduction in tsunami flow pressure with the establishment of a forest of 100-m wide and tree density of 30 trunks/100 m^2 based on numerical modeling experiments [6].

An important consideration when planning for forest width involves the avoidance of gaps within the bioshields. Thuy et al. calculated the highest flow velocities within a 15-m wide gap in a bioshield [54]. This suggests that trees and shrubs should be planted close enough to avoid gaps and reduce wave velocity, while also maintaining sufficient distance between trees to allow them to achieve maximum diameter for that particular species. Depending on the individual tree species selected for inclusion in the bioshield, this could necessitate thinning of trees and shrubs as they mature.

Because gaps in the bioshield are often unavoidable, Wanger et al. suggest staggering the planting pattern to reduce the depth of any gap, or to ensure that gaps only occur on inclines, where wave energy will naturally dissipate [55]. Such design considerations should take into account the community who will benefit most from the bioshield, particularly as such efforts are meant to last over multiple generations. The type of tsunami (distant or near-source) likely to impact the bioshield also plays an important role when considering forest width and vegetation density. As Forbes and Broadhead note, densities of undergrowth vegetation and lower branches, achieved through the establishment of forest width, play an important role in reducing flow velocity for shorter period waves, such as those generated locally or regionally [5]. As described below, Nu'u is subject to both near and distant-sourced tsunamis, increasing the complexity of bioshield design considerations there.

Arboreal characteristics

The specific characteristics of the trees and shrubs which make up the bioshield influence the placement of species within it. As noted above, functional criteria for species inclusion included three related dimensions, including wood and leaf density of trees and shrubs, strength and flexibility of the tree main stem, and the ability of a tree or shrub to capture sediment and slow wave velocity. Mukherjee et al. note that wave reflection increases with tree rigidity [56]. For this reason, they stress the importance of placing species with the greatest wood density on the shoreward side of the bioshield in order to maximize wave reflection at the point of contact with the bioshield. However, because trees with greater flexibility provide a continuous increase of reflected energy as the flow progresses, they suggest pairing rigid tree species at the front of the bioshield with (relatively) flexible trees in the

Table 4
Candidate tree species for the Nu'u bioshield.

Tree	Scientific Name	Origin Status	Height at Maturity	Diameter at maturity	Position in bioshield	Invasive	Cultural Value	Cultural Uses	Description of Arboreal Characteristics and Structure	Area Appropriateness
Hala	*Pandanus tectorius*	Indigenous	3- 10 m	20 cm	Center apices of rhombus and back line	No	High	Leaves used for weaving	*P. tectorius* can achieve a spread of 4–5 m; aerial roots are strong and can act as sediment filters	Nearby (<10 km)
Hao	*Rauvolfia sandwicensis*	Endemic	3–10 m	30 cm	Seaward apex of rhombus	No	Medium	Used both medicinal and in religious ceremonies	*R. sandwicensis* has very dense and hard wood, and is known to spoil stone adzes	Nearby (<10 km)
Hame	*Antidesma platyphyllum*	Endemic	6–9 m	30 cm	Seaward apex of rhombus	No	High	Wood used as an anvil for beating fibrous plants	*A. platyphyllum* is a very dense, hard reddish-brown hardwood	Wood fragment in wetlands
'Iliahialo'e	*Santalum ellipticum*	Endemic	1–5 m	30 cm	Interior of the bioshield	No	Low	Best known for its fragrant wood	*S. ellipticum* often forms dense thickets	Not in area
Kamani	*Calophyllum inophyllum*	Polynesian Introduction	8–20 m	30–45 cm	Interior or landward rhombus apex	No	High	Used medicinally and to build canoes, calabashes and for home construction	*C. inophyllum* produces a hard wood with a deep root system	Archaeobotanical record (nearby)
Kauila	*Colubrina oppositifolia*	Endemic	5–13 m	Not available	Seaward apex of rhombus	No	High	Hard wood for weapons and kapa beaters;	*C.oppositifolia* is a very dense wood	Archaeological record; endangered
Keahi	*Sideroxylon polynesicum*	Indigenous	up to 10 m	25 cm	Interior of the bioshield	No	Low	No specified uses in Hawai'i;	*S. polynesicum* is known for its hard wood	Not known in area historically, agreed to be appropriate
Kolea	*Myrsine lessertiana*	Endemic	18 m	30–60 cm	Interior of the bioshield	No	Medium	Used for home construction, an anvil for making bark cloth	M. *lessertiana* sometimes presents as a shrub, but both trees and shrubs are stout	Palynological record
Kukui	*Aleurites moluccana*	Polynesian Introduction	10 −20 m	90 cm	Interior or landward rhombus apex	No	High	Seed oil used for light, medicine and for dying fabric	*A. moluccana* forms a spreading crown that can shade out the understory	Archaeobotanical record and nearby (<10 km)
Lama	*Diospyros sandwicensis*	Endemic	2–10 m	30 cm	Interior of the bioshield	No	Medium	Used in home construction	*D. sandwicensis'* thick trunk made it popular for home construction	found nearby (<10 km)
Loulu	*Pritchardia hillebrandii*	Endemic	6–7 m	15–25 cm	Interior of the bioshield	No	Medium	Frequently used for thatching of homes and other structures;	*P. hillebrandii* is a palm, and has flexible wood	Palynological record
Milo	*Thespesia populnea*	Polynesian Introduction	5–10 m	20–60 cm	Interior or landward rhombus apex	No	High	Fruits were used to make a yellow fabric dye; wood used for carving	*T. populnea* often forms more than one main trunk	On-site
Olopua	*Nestegis sandwicensis*	Endemic	8–25 m	20 cm	Interior of the bioshield	No	Medium	Wood used to make adze handles and other tools	N. *sandwicensis* is common in dry to mesic forests	Archaeobotanical record
'Ohe makai	*Polyscias sandwicensis*	Endemic	5–10 m; can reach 20 m	50–60 cm	Interior of the bioshield	No	Medium	wood used to make stilts	*P. sandwicensis* is known both for its hard wood	Archaeobotanical record and nearby (<10 km)

bioshield interior [56].

Tree breakage patterns comprise a second element of arboreal characteristics when considering bioshield design. Tanaka et al. point out that tree breakage patterns fall into two broad categories, the modus of rupture, in which stems, trunks and branches break due to the fluid force passing over and through them, and the modus of overturning, in which, through the combined force of both shearing and erosion, trees overturn as the tsunami wave passes through the bioshield [57]. Understanding the vulnerabilities of tree species to rupture or overturning during high intensity flow events therefore represents an important element of bioshield design.

Tree and shrub response to high energy marine inundation and the mode of their breakage derives largely from the standing structure of the tree species in question, including the crown height, the density of branches on the main stem and the diameter of the tree at breast height [6]. However, validating theories of tree breakage patterns (i.e. of tree breakage vs. overturning) requires destructive tests on mature trees, a method often not available to researchers, particularly for trees that no

longer commonly occur in an area [58]. Because this is often the case in Hawai'i, where candidate trees for inclusion in the bioshield are increasingly uncommon, reliance on traditional ecological knowledge provides an important alternative, as discussed below.

Specific characteristics of individual tree species also play an important role in bioshield placement. While the role that leaf and stem density plays in reducing flow velocity was mentioned above, structural elements, such as prop roots, which provide disproportionate strength relative to stem diameter, provide both arboreal stability while also filtering sediment of varying sizes. For this reason, mangroves, particularly those in the genus Rhizophera, as well as trees in the genus Pandanus have proven important for bioshield design, including at Nu'u, as discussed below.

Research conducted in the aftermath of the CE 2011 Tōhoku-oki tsunami has highlighted the importance of species diversity in the design and implementation of the bioshield. As Iwachido et al. note, species diversity is important in promoting functional complementarity and stability in coastal forests subjected to HEMI events [8]. Functional and response diversity play critical roles in both the selection of various species and their placement within the bioshield. Functional diversity in this case refers to the function different groups (i.e. trees, shrubs, etc.) within the bioshield contribute to upholding the performance of the system during episodes of high energy inundation. Similarly, response diversity in the context of bioshield function refers to the variety of ways individual trees and shrubs respond to inundation events [59]. Accumulated deadwood and wood jams, which add rugosity to the forest floor and reduce hydrological flow velocity, represents an important example of response diversity in undisturbed forest ecosystems.

Species selection in bioshield design

Species selection for inclusion in the bioshield came through an assessment of existing species in the region, as well as field work in the Pūpuka wetlands, including both palynological and archaeobotanical data. Extant indigenous, endemic and Polynesian-introduced species, as well as those identified in the historical record, were listed as candidate species for the bioshield. Arboreal characteristics, including the ability to reduce wave velocity, refract wave energy and capture sediment, along with traditional ecological uses, contributed additional criteria for inclusion in the bioshield.

Pollen

Twenty-one types of pollen and spores were identified (Table 2). In general, the assemblage reflected the coastal dry habitats of southern Maui [41]. Pollen concentrations generally were moderate to somewhat high (10,000 to 50,000 grains per gram); the sample from the top of the core had an extremely high concentration (370,000 grains per gram), possibly due to intensive cultural activity, depositional processes or the introduction of high-pollen producing non-native species (cf. *Prosopis pallida* and *Casuarina equisitifolia*). The number of species per sample consisted of fewer than 10 to 15 species per sample, while the percentages of degraded grains were generally fewer than 10 percent per sample. Overall, moderate pollen concentrations and types of grains per sample, and the relatively low percentages of degraded grains suggested good preservation. The data were therefore considered as giving a reasonably accurate reflection of the original pollen assemblage.

Grass or Cheno-Am pollen dominated nearly all samples, with the uppermost strata consisting mainly of species in the pea family (*Fabaceae*). Plants in the Asteraceae family and fern spores were subdominants. In general, the composition of the assemblage reflected dry grasslands with abundant shrubs, a condition similar to that found at Nu'u today. *Niu* (coconut) constituted the only Polynesian introduction observed in the pollen record, while *C. equisitifolia* and *P. pallida* reflect historical introductions, after CE 1778. It is possible that occasional large grass pollen grains represented rice and/or sugarcane farming in the area, or the cultivation of *pili* (*Heteropogon contortus*) a species known to be used by Hawaiians for thatching [60]. Distinguishing these species is difficult as rice, sugar cane and *pili* pollen grains have common traits under light microscopy and are indistinguishable.

Previous research at Nu'u has demonstrated that the recovered pollen grains represent depths corresponding to the mid-20th century [18]. However, photos of Nu'u from this time period show a near-complete dominance by that time of *P. pallida* [61]. Considering this nearly complete transformation of the coastal forest at Nu'u in the 19th and 20th century, the deposition of the pollen likely occurred much earlier than this time period and experienced reworking during later tsunami inundation.

Archaeobotany

Wood samples recovered from the Pūpuka wetlands during field work in 2022 are listed in Table 3. Examination of the archaeobotanical samples from Pūpuka wetlands revealed high taxonomic diversity. These samples were collected from tsunami deposits presumed to be associated with the CE 1837, CE 1946 and CE 1960 tsunamis [18]. Dating of this material using AMS ^{14}C ranged from the mid-17th century to the first half of the 20th century. Ten unique genera were identified from twenty-one samples examined. The most abundant taxon (by weight) was Euphorbia (*'akoko*) with over 300 g present within four samples. Other taxa identified include: cf. *Alphitonia* ponderosa (*kauila*), cf. *Antidesma* sp. (*hame*), *Artocarpus altilis* (*'ulu*), *Chenopodium oahuense* (*'āweoweo*), *Coprosma* sp. (*pilo*), *Lagenaria siceraria* (*ipu*), *Metrosideros polymorpha* (*'ōhi'a lehua*), *Nothocestrum* cf. *latifolium* (*'aiea*), and *Syzygium malaccense* (*'ōhi'a 'ai*). Among the archaeobotanical remains two wooden artifact fragments were also present. The fragments are conjoining pieces of a digging stick (*'ō'ō*) made from *kauila* wood. This species is known as a very hard wood and one of its many known uses is for digging sticks [60]. The *'ō'ō* tip has been modified into a sharpened point and adze marks are visible across the exterior surface of the artifact from manufacturing. The recovery of *C. oahuense* represents the only overlap between the species identified in the pollen record and the archaeobotanical record.

The tool described above showed obvious cultural use patterns, suggesting the possibility of anthropogenic transportation. While its parent tree was considered for inclusion in the bioshield, its presence raises the possibility of anthropogenic transportation into the wetlands and requires deeper investigation into its suitability for inclusion in the bioshield. Additionally, the possibility that some of the wood discovered in the Pūpuka wetlands arrived as shoreline driftwood, with secondary deposition occurring through a HEMI event, cannot be ruled out. A thorough review of the literature indicated the plausibility of each of these species thriving under the past environmental conditions of leeward, coastal Maui. [41,42,62] Using these criteria and the fieldwork described above, we compiled a list of 14 trees and 7 shrubs for possible inclusion in the bioshield (Tables 4 and 5).

Bioshield keystone species and cultural considerations

Certain species play an outsized role in the bioshield due to their arboreal characteristics, particularly their ability to capture sediment and reduce flow velocity. *Pandanus tectorius* plays such a role in the bioshield. Thuy et al. and Osti and Istiyanto identify Pandanus odoratissimus (a closely related species to the Hawaiian indigenous *P. tectorius*) as particularly effective at reducing wave velocity and capturing sediment due to the complexity of the prop root and branch system which creates a dense vertical structure in a forest context (Fig. 3) [10,54]. Tanaka notes the utility of *Pandanus*, pointing out that its shade tolerance allows it to grow well within a diverse forest setting [6]. In field surveys after the 2004 Indian Ocean tsunami, Tanaka et al. noted that Pandanus withstood tsunami waves up to 5 m even when those waves also transported debris [63]. Notably, under tree breaking

Table 5
Candidate shrubs for inclusion in the Nu'u forested bioshield.

Shrub	Scientific Name	Origin Status	Height at Maturity	Position in bioshield	Invasive	Cultural Value	Cultural Uses	Description of Arboreal Characteristics and Structure	Area Appropriateness
A'ali'i	*Dodonoea viscosa*	Indigenous	2–8 m	Paired with bioshield trees	No	High	House posts and digging sticks	*D. viscosa* is a dense shrub with durable wood; noted for its ability to withstand strong winds	Archaeobotalnical Record
Akia	*Wikstromia monticola*	Endemic	1–3 m	Paired with bioshield tres on lava terrain	No	Medium	Bark used to make fiber rope	W. *monticola* typically has a spread of just over 1 m	Currently on property
Akoko	*Chamaesyce olowaluana*	Endemic	2–9 m	Paired with bioshield trees; in fenced enclosures	No	Low	Limited, but a popular firewood	*C. oluwaluana* can reach heights of several meters, but is vulnerable to bark stripping by ungulates	Archaeological record, wood fragment in wetlands
Alahe'e	*Psydrax odorata*	Indigenous	3–6 m	Paired with bioshield trees	No	Medium	Tools for fishing and farming; black cloth dye	*P. odorata* prefers dry environments and is drought tolerant	Archaeological record, wood fragment in wetlands
Aweoweo	*Chenopodium oahuense*	Endemic	.5–2 m	Paired with bioshield trees	No	Low	Woody trunk used to make shark hooks	*C.oahuense* is drought tolerant and thrives in coraline substrates	Archaeological and palynological record, wood fragment in wetlands and currently on property
Hau	*Hibiscus tiliaceus*	Polynesian Introduction	2–10 m	Used judiciously in seaward area	Yes	High	Bark was used to make rope	*H. tileaceus* often forms dense thickets	Currently on property
'Ulei	*Osteomoles anthyllidifolia*	Indigenous	prostrate-3 m	Paired with bioshield trees	No	Medium	Spears, round fish nets, digging sticks	*O. anthyllidifolia* has a typical spread of 1–10 m; wood is known to be strong but pliable; gains height when subject to browsing	Nearby (<10 km)

(a) (b)

Fig. 3. (a) *Pandanus tectorius* in a forest setting on Maui, note the complexity of the branch system; (b) close up of the root system of *P. tectorius.* Photo S. Fisher.

conditions, the aerial roots remained and continued to contribute to sediment capture and reduction of wave velocity. During their survey in the aftermath of the Indian Ocean tsunami, Forbes and Broadhead point out that Pandanus forests 10 m wide reduced inundation distances by 24 % [5].

Hibiscus tiliaceus (known as *Hau* in Hawai'i) represents a species that, despite its demonstrated ability to mitigate high energy marine inundation events, should only be used judiciously in a forested bioshield due to its propensity to become an ecosystem modifying invasive species (Fig. 4). Forbes and Broadhead note that *H. tiliaceus* played an important role in reducing both inundation depth and hydraulic force of tsunami waves during the 1998 Aitape, Papua New Guinea tsunami [5]. Their research indicated that four *H. tiliaceus* trees covering 100 m^2 reduced the hydraulic force by approximately 67 %. *H. tiliaceus* tends to cover very large areas, making the land in which it grows effectively unusable for other purposes. However, in areas that are otherwise unusable, it can serve as a useful bioshield species.

Traditional cultural use represents an additional consideration for inclusion in the bioshield. Traditional uses include such applications as use for anvils (e.g. *hao: Rauvolfia sandwicensis* and *hame: Antidesma platyphyllum*), tool handles (e.g. *olopua: Nestegis sandwicensis*), or carved image production (e.g. *milo: Thespesia populnea*). Such information often, though not always, provided insights into the arboreal characteristics of a particular tree species. This facilitated an understanding of

Fig. 4. (a) *Hau* (*H. tiliaceus*) at Nu'u; an effective bioshield species that is also prone to becoming invasive. This grove measures 50 m long by 20 m deep. (b) close up illustrating the dense branch system. Photo S. Fisher.

the placement of particular species into their ideal location within the bioshield. Tables 3 and 4 provide a list of the cultural uses of bioshield tree and shrub species. In addition to examining the traditional uses of the bioshield species relating to aspects such as the solidity or malleability of the wood or the relative leaf density, other customary practices, particularly medicinal uses (*la'au lapa'au*) represent an important criteria for inclusion, mainly because it provided a value to the local community [42]. Creating value contributes to the perpetuation of the bioshield by future generations.

Summary of bioshield design

The bioshield design presented here is based on three primary sources of evidence. The first of these include a review of the published literature from appropriate numerical and wave tank simulations conducted under laboratory conditions [4,8]. Such wave tank studies use a simulated tsunami to inundate a model forest in order to better understand fluid-structure interactions [56]. We used these to determine the species required to reduce energy of the tsunami, and in particular the need for mixed species traits. For example, trunk strength to resist transport and enhance root and branch complexity at lower elevations, and to increase turbulent energy expenditure [12]. A second source of the bioshield design derived from published accounts from post-tsunami surveys describing tree species' response to tsunami inundation, with a special focus on Pacific Island and Indian Ocean settings [64]. We used these to refine the species lists relevant to Hawaiian coastal settings but also to 'ground truth' the wave tank experiments. in particular with field based evidence from the role of trunk strength (e.g. *Rauvolfia*), understorey complexity (e.g. *Dodonoea*) and root complexity (*Pandanus*). Finally, palynological and archaeobotanical research provided the suite of ecologically appropriate trees and shrubs to the area (Fig. 5).

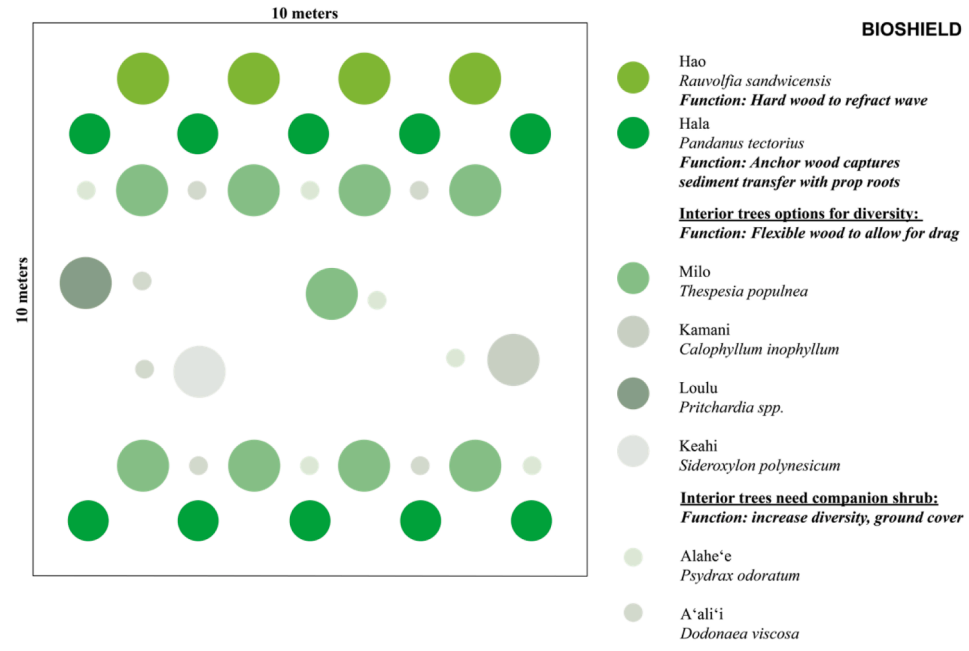
While a number of bioshield configurations were considered, emphasis was placed on maximizing diversity of species within the bioshield as well as functional and response diversity to wave inundation [59]. For example, a preliminary design included a near-monoculture of *Pandanus,* considering its known ability to reduce wave velocity and capture sediment [63]. This initial design, however, was modified to enhance biodiversity, which has been recognized as promoting both tree stability and bioshield efficacy [8,65].

The following describes the elements incorporated into the bioshield design. First, for every 100 m^2, planting density should consist of no fewer than 30 trees and shrubs [6]. Second, pairing of shrubs with trees provides the most consistent VDLV [12]. A third consideration includes planting arrangements which focus on avoiding gaps within the bioshield [55]. Strategic placement of shrubs with high leaf density can help to address this issue as well [54,57]. Plantings of trees with the highest wood density should occur at the leading edge (i.e. facing the ocean) of the bioshield in order to maximize the reflection of the water as it moves into the bioshield [56]. Other important arboreal characteristics include the filtering effect that certain tree species can provide [5]. Species with strong, dense prop roots, such as mangrove (e.g. *Rhizophera*), *Ficus* and *Pandanus* play a vital role in both reducing wave velocity and attenuating sediment transportation under high flow velocities.

The bioshield pattern gives the appearance of a rhombus at the front of the bioshield, followed by a single or double layer of tree-shrub combinations, with a triangle pattern at the rear section of the bioshield (Fig. 5). The apex of the rhombus consists of one tree with very dense wood (e.g. *hao, Rauvolfia sandwicense*) to enhance refraction, with the side apices consisting of *Pandanus tectorius* (*hala*) for sediment capture. The inland apices of this rhombus consists of a variety of species which are known to have softer wood (to allow for bending) with high leaf density in order to increase drag. Within the bioshield, shrub species are paired with trees to enhance VDLV and reduce erosion as the wave passes over the bioshield trees and shrubs [12]. The triangle pattern at the back (inland edge) of the bioshield consists of an interior tree (typically *milo, Thespesia populnea, kukui, Aleuritus moluccana,* or *kamani Callophyllum inophyllum*) selected due to their recognized potential to attain a diameter at breast height greater than 40 cm. In the aftermath of the 2011 Tōhoku tsunami, trees with a diameter greater than 40 cm were noted to more effectively withstand tsunami inundation without breaking [9]. Each of these latter trees are also paired with a shrub selected to enhance leaf complexity.. A line of *Pandanus* completes the rearward triangle of the bioshield.

Challenges to implementation

The three most challenging impediments to the development and expansion of the bioshield at Nu'u are the need for invasive species clearance, the lack of available fresh water for irrigation and the detrimental effects of grazing and browsing ungulates. Since October 2022, when bioshield planting began, field work has primarily focused on the removal of invasive species prior to planting of new bioshield trees and shrubs, and limiting reestablishment of these same invasive species. Additionally, the lack of irrigation on site limits the rate of expansion by requiring both staff and volunteers to take on the responsibility of



(a)

(b)

Fig. 5. (a) Schematic representation of a 10 m x 10 m section of the Nu'u bioshield. Actual species composition varies to maximize biodiversity. The seaward edge of the bioshield is at the top. (b) Initial bioshield planting in 2022. Existing tree species are set for removal.

weekly watering during the summer months from June to September. Through the dedicated work of volunteers and staff, to date, mortality due to the arid and generally challenging environmental conditions of Nu'u has been kept to below 6 % of all planted trees. Ungulate predation by goats, pigs and Axis deer on bioshield species has proven challenging, requiring the use of electric netting and physical removal (by both live trapping and hunting) of problem animals. While a hogwire fence surrounds the Pūpuka wetlands, providing protection for phase 1 of the bioshield, electric netting provides the only meaningful protection in all other phases of the bioshield (Fig. 6).

Despite these challenges, community support for the bioshield has proven remarkable. Each quarter Hawai'i Land Trust staff welcome between 60 and 75 volunteers willing to dedicate between 4 and 6 h to the removal of invasive species and the planting of new bioshield trees and shrubs. During the dry season key volunteers have proven critical in transporting approximately 1300 Ls of water each month for the hand irrigation of bioshield trees and shrubs. Community support for the planting, protection and preservation of the bioshield has proven to be among the most important elements of the success of the bioshield establishment phase.

A final challenge lies in the need for an assessment and adaptation of the bioshield to the site specific geology and geography of the planting site. For example, the escarpment which protects the Pūpuka wetlands on the inland and eastern side, while providing some measure of protection from the east, potentially amplifies and concentrates tsunami intensity from the south and west (Fig. 1). Historical descriptions of a local tsunami in CE 1891 and debris accumulated from the April CE 1946 Aleutian Islands event suggests vulnerability from both wave refraction from the escarpment as well as from waves (possibly edge waves) impacting the Pūpuka wetlands from the west [21]. For these reasons, the first two phases of bioshield plantings focused on encircling the exposed half of the Pūpuka wetlands (Fig. 6). Collectively, these two arcs, each of which are approximately 10 m wide and 200 m long, provide a front protecting the Pūpuka wetlands.

Fig. 6. Schematic of the phases of the Nu'u bioshield. Note that the gaps between sections are only intended to indicate phases of planting, and run.

Three additional sections of the bioshield remain in the planning and clearing stage, with final planting and transition to a maintenance phase anticipated between 2029 and 2034. Like the first two stages of the bioshield, these three subsequent stages will consist of lines 10 m wide and will extend from in front of the Pūpuka wetlands to the edge of Nu'u Refuge (Fig. 6). Due to the closer proximity to the coast (and the adverse impacts of sea spray and more frequent marine inundation), a change in species composition from the earlier phases may be warranted.

Discussion

An evaluation of the tsunami vulnerability of the Nu'u Refuge, particularly the ecologically critical and culturally important Pūpuka wetlands, determined the necessity of a forested bioshield to mitigate future HEMI events. The wetlands serve as habitat for resident endangered waterbirds, as a transit and stop-over point to Hawai'i Island for non-resident waterbird populations, and possess significant cultural importance. Its loss would contribute to the further decline of endangered Hawaiian waterbirds and would result in the destruction of important Hawaiian cultural sites [66]. A well-designed and thoroughly researched forested bioshield represents an effective means of providing protection to the Pūpuka wetlands.

Over the past 400 years at least five destructive tsunamis have left discernible tsunami deposits in the Pūpuka wetlands. The largest of these had wave heights of around 8 m, with inundation distances of at least 250 m and wave velocities of no $<$5.5 m/s [27]. Iwachido et al. note that tsunami simulations on coastal forests indicate that catastrophic destruction occurs when wave heights exceed 15m [8]. Waves of this height appear to be very infrequent around the Pūpuka wetlands (i.e. $>$500 years).

However, since CE 1891 infill from HEMI events have deposited at least 1.2 m of sediment into the wetlands, effectively transforming it from a relatively deep freshwater fishpond (a type known as a *loko pu'uone*) in the prehistoric period, to a relatively shallow palustrine discharge wetland today (Fig. 2) [67]. In spite of these changes, the Pūpuka wetlands remains one of the most important coastal wetland

habitats in the Hawaiian Islands [24]. For this reason, bioshield design at Nu'u has focused on maximizing sediment capture and reducing wave velocity.

Perhaps the most significant challenge to the establishment of an effective forested bioshield at Nu'u, one which provides maximum protection to the Pūpuka wetlands, stems from the proximity of the wetlands to the shoreline, approximately 110 m. As described earlier, since CE 1946 the shoreline at Nu'u has accreted approximately 60 m (Fig. 2) [27]. While this would seem to provide additional protection from tsunamis and storms, the unconsolidated nature of the cobbles and boulders in particular makes them much more prone to transportation during HEMIs. [68] Additionally, the limited quantity of fine sediment in which to plant has proven challenging to establish the trees and shrubs needed to create the bioshield in this newly accreted area. Fortunately, a large (20 m deep, 50 m long) *hau* (*H. tiliaceus*) grove (which predates the bioshield establishment) in the narrowest area between the wetlands and the ocean provides substantial protection from a potential event (Fig. 4). While the *hau* will provide some degree of protection for the foreseeable future, geomorphological shifts to erosional trends could exacerbate the challenge of the wetland's close proximity to the ocean.

Evaluating the merits and liabilities of forested bioshields

Although researchers have demonstrated the benefits of bioshields in a number of tsunami-impacted areas, their presence can also pose challenges to those ecosystems and communities. First, bioshields are a long-term investment for a relatively rare event (typically on the order of decades to centuries). Although bioshields are cost-effective and relatively inexpensive to install, their presence prevents alternative land uses such as non-arboreal agriculture or housing [69]. Communities experiencing chronic land shortages may not have the luxury of sacrificing potentially productive areas to mitigate events of such relative infrequency. Habitat loss for threatened and endangered species poses a second challenge for bioshields. In their research, Feagin et al. noted losses in biodiversity and degradation of sea turtle habitat in areas modified for the establishment of monotypic plantation-style stands of bioshield trees along portions of the coast of India [3]. This would seem to argue in favor of employing strategies to maximize biodiversity in bioshield construction.

A third liability lies in the potential for illegal, illicit or other antisocial activity in the bioshield. Some communities, particularly those in urban areas, have witnessed an increase in criminal activity in and around the bioshield [69]. In such cases the presence of a bioshield may require extra policing and enforcement, potentially posing a social and economic burden on the community it is meant to protect.

The potential for creating a false sense of security illustrates a fourth liability of bioshield establishment [49]. While this may apply to individuals during an event, more perniciously a false sense of security could encourage community leaders to permit activities, such as housing developments, in areas that are likely to experience tsunami flooding. This reality suggests the importance of avoiding falsely portraying the potential benefits of forested bioshields, and to encourage other mitigation strategies, such as sirens, to warn communities of tsunami threats.

Finally, an important criticism of forested bioshields derives from their potential inefficacy during a catastrophic HEMI event. While such catastrophic events are known to occur at Nu'u, they are rare. The previous two tsunamis to have left a sedimentary signature in the Pūpuka wetlands have been moderate in size (with run up heights of 3 m), and the wetlands would have benefited substantially from any type of barrier designed to reduce wave velocity and sediment transportation. Ultimately, the efficacy of a bioshield will be most easily justified through further HEMI research and numerical modeling, a research project currently underway at Nu'u.

In spite of these potential liabilities, in addition to their protective role, bioshields can also provide other important benefits. When integrated into a broader ecological restoration program, bioshields can provide habitat for threatened or endangered species. For example, the root system and accumulated leaves of *P. tectorius* are known to provide nesting areas for Newell's shearwaters, an indigenous Hawaiian seabird experiencing habitat loss and degradation (Vanderwerf Pers. Comm. November 2023) [70]. Alternatively, the use of economically productive trees (such as fruit trees) into the bioshield design can offset some of the economic losses associated with land transformation [71]. Terrell et al. notes the generational maintenance of agroforestry systems along the coast of Papua New Guinea, highlighting its ability to strengthen bonds of kinship and serve as a source for post-disaster recovery [72].

Areas for future research

The only authentic test for the Nu'u, or any, bioshield will come about when it is subjected to actual HEMI conditions. However, such a natural experiment may take decades or centuries to occur. Numerical modeling in controlled environments offers an alternative to a real world event. Rapid developments in artificial intelligence (AI) and machine learning offer a novel alternative for optimizing the design of a forested bioshield, although the quantity of data needed for such applications may prove prohibitive for the foreseeable future [73].

Adding to our knowledge of the arboreal characteristics of candidate species for inclusion in a bioshield presents another avenue of future research. Such an approach could potentially capitalize on both quantitative data such as arboreal responses to high intensity wave inundation, or qualitatively by looking at historic and cultural uses of various tree species to better understand both functional diversity and response diversity of individual trees and entire bioshield forests.

The application of new techniques to gather paleoecological data, such as the use of sediment ancient DNA (sedaDNA) approaches, holds promise for expanding the range of species for inclusion in the bioshield. As such techniques become available it seems plausible that practitioners may have access to species which once thrived at a site under a variety of environmental conditions. This may prove particularly helpful in responding to changing climate conditions.

Gathering field data in the aftermath of a tsunami will likely remain one of the most important strategies to evaluate the ways individual trees and entire forests respond to such events [74]. Historical and paleotsunami/storm research should also play a key role in characterizing the nature of HEMI in areas subject to such events. Piecing together both the recurrence interval and gauging the intensity of past events fills an important gap in our understanding of the nature of HEMI in a given area. Narrowing this gap in our understanding contributes to the optimization of bioshield design both around the Hawaiian archipelago and across the Pacific.

The main limitation in gauging the effectiveness of a forested bioshield lies with the stochastic and infrequent nature of storms and tsunamis. Ultimately, only an event of sufficient intensity will test the bioshield planted at Nu'u. Until the bioshield is tested in an actual HEMI event we will not know its true efficacy. However, the thorough and deliberate steps taken in its design provide us with a high degree of confidence that, when put to the test, it will effectively reduce both wave energy and sediment transportation.

In the end, bioshield establishment requires the recognition of the race between the rate of planting and maturation, and the stochastic nature of HEMI events. A multi-year project in a HEMI-prone setting may prove a deterrent to some. Although the investment remains uncertain, in many instances forested bioshields present a more appealing option than the alternatives of hard engineering or wetlands loss.

Conclusion

Substantial evidence has emerged over the past two decades suggesting that forested bioshields save lives, and protect property and

habitat from the effects of HEMI events. In locations as diverse as Papua New Guinea, India, Sri Lanka, Indonesia, Thailand and Japan, coastal forests have been recognized as providing substantial protection from tsunami events. Maximizing their efficacy requires careful consideration of both the vertical and horizontal dimensions (particularly forest width and planting density) as well as the arboreal characteristics of species proposed for inclusion in the bioshield.

This paper demonstrates an approach to forested bioshield design that is grounded in local evidence and adopts a multiproxy approach using palaeoecological and palaeoenvironmental data allied to cultural history to select species relevant to the local conditions. Review of the literature provided design specifications in terms of the distribution of selected species. Nevertheless, the main test of the approach will come when the forested bioshield is fully established and is exposed to a HEMI event.

However, bioshields are not a panacea for protecting coastal ecosystems from tsunami inundation. Recognized liabilities of bioshields include the fact that they are long-term investments for rare, stochastic events. The presence of a bioshield can restrict other land uses, particularly in land-limited communities. Bioshields have also been recognized as reducing habitat and potentially creating a false sense of safety. All of these liabilities suggest that bioshield establishment requires careful consideration of both the liabilities and the potential benefits.

Successful bioshield construction requires both substantial community engagement and traditional ecological knowledge to determine how to maximize the potential benefits and minimize the liabilities described above. Through careful and deliberate consideration, bioshields can provide substantial protection as an affordable and ecologically sound alternative to engineered HEMI protective barriers.

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CRediT authorship contribution statement

Scott Fisher: Writing – original draft, Project administration, Methodology, Funding acquisition, Data curation, Conceptualization. **James Goff:** Writing – review & editing, Supervision, Conceptualization. **Andrew B. Cundy:** Writing – review & editing, Supervision, Conceptualization. **David Sear:** Writing – review & editing, Supervision, Conceptualization. **Christina McWhorter:** Writing – review & editing, Software, Resources.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. JG is an Editor-in-Chief for Natural Hazards and was not involved in the editorial review or the decision to publish this article.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.nbsj.2025.100222.

Data availability

The datasets generated during and/or analyzed during the current study are available in the Hawai'i Land Trust repository, https://pubdoc.hilt.org/sfpd.

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CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

AGENDA

HCR122 HD1
Working Group Meeting

October 2, 2025
2pm – 3pm
Zoom Link: https://zoom.us/j/95758873247

HCR122 HD 1 (2025) Requests "The Department of Land and Natural Resources to Establish A Collaborative Working Group to Survey, Identify, and Monitor Culturally Sensitive Shorelines Impacted by Erosion"

1. **Welcome & Introductions**
2. **Discussion Topic: Task #1 of HCR 122, "Collaborative working group is requested to determine a process to address iwi kūpuna exposed along shorelines, ensuring their protection from adverse impact."**
   a. **Brief summary of SHPD's current process regarding inadvertent discovery process**
   b. **Does this process ensure protection of iwi kūpuna from adverse impact, if not, what process would you recommend?**
3. **Topics for next meeting**
   a. Discussion on Task #2 of HCR 122, "the Collaborative working group is requested to assess public lands near culturally sensitive areas were iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable for reinterment sites."
4. **Proposed Next Meeting Dates:**
   a. Meeting #3: Wednesday, October 29th, 12noon – 1pm
   b. Meeting #4: Friday, November 21st, 12noon – 1pm
   c. December #5: Wednesday, December 10th, 12noon – 1pm (**goal: final meeting to review report)
5. **Closing & Adjournment**

Requirements listed in HR118 HD1/HCR122 HD1:

1. *The collaborative working group* is requested to determine a process to address iwi kūpuna exposed along shorelines, ensuring their protection from adverse impact.

2. *The collaborative working group* is requested to assess public lands near culturally sensitive areas were iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites.

3. The *Department of Land and Natural Resources* is requested to consider the appropriate methods of funding to support the collaborative working group, including for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kūpuna.

4. The *collaborative working group* is requested to submit a report of its findings and recommendations, including any proposed legislation, to the Legislature no later than twenty days prior to the convening of the **Regular Session of 2026** *(December 2025)*

Draft Notes from
HCR122 HD1 Working Group Meeting on

October 2, 2025
2:00pm – 3:00pm
Held via Zoom

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HCR122 HD 1 (2025) Requests "The Department of Land and Natural Resources to Establish A Collaborative Working Group to Survey, Identify, and Monitor Culturally Sensitive Shorelines Impacted by Erosion"

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Agenda

- Welcome & Introductions
- Discussion Topic: Task #1 of HCR 122, "Collaborative Working Group is requested to determine a process to address 'iwi kūpuna exposed along shorelines, ensuring their protection from adverse impact."
    - Brief summary of SHPD's current process regarding inadvertent discovery process
    - Does this process ensure protection of 'iwi kūpuna from adverse impact, if not, what process would you recommend?
- Topics for Next Meeting
    - Discussion on Task #2 of HCR 122, "the Collaborative working group is requested to assess public lands near culturally sensitive areas where iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable for reinterment sites."
- Proposed Next Meeting Dates:
    - Meeting #3: Wednesday, October 29th, 12noon – 1pm
    - Meeting #4: Friday, November 21st, 12noon – 1pm
    - December #5: Wednesday, December 10th, 12noon – 1pm (**goal: final meeting to review report)
- Closing & Adjournment

Working Group Attendees

- DLNR Chair: **Dawn Chang** *(Working group Chair)*
- OHA Chair Representative: **Kūʻikeokalani "Kūʻike" Kamakea-ʻŌhelo,** OHA ʻŌiwi Wellbeing and ʻĀina Momona Director
- SHPD Designee: **Jordan "Kea" Calpito,** SHPD History & Culture Branch Chief
- OCCL Designee: **Tiger Mills** (Kimberly T. Mills), OCCL Staff Planner
- Representative of the Island Burial Councils: **Scott Fisher,** Hawaiʻi Land Trust, Director of ʻĀina Stewardship and currently serving as Chair of the Maui/Lanai Island Burial Council
- Representative from the City and County of Honolulu: **Michael Kat**, Historic Preservation Planner, Department of Planning & Permitting
- Representative of the County of Hawaiʻi: **Laura Acasio,** Office of Sustainability, Climate, Equity, and Resilience as Administrator
- Representative of the County of Maui: **Layne Krause**, County of Maui GIS Analyst in Department of ʻŌiwi Resources
- Representative of the County of Maui: **Ms. Kadian Shaw,** Executive Assistant**,** Office of the Mayor
- Representative of the County of Kauaʻi: **Mauna Kea Trask**, private attorney and former member of the Kauaʻi/Niʻihau Island Burial Council from 2012 to 2014
- Other Attendees:
    - DLNR Staff: Rebecca "Becca" Crall, Outreach Coordinator, serving as working group support.
    - HACBED Staff: Merri Keliikuli, serving as notetaker.

Takeaways

- *Tasks Set Forth for the Working Group in HCR 122* -- were reiterated by Chair Chang and are as follows:
    - Determine a process to address ʻiwi kūpuna exposed along shorelines, ensuring their protection from adverse impact.
    - Assess public lands near culturally sensitive areas where ʻiwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites.

- Consider funding methods for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of ʻiwi kūpuna.
- Prepare a report to the Legislature by January 2026.

- *Meeting Process* -- Chair Chang noted a meeting would be dedicated to each of the outlined tasks with the goal of having proposed recommendations for a final report distributed in December 2025 for the group's review.
- *Review of SHPD's Shoreline Inadvertent Discovery Process* -- Working Group members were asked if SHPD's current process, as it specifically relates to ʻiwi kūpuna subject to coastal erosion, works. Many were in agreement that the process works, but should be further informed by lineal and cultural descendants, Aha Moku, and Burial Council of the area to create individualized processes for each community. This would also help to keep cultural aspects top of mind to ensure the proper care and handling of ʻiwi.
- *Concerns Raised Regarding the Process* -- Working Group members raised several concerns with the current process and offered recommendations to address those concerns.
  - *Delayed Notification of Inadvertent Discoveries* -- timely action is needed to protect ʻiwi kūpuna from imminent harm. The number of agencies who might be notified of inadvertent discoveries potentially delays SHPD learning of the discovery and ability to respond.
    - *Recommendation* -- signage at identified hotspot locations informing the public to notify SHPD directly was offered to address this concern.
  - *Accelerated Erosion* -- the removal of ʻiwi can lead to accelerated erosion.
    - *Recommendation* -- for a more solution oriented approach, it was suggested the Group consider ecosystem based strategies, to include erosion bioshields such as native plants, that could reduce the rate of erosion and keep ʻiwi together.
  - *The Process is Difficult to Navigate* -- especially for private landowners.
    - *Recommendation* -- create a streamlined process so when excavation is necessary, a burial site has already been identified for repatriation to occur. This might also include a template for drafting a burial treatment

plan (BTP) to facilitate the process of getting burials in approved designated areas. This might also be applicable to identified hotspots on State owned land.

- *Limited Capacity to Manage the Process* -- it could be helpful to take a more proactive approach given the limited capacity across the State to address ʻiwi kūpuna.
  - *Recommendations*
    - Create tailored preservation plans to minimize erosion at identified hotspots to reduce the demand placed on the SHPD team.
    - Address seasonal influx, such as winter's high surf periods, with increased capacity for SHPD and its partners to be able to respond in a timely manner.
- *Improved Response Process* -- Working Group members identified the need for an improved response process.
  - *Recommendations*
    - Creation of a Permissive Interaction Group (PIG) or other type of subcommittee to identify burial sites, with the use of GIS overlay maps and other resources such as Sam Gon maps to allow for more proactive planning and permitting. Such a group could also be called to action when SHPD has an inadvertent so a decision isn't made laterally and they have resources.

Next Steps

- *All*
  - Share processes and structures related to iwi kūpuna you have implemented.
  - Share other resources that might be beneficial to these discussions.
  - Identify a hotspot for iwi kūpuna on your island.
  - Come with any additional recommendations.
  - Next meeting dates
    - Meeting #3: Wednesday, October 29th, 12noon – 1pm
      - Discussion on Task #2 of HCR 122, "the Collaborative working group is requested to assess public lands near culturally sensitive areas where iwi kūpuna were exposed along shorelines to

determine locations that may be designated as suitable for reinterment sites."

- Meeting #4: Friday, November 21st, 12noon – 1pm
- Meeting #5: Wednesday, December 10th, 12noon – 1pm (**goal: final meeting to review report)

- *Becca*
  - Distribute meeting notes.

SHORELINE INADVERTENT DISCOVERY PROCESS

STATUTE + RULE

HRS §6E-43.6

HAR §13-300-40

DEFINITION

3

HAR §13-300-2

"Inadvertent discovery" means the unanticipated finding of human skeletal remains and any burial goods resulting from unintentional disturbance, erosion, or other ground disturbing activity.

REPORTING

HAR §13-300-40(b):

The inadvertent discovery shall be immediately reported to the following persons:

1) The state historic preservation division, unless discovery occurs on Saturday, Sunday, or holiday at which time the report shall be made to the division of conservation and resource enforcement;
2) The medical examiner or coroner from the county in which the inadvertent discovery occurred; and
3) The police department of the county in which the inadvertent discovery occurred.

- Since many inadvertent discoveries on the shoreline are found by the "average person" walking along the beach who have never heard of the State Historic Preservation Division, the police department are usually called first. After responding, the police will then contact SHPD or DOCARE—if it is the latter, DOCARE will contact SHPD.
- Also note that O'ahu is the only island with a medical examiner.

RULE

5

HAR §13-300-40(c):

Once the report of an inadvertent discovery has been made, the department shall do the following [for single iwi: within one working day on O‘ahu, two on the neighbor islands; for multiple iwi: within two working days on O‘ahu, three on the neighbor islands]:

1) Assure that all activity in the immediate area of the human skeletal remains ceases and that appropriate action to protect the integrity and character of the burial site from damage is undertaken;
2) Assure that a representative of the medical examiner or coroner's office and a qualified archaeologist determines whether the human skeletal remains are over fifty years old;
3) Conduct a site inspection where necessary;
4) Gather sufficient information, including oral tradition, by seeking individuals who may have knowledge about the families possibly connected lineally or culturally with the inadvertently discovered human skeletal remains, to help document the nature of the burial context and determine appropriate treatment;
5) Complete departmental inadvertent discovery forms;
6) Notify the council member who represents the geographic region where the human skeletal remains were discovered, and the Office of Hawaiian Affairs;
7) Inform the landowner or its agent of the discovery if different from the person making the report; and
8) Determine whether to preserve in place or relocate the human skeletal remains.

REALITY

6

For shoreline inadvertent discoveries exposed through erosion, the iwi are typically "loose," necessitating a quicker response process, thus:

1) Once SHPD is notified, staff will try to conduct a site visit that same day.
   - *Burial Sites Specialist*—make determinations on the disposition of the iwi.
   - *Archaeologist*—determine whether the iwi are (1) human and (2) historic.
2) The iwi is immediately retrieved due to the "threat" of being washed away or collected by beachgoers. Sometimes, other agencies will retrieve on our behalf.*
   - On Oahu, the City & County has a contract with Pacific Legacy, Inc. to conduct routine inspections at Kualoa and will retrieve iwi in consultation with SHPD.
   - On Hawaii Island, SHPD works regularly with State Parks archaeologist and DOCARE, particularly for inadvertent discoveries on the Kona coast.
   - On Maui, SHPD works regularly with the County's Department of Oiwi Resources to retrieve iwi from specific areas.
   - If there are iwi "stuck" in the sand, SHPD will assess whether preservation in place is feasible until such time that they are able to naturally erode out, or, if disinterment is necessary, for example, in high foot traffic areas.
3) The iwi is usually brought back to the SHPD office for temporary curation.
   - If iwi were retrieved by a third-party, SHPD will take custody of the iwi and bring them back to the SHPD office until reinterment.
   - Where possible, SHPD makes attempts to locate recognized descendants who can temporarily curate the iwi until they can be reinterred.*
4) SHPD initiates notification and consultation procedures.

SUPPORTING RULES

§13-300-40(k):

Intentional removal of inadvertently discovered human skeletal remains or burial goods is prohibited until a determination to relocate is made by the department pursuant to section 6E-43.6, HRS, and this chapter, except that the department shall be authorized to allow temporary removal of the remains or burial goods to protect from imminent harm, until a determination is made.

§13-300-41 Private possession of human remains.

(a) There shall be a prohibition on the private possession of human skeletal remains over fifty years old knowingly removed or originating from a burial site in the State, except the department may authorize possession where:

1) Private archaeological firms curate human skeletal remains temporarily until reburial occurs;
2) A person is able to establish known lineal or cultural descent pursuant to section 13-300-35 to the human skeletal remains and wishes to possess or continue to possess the human skeletal remains or authorizes possession by a third person;
3) Possession of human skeletal remains is an ethnically acceptable practice; Or
4) Human skeletal remains have been manufactured into artifacts prehistorically.

CHALLENGE

8

iwi can remain in “temporary” curation, *indefinitely*

RECOMMENDATIONS

1) Create separate statutory and/or regulatory processes for inadvertent discoveries resulting from coastal erosion.
    - Currently, there is only one process for inadvertent discoveries, regardless if the iwi were exposed from coastal erosion or ground disturbing activities. Amendments might reflect more flexibility and an expedited process to reinter the iwi.

2) Normalize agreements that would allow "blanket approvals" for permitted agencies and/or organizations to retrieve iwi.
    - This would only apply to specific locations where iwi are expected to continuously erode out of the shoreline within the same site number, for instance, when all the iwi within the same site were not able to be retrieved immediately because they were still fixed.

3) Establish reinterment vaults in the immediate vicinity of "hotspot" areas.
    - These can be for both, temporary and permanent reinterment and is more culturally appropriate than being curated in SHPD offices.

MAHALO

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIA'ĀINA

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA

P.O. BOX 621
HONOLULU, HAWAII 96809

DAWN N.S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RYAN K.P. KANAKAʻOLE
FIRST DEPUTY

CIARA W.K. KAHAHANE
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
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LAND
STATE PARKS

AGENDA

HCR122 HD1
Working Group Meeting

October 29, 2025
12 noon – 1pm
Zoom Link: https://zoom.us/j/98580070228

HCR122 HD 1 (2025) Requests "The Department of Land and Natural Resources to Establish A Collaborative Working Group to Survey, Identify, and Monitor Culturally Sensitive Shorelines Impacted by Erosion"

1. **Opening protocol** (given by WG member) **and introductions** *(5 min)*
2. **Re-cap of meeting #2** *(5 min)*
    a. WG member comments on notes/recommendations for Task #1?
3. **Discussion Topic: Task #2 of HCR122 Assess public lands near culturally sensitive areas were iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites** *(35 – 40 min)*
    a. Review Map of hotspots provided by SHPD
    b. WG member discussion
    c. Re-cap any key recommendations
4. **Topics for next meeting** *(5 mins)*
    a. Discussion on Task #3 of HCR 122: consider the appropriate methods of funding to support the collaborative working group, including for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kupuna
    b. Identify any information needed or "homework" for WG members before next meeting.

5. **Proposed Next Meeting Dates:** (*3 mins)*
    a. Meeting #4: Friday, November 21st, 12noon – 1pm
    b. December #5: Wednesday, December 10th, 12noon – 1pm (**goal: final meeting to review report)
6. **Closing & Adjournment** (2 mins)

Requirements listed in HR118 HD1/HCR122 HD1:

1. *The collaborative working group* is requested to determine a process to address iwi kūpuna exposed along shorelines, ensuring their protection from adverse impact.

2. *The collaborative working group* is requested to assess public lands near culturally sensitive areas were iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites.

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4. The *collaborative working group* is requested to submit a report of its findings and recommendations, including any proposed legislation, to the Legislature no later than twenty days prior to the convening of the **Regular Session of 2026** *(December 2025)*

Notes from
HCR122 HD1 Working Group Meeting on

October 29, 2025
12:00pm – 1:00pm
Held via Zoom

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HCR122 HD 1 (2025) Requests "The Department of Land and Natural Resources to Establish A Collaborative Working Group to Survey, Identify, and Monitor Culturally Sensitive Shorelines Impacted by Erosion"

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Agenda

- Opening Protocol & Introductions
- Recap of Meeting 2
    - WG comments on notes/recommendations for Task #1
- Discussion Topic: Task #2 of HCR122: Assess public lands near culturally sensitive areas were iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites
    - Review map hotspots provided by SHPD
    - WG member discussion
    - Recap any key recommendations
- Topics for next meeting
    - Discussion on Task #3 of HCR 122: Consider the appropriate methods of funding to support the collaborative working group, including for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kūpuna
    - Identify any information needed or "homework" for WG members before next meeting
- Proposed Next Meeting Dates:
    - Meeting #4: Friday, November 21st, 12noon – 1pm

    - Meeting #5: Wednesday, December 10th, 12noon – 1pm (**goal: final meeting to review report)
- 5. Closing & Adjournment

Working Group Attendees

- DLNR Chair **Dawn Chang** *(Working Group Chair)*
- OHA Representative: **Kamakana Ferreira** on behalf of Kūʻikeokalani "Kūʻike" Kamakea-ʻŌhelo, OHA ʻŌiwi Wellbeing and ʻĀina Momona Director
- SHPD Designee: **Jordan "Kea" Calpito,** SHPD History & Culture Branch Chief
- OCCL Designee: **Tiger Mills** (Kimberly T. Mills), OCCL Staff Planner
- Representative of the Island Burial Councils: **Scott Fisher,** Hawaiʻi Land Trust, Director of ʻĀina Stewardship and currently serving as Chair of the Maui/Lanai Island Burial Council
- Representative from the City and County of Honolulu: **Michael Kat**, Historic Preservation Planner, Department of Planning & Permitting
- Representative of the County of Hawaiʻi: **Laura Acasio,** Office of Sustainability, Climate, Equity, and Resilience as Administrator
- Representatives of the County of Maui: **Layne Krause**, County of Maui GIS Analyst in Department of ʻŌiwi Resources and **Ms. Kadian Shaw,** Executive Assistant (Office of the Mayor)
- Representative of the County of Kauaʻi: **Mauna Kea Trask**, private attorney and former member of the Kauaʻi/Niʻihau Island Burial Council from 2012 to 2014
- Other Attendees:
    - DLNR Staff: Rebecca "Becca" Crall, Outreach Coordinator, serving as working group support.
    - HACBED Staff: Merri Keliikuli, serving as notetaker.

Takeaways

- *Tasks Set Forth for the Working Group in HCR 122* -- were reiterated by Chair Chang and are as follows:
    - Determine a process to address iwi kūpuna exposed along shorelines, ensuring their protection from adverse impact.

    - Assess public lands near culturally sensitive areas where iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites.
    - Consider funding methods for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kūpuna.
    - Prepare a report to the Legislature by January 2026.
- *Focus for This Third Meeting of Five* -- Chair Chang reminded Working Group members the focus for the day is Task #2 of HCR122, to assess public lands near culturally sensitive areas where iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites.
- *Maps of Burial Site Hotspots Across the State* -- SHPD prepared maps that represent hotspots of areas where burial site specialists have identified exposed remains, are within 3.2 foot sea level rise projections, and would be subject to complete erosion. Although the maps are not 100% reliable due to missing GPS data, unrecorded burials, or other factors, the goal is to provide Working Group members an idea of where the hotspots are and a visualization of the number of iwi kūpuna being exposed as a result of coastal erosion. Kea provided clarification that the maps represent a combination of interred and disinterred iwi kūpuna.
    - *Recommendation* -- to improve or enhance the maps, the following recommendations were made:
        - Instead of using 3.2 sea level rise area, the below might be better suited to identify areas impacted by erosion:
            - Passive flooding
            - High wave action
        - Identify existing locations of existing interment vaults to ensure sufficient coverage around the island and to avoid duplication.
- *Finding Suitable Locations* -- SHPD's goal is to do the hard work to identify suitable interment locations and allow lineal descendants to do cultural protocol appropriate for the interment. While SHPD's current process is to work with lineal and cultural descendants, individuals or representative organizations, of iwi kūpuna, interment

locations have only been identified by lineal descendants in limited instances. Interment locations must allow for access.

- *Suggestions from Working Group Members Include:*
  - Reinter mauka in a forest reserve area with State approval or easement to access.
  - Avoid tsunami and storm zones.
- *Working Group Members Were in Agreement with the Following*:
  - Working Group members agree burial vaults should be situated in a location closest to the concentration of iwi kūpuna exposed due to coastal erosion, within the same ahupuaʻa, and on State owned land.
  - Working Group members agree lineal and cultural descendants should be consulted before any decisions are made by the State and there should be options for each community to determine what is best for them.

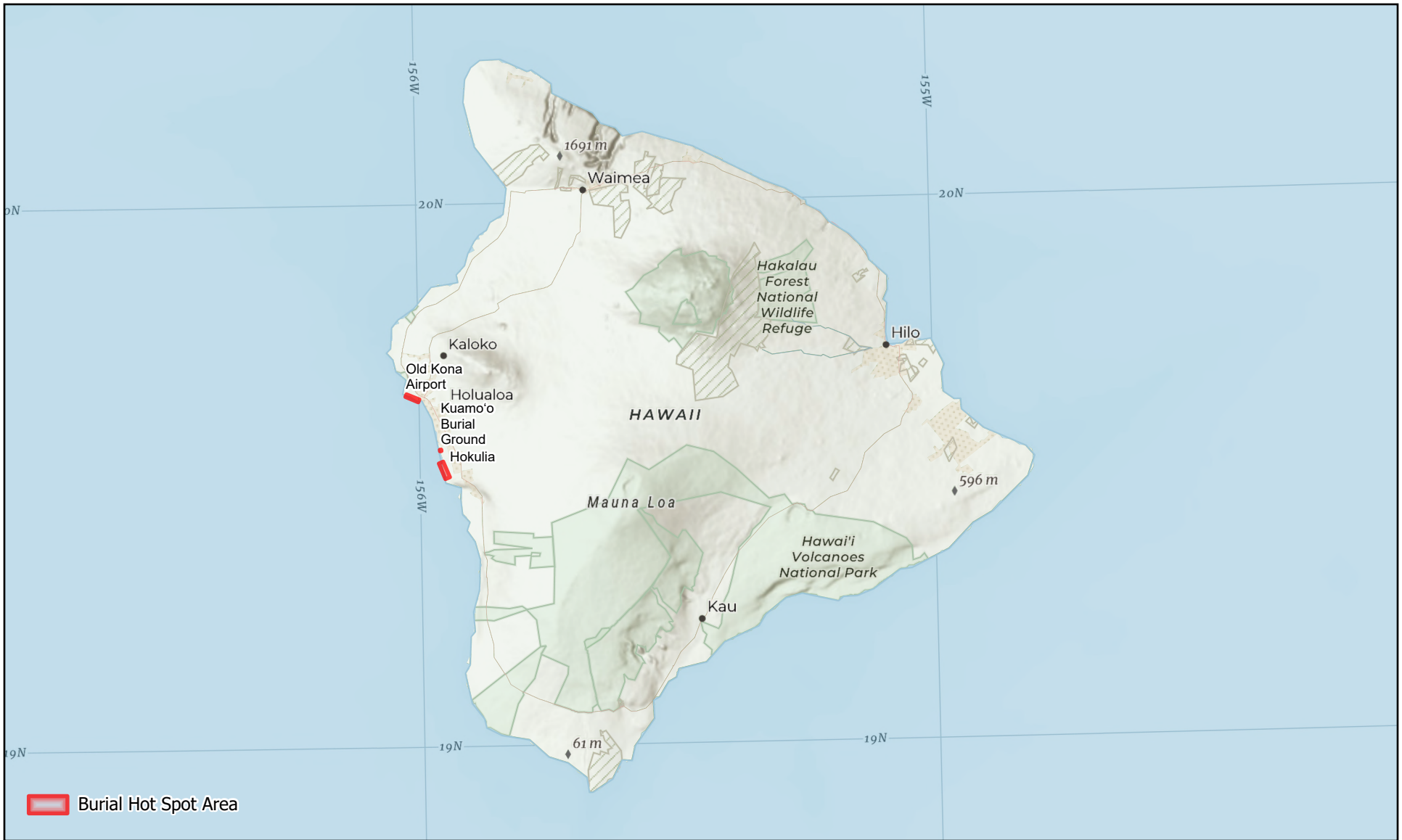
- *Concerns Raised Regarding the Process* -- new concerns and recommendations with the current process that were raised by Working Group members are as follow;
  - *Responsibility When Iwi is Exposed* -- while the State used to take responsibility for exposed iwi, that burden has now been placed on the private landowner. This raises the concern that proper disclosure and action may not occur due to the cost burden.
    - *Recommendation* -- while not within the purview of this Working Group, Chair Chang suggested the recommendations of this Working Group could inform issues beyond HCR 122, including private landowners and previously identified iwi.
  - *Iwi Temporarily Curated at SHPD* -- there is a large number of iwi temporarily housed at SHPD facilities. Addressing these iwi individually could lead to a delay to permanently inter iwi.
    - *Recommendation* -- once an infrastructure of care and vaults is established, do a blanket reinterment.
- *DLNR's Proposed Budget* -- SHPD will be asking for funding of $500,000 for burial vaults in the upcoming legislature session.

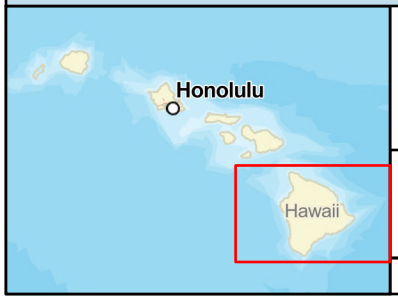
Next Steps

- *All*
    - Recommendation for a pilot project vault to help prioritize a vault location based on areas recognized by the Working Group.
    - Share other resources that might be beneficial to these discussions with Becca.
    - Come with any additional recommendations.
    - Next meeting dates
        - Meeting #4: Friday, November 21st, 12noon – 1pm
            - Discussion on Task #3 of HCR 122: Consider the appropriate methods of funding to support the collaborative working group, including iwi for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kūpuna.
        - Meeting #5: Wednesday, December 10th, 12noon – 1pm (**goal: final meeting to review report).
- *Becca*
    - Distribute meeting notes.

Shared Resources

- *Maps Presented by SHPD*:
    - O‘ahu
        - Kualoa
        - Mauna Lahilahi
    - Hawai‘i Island
        - Old Kona Airport
    - Kaua‘i
        - Wailua / Kapa‘a
    - Maui
        - Paia / Kaulahao / Ho‘okipa
- *Additional Maps* -- created by SHPD but not presented during the meeting.





Burial Site "Hot Spots" Vulnerable to Sea Level Rise

Sea Level Rise, Government Owned Parcels, TMK, and Soils data sourced from the Hawai'i Statewide GIS Program. Burial data from DLNR SHPD. This map is not intended for sharing with the public or media.

Basemap credits:Esri, CGIAR, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community

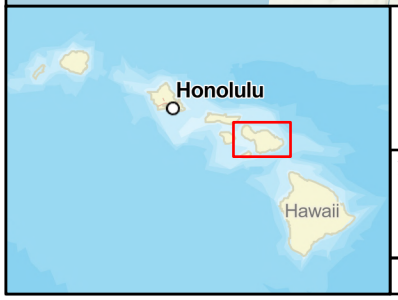
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere, Date: 10/22/2025

Island of Hawai'i

N

0 15 30 Kilometers

0 10 20 Miles



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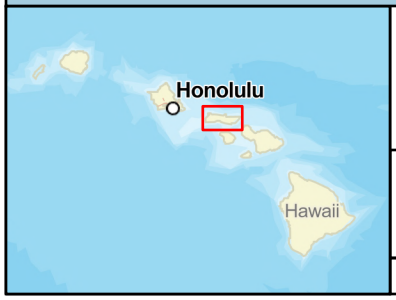
Island of Maui

N

0 5 10 Kilometers

0 3 6 Miles



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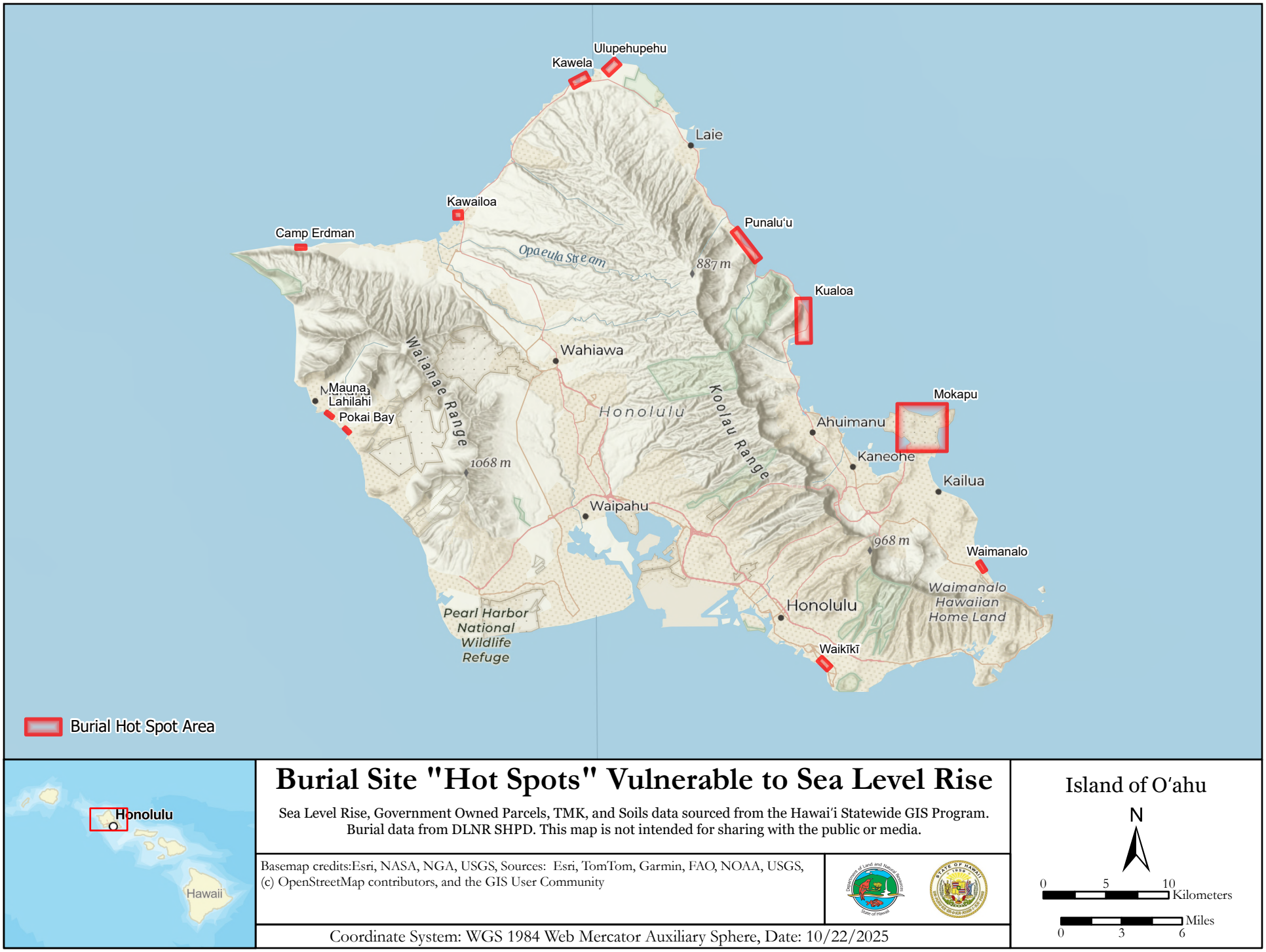
Island of Moloka'i

N

0 4 8 Kilometers

0 2 4 Miles



Burial Site "Hot Spots" Vulnerable to Sea Level Rise

Sea Level Rise, Government Owned Parcels, TMK, and Soils data sourced from the Hawai'i Statewide GIS Program. Burial data from DLNR SHPD. This map is not intended for sharing with the public or media.

Basemap credits:Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere, Date: 10/22/2025

Island of O'ahu

N

0 5 10 Kilometers

0 3 6 Miles

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIA'ĀINA

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA

P.O. BOX 621
HONOLULU, HAWAII 96809

DAWN N.S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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FIRST DEPUTY

CIARA W.K. KAHAHANE
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ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

AGENDA

HCR122 HD1
Working Group Meeting #4

November 21, 2025
12 noon – 1pm
Zoom Link: https://zoom.us/j/95676160661

HCR122 HD 1 (2025) Requests "The Department of Land and Natural Resources to Establish A Collaborative Working Group to Survey, Identify, and Monitor Culturally Sensitive Shorelines Impacted by Erosion"

1. **Opening protocol** (given by WG member) **and introductions** *(5 min)*
2. **Re-cap of meeting #3** *(5 min)*
    a. WG member comments on notes/recommendations for #2?
3. **Discussion Topic: Task #3 of HCR 122: consider the appropriate methods of funding to support the collaborative working group, including for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kupuna** *(35 – 40 min)*
    a. Presentation and information from SHPD
    b. WG member discussion
    c. Re-cap any key recommendations
4. **Topics for next meeting** *(5 mins)*
    a. Review and Discussion Draft Report to the 2026 Legislature.
        i. Goal date for draft to be circulated to working group members is_____.
    b. Identify any information needed or "homework" for WG members before next meeting.
5. **Proposed Next Meeting Dates:** (*3 mins)*

a. December #5: Wednesday, December 10th, 12noon – 1pm (**goal: final meeting to review report)

6. **Closing & Adjournment** (2 mins)

Meeting materials from all HCR 122 meetings are available via the HCR 122 Working Group Member Shared folder

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Requirements listed in HR118 HD1/HCR122 HD1:

1. *The collaborative working group* is requested to determine a process to address iwi kūpuna exposed along shorelines, ensuring their protection from adverse impact.

2. *The collaborative working group* is requested to assess public lands near culturally sensitive areas were iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites.

3. The *Department of Land and Natural Resources* is requested to consider the appropriate methods of funding to support the collaborative working group, including for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kūpuna.

4. The *collaborative working group* is requested to submit a report of its findings and recommendations, including any proposed legislation, to the Legislature no later than twenty days prior to the convening of the **Regular Session of 2026** *(December 2025)*

Notes from
HCR122 HD1 Working Group Meeting on

November 21, 2025
12:00pm – 1:00pm
Held via Zoom

~~~~~~~~~~~~~~~~~

HCR122 HD 1 (2025) Requests "The Department of Land and Natural Resources to Establish A Collaborative Working Group to Survey, Identify, and Monitor Culturally Sensitive Shorelines Impacted by Erosion"

~~~~~~~~~~~~~~~~~~~

Agenda

- Opening Protocol & Introductions
- Recap of Meeting 3
    - WG comments on notes/recommendations for Task #2
- Discussion Topic: Task #3 of HCR122: Consider the appropriate methods of funding to support the collaborative working group, including for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kupuna
    - Presentation and information from SHPD
    - WG member discussion
    - Recap any key recommendations
- Topics for next meeting
    - Review and Discussion Draft Report to the 2026 Legislature.
        - Goal date for draft to be circulated to working group members is December 5, 2025.
        - Identify any information needed or "homework" for WG members before next meeting.
- Proposed Next Meeting Dates:
    - Meeting #5: Wednesday, December 10th, 12noon – 1pm (**goal: final meeting to review report)
- 5. Closing & Adjournment

Working Group Attendees

- SHPD Designee: **Jordan "Kea" Calpito,** SHPD History & Culture Branch Chief *(Filled in for Chair Chang as the facilitator for this meeting.*)
- OCCL Designee: **Tiger Mills** (Kimberly T. Mills), OCCL Staff Planner
- Representative of the County of Hawai'i: **Laura Acasio,** Office of Sustainability, Climate, Equity, and Resilience as Administrator
- Representatives of the County of Maui: **Ms. Kadian Shaw,** Executive Assistant (Office of the Mayor)
- Representative of the County of Kaua'i: **Mauna Kea Trask**, private attorney and former member of the Kaua'i/Ni'ihau Island Burial Council from 2012 to 2014
- OHA Representative: Kū'ikeokalani "Kū'ike" Kamakea-'Ōhelo **(AI Notetaker only)** on behalf of Kū'ikeokalani "Kū'ike" Kamakea-'Ōhelo, OHA 'Ōiwi Wellbeing and 'Āina Momona Director
- Other Attendees:
    - DLNR Staff: Rebecca "Becca" Crall, Outreach Coordinator, serving as working group support.
    - HACBED Staff: Merri Keliikuli, serving as notetaker.

Takeaways

- *Notes Approved for Working Group Meeting* -- notes for the group's meeting on 10/29/25 were approved by Working Group members in attendance.
- *Focus for This Fourth Meeting of Five* -- Working Group members were reminded the focus for the day is Task #3 of HCR122, consider the appropriate methods of funding to support the collaborative Working Group, including for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kupuna.
- *Discussions with DPR Staff (Kualoa Beach Park & Mauna Lahilahi / Pōka'i Bay)* -- summary notes from Michael Kat's discussions with DPR staff were shared with the Working Group.
    - *Kualoa Beach Park*

        - Contract management challenges: Park staff do not manage the monitoring contract with Pacific Legacy directly; procurement is handled by DDC. This separation has complicated oversight and coordination.
        - Pacific Legacy monitoring inconsistencies: Monitoring frequency has decreased from monthly, to every other month, to "as needed." Funding lapses make scheduling difficult, although Pacific Legacy has continued monitoring voluntarily in some cases.
        - Inventory facility updates: The Kualoa repository has been recently renovated, and the reinterment vault has additional capacity. Staff are opposed to take on iwi originating from outside the park due to long-term stewardship responsibilities.
    - *Mauna Lahilahi / Pōkaʻi Bay*
        - Concerns about new reinterment responsibilities: Staff are hesitant to support installation of a new vault without long-term maintenance funding. There is concern that a one-time funded project would create ongoing expectations without sustained resources.
        - Erosion issues: Portions of Pōkaʻi Bay are eroding rapidly (~10 ft/year). There is concern that the newly constructed revetment may be accelerating erosion.
        - Native planting feasibility: While vegetation could help slow erosion, irrigation infrastructure is either absent or non-functional, limiting feasibility without additional investment.
        - Existing reinterment site at risk: Staff reported an existing buried reinterment site near Mauna Lahilahi that may be threatened by future shoreline erosion, potentially requiring relocation.
- *DLNR's Proposed Budget* -- SHPD's request for funding of $500,000 for burial vaults is not moving forward in the Governor's budget for the upcoming legislature session.
- *Reinterment Vault Costs* -- SHPD reached out to Kāneʻohe Marine Corps Base and two archaeological firms to see what might be learned from their projects. While unable to get exact figures tied to reinterment vault projects, the following was learned:

    - *Prefabricated Utility Boxes* -- were purchased through local concrete manufacturing companies for use as reinterment vaults, which is cheaper than creating customized concrete underground vaults.
    - *Above Ground Reinterment Locations* -- are common. Layne Krause may have costs associated with temporary and permanent reinterment locations tied to relocation of iwi kūpuna on Maui.
    - *Dry Stack* -- is as culturally appropriate as concrete, looks more natural, and is cheaper
- *Funding Needs* -- Working Group members agreed funding for any reinterment locations would need to support:
    - *Community Outreach and Communication* -- to ensure the community is aware of and comfortable with the sincere work being done across the State to care for iwi kūpuna.
    - *Acquisition & Construction* -- for any acquisition and construction of secure and culturally appropriate reinterment vaults.
    - *Staff & Long Term Maintenance* -- to ensure the respectful and permanent protection of iwi kūpuna.
- *Funding Sources* -- Working Group members agreed funding for this should be a **State Budget line item**. Iwi kūpuna will continue to be disturbed and legislative mandates mean nothing unless it is funded, and capacity is built in.
- *Recommendations* -- made by the Working Group during the 11/21/25 discussion:
    - *More Time and Discussion* -- Working Group members believe more discussion is needed to get into the finer details and recommend extending the Working Group beyond the report to the legislature.
    - *Use of State Mauka Lands* -- as reinterment locations. Access could be provided through area trails, which would minimize reinterment costs, and could potentially be executed through Aha Moku.

Next Steps

- *All*
    - Share anything you wish to see included in the report. These might include:

        - Discussions that need to happen next and with whom for each Working Group member's community or current plan of action for each County, especially those actions that have begun through the efforts of this Working Group.
        - Recommendations of potential legislative changes to HRS 6E.
        - Working Group members are cautioned that anything in the report will be made available to the public.
    - Review draft report to be circulated to Working Group members on December 5, 2025.
    - Next proposed meeting date
        - Meeting #5: Wednesday, December 10th, 12noon – 1pm (**goal: final meeting to review report).
- *Becca*
    - Distribute meeting notes.

Shared Resources

- *Reinterment Location Examples* -- shared by Tiger.
- *Notes from Michael Kat 11-20-2025* -- discussions with City & County of Honolulu related to Kualoa Beach Park & Mauna Lahilahi / Pōkaʻī Bay.
    - Includes *Draft BSC_Kualoa BP*
- *Measure Status Details for DC 407* & *Measure Status Details for DC 78* -- report samples provided by Becca.

BWS Property Pupukea, Oʻahu

PMRF Nohili, Kauaʻi

Cambridge re-internment at Nuʻuanu Pali Lookout, Oʻahu

Nauʻe, Kauaʻi ...Auē

Pacific Legacy

Historic Preservation

DRAFT

BURIAL SITE COMPONENT

OF AN

ARCHAEOLOGICAL DATA RECOVERY PLAN

FOR SITE 50-80-06-7568

AND FOR INADVERTENT DISCOVERIES OF HUMAN REMAINS

AT

KUALOA REGIONAL PARK

KUALOA, KO`OLAUPOKO, O`AHU

(TMK (1) 4-9-04:01)

Pacific Legacy: Exploring the past, informing the present, enriching the future.

CULTURAL RESOURCES CONSULTANTS

Hawai'i Offices:
Kailua, O'ahu
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California Offices:
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Inland Empire
Sierra/Central Valley

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(TMK (1) 4-9-04:01)

Prepared by

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Submitted by

Department of Parks and Recreation
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Submitted to

State Historic Preservation Division
Department of Land and Natural Resources
601 Kamokila Blvd., Suite 555
Kapolei, HI 96707

October 2014

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Frontispiece: Kualoa Reinterment Platform

INTRODUCTION

Kualoa Regional Park, is located on the windward side of the island of O`ahu in the seaward end of the *ahupua`a* of Kualoa (TMK 4-9-04:01) (Figure 1). This park is owned and administrated by the City and County of Honolulu, Department of Parks and Recreation since its inception in 1973.

The eastern beach of Kualoa Regional Park (the Park) has undergone severe erosion over the past 30+ years. Aerial photographs in the archaeological collection at the Park show the erosion of the eastern beach and the accretion of the southern beach (Figure 1). The erosion appears to be caused by a longshore current that runs from the north to the south. Several of the house properties that are located to the north of the Park have built stone walls and groins extending out into the water. These structures have been built over time to help individual property owners from suffering erosion and sand loss from their properties. This has caused problems to the south, namely at the Park, because the current flow has been altered and now causes erosion along the eastern beach at Kualoa.

Since 1975, over 100 sets of human remains have been recovered from the Park. All of these remains had been eroded out of the eastern beach area of the Park. Most of the remains are recovered from the eastern beach in the area labeled "Area of Erosion" on Figure 1; occasionally fragmentary remains are found west of Kualoa Point in the area labeled "Area of Accretion" on Figure 1; these finds are generally weathered and often waterworn indicating long exposure to the elements. The remains recovered from the area to the West of Kualoa Point undoubted originated from the "Area of Erosion."

Most of the sets of remains are fragmentary, often consisting of single bone fragments. Some however are complete individuals. The recovery of most of the relatively complete sets of remains has been done by State Historic Preservation Division (SHPD) staff members because the remains are most commonly found below the high water line on the beach, which is land under State jurisdiction. Other remains (primarily isolated bone fragments) have been found by visitors to the Park who alert Park staff of their existence; these remains are collected by Park staff.

All of the sets of remains are temporarily stored in the Park's archaeological curation facility until a reinterment date is set by the descendants and Park staff (see below). The Park curation facility is a climate controlled room in a fireproof building that secured by fencing, deadbolt locks, and an electronic alarm system.

CULTURAL BACKGROUND

The *ahupua`a* of Kualoa has a rich oral history. Its history can be traced back to Haumea and her husband Wakea who resided there. Haumea's daughter, Hi`iaka visited Kualoa and fought and killed a huge *mo'o* or lizard there, and the tail of the *mo`o* became Mokoli'i Island and his body

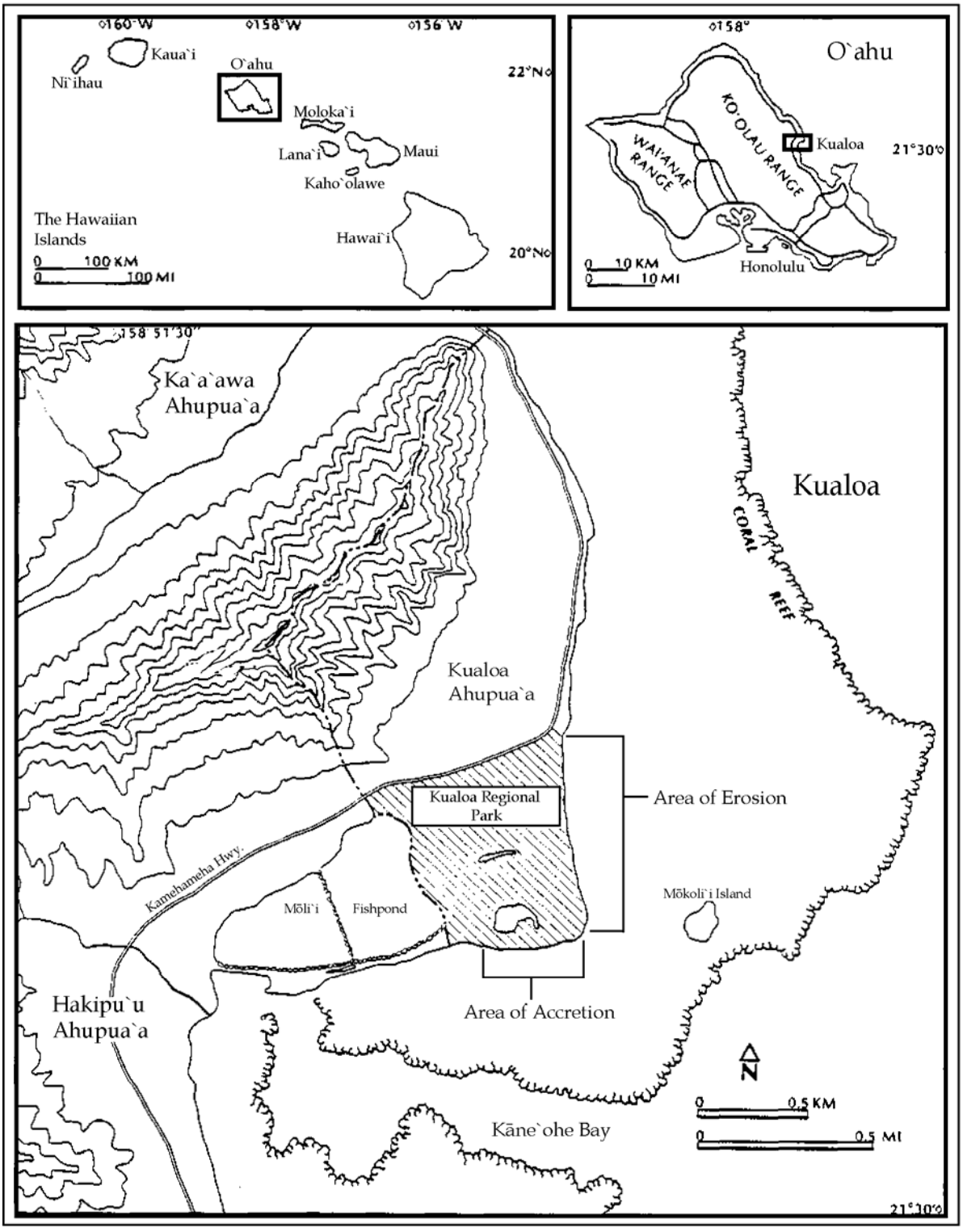

Figure 1. Project Location Map (adapted from Gunness 1987: Figure 1).

became the foothills and lowlands below the Kualoa cliffs (Beckwith 970 and Fornander 1880 as cited in Gunness 1987:15). Kamapua'a, the half man half pig, once hid from the goddess Pele at Kualoa; in his haste to escape Pele, Kamapua`a made the holes that can be seen today in Kualoa ridge (Summers and Sterling 1978, as cited in Gunness 1987:15). There are also traditions of a shark god that dwelled in the waters of Kualoa (Gunness 1987:16).

Kualoa was revered as a very sacred place, where canoes lowered their sails when passing Kualoa in respect for its sacredness (Gunness 1987:16); even Kamehameha I is said to have followed this custom of lowering his sails when passing Kualoa (Raphaelson 1929 as cited in Gunness 1987:22). The entire *ahupua`a* of Kualoa was a *pu'uhonua* or place of refuge (Kamakau 1964 and Thrum 1911, as cited in Gunness 1987:18). Traditionally, Kualoa was also a place where whale ivory washed ashore (Gunness 1987:18). Finally, Kualoa is where the Tahitian voyager, Kaha'i, brought the first *`ulu* from Kahiki and planted it at Kualoa (Gunness 1987:2).

ARCHAEOLOGICAL BACKGROUND

Numerous archaeological investigations have taken place at the Park over the last 30 years. Jo Lynn Gunness' Master's thesis from the University of Hawai'i at Mānoa chronicles the investigations that took place between 1975 and 1985. These archaeological investigations included systematic surface collecting, test probing associated with Park development, and two University of Hawaii archaeological fieldschools. These archaeological investigations showed that there was considerable traditional Hawaiian activity taking place along the eastern side of the Park. These activities included habitation, stone tool making (adzes, etc.), games (*ulu maika*), and training in warfare (sling stones). Another important activity taking place along the eastern beach of the Park was human burial. During the 20 year period between 1975 and 1995, 81 human burials were found in the Park. Fourteen of these burials were left in place and 67 were disinterred because of their imminent danger of being destroyed. These 67 sets of human remains were temporarily stored in the Park's archaeological curation facility.

There are generally two ways human remains are found at the park – either as isolate bones or as complete or nearly complete skeletons. Isolate bones are generally found and reported on by visitors to the Park. A finding of an isolated bone is reported to the Park Office; Park personnel go to the find spot and visually search the area for more bone. If more bone is observed, Park staff contact either the Park archaeologist or the State Historic Preservation Office. If is a single bone, the location is noted and the bone is taken to the Park curation facility.

When a complete of nearly complete skeleton is found it is usually actively eroding out of the sand below the vegetation line. Park staff notify the Honolulu Police Department and the State Historic Preservation Division (SHPD) (in the past the Medical Examiner's Office was also notified, but they wanted the Police or SHPD to handle the remains). Every set of remains that have been found at the Park have been over 50 years old and have been under the jurisdiction of the SHPD. The Police generally secure the area and await the arrival of SHPD archaeologists. SHPD archaeologists follow professional archeological methods to recover the remains. These methods include toweling and brushing sand, screening sediment a, and bagging remains. The methods sometimes need to be modified based on current conditions, such as a rapidly rising

tide and nightfall. SHPD archaeologists have consistently performed their duties in a professional and respectful manner. The recovered remains are then transferred to the curation facility.

PREVIOUS REINTERMENTS

In 1995, 67 sets of human remains were re-buried in a reinterment facility within the park boundary. This re-burial was organized by the State Historic Preservation Division (SHPD), with Edward Halealoha Ayau of the SHPD taking the lead. A permanent, secure reinterment site was chosen and developed (see below) (Figure 2). Recognized lineal descendants conducted the reinterment.

A second re-burial; took place in 2006, when 32 sets of remains were reinterred. The reinterment was culturally appropriate as dictated by the descendents.

A third re-burial of 12 sets of remains took place in 2008. This reinterment followed the wishes and protocol's established by the descendents.

The recognized descendants, with SHPD participation conducted a fourth reburial of 40 sets of remains took in June 2013

LINEAL DESCENDANTS

In 1993, SHPD staff genealogist Kanaʻi Kapeliela completed his review of genealogical information that had been submitted by individuals claiming lineal descent from the ancestors of Kualoa. Mr. Kapeliela recommended that the following individuals be recognized as lineal descendants and the O`ahu Island Burial Council, at their 13 October 1993 meeting, voted to recognize these individuals as lineal descendants of the *iwi kupua* at Kualoa. They are:

Cy Bridges
Gladys Pualoa and Ipolani Tano
Roland Logan
Sam Kekauoha
Winnifred Miller
Dawn Wasson
Kekela Miller

PROPOSED TREATMENT

The City and County of Honolulu, Department of Parks and Recreation has long understood its responsibility as the steward of the cultural and historical resources at Kualoa Regional Park. The administration has supported archaeological work in the Park since its inception in 1973. The Park now has a curational facility and a consulting archaeologist who spends eight hours per month maintaining the archaeological collection as well as assisting the Park administration

is other archaeological and historical matters. The Park has also created a reinterment site for inadvertently discovered human burials found at Kualoa.

The Park has been maintaining the reinterment site at Kualoa for the last 19 years. The reinterment site is located adjacent to two exceptionally large *Kamani* trees in an undeveloped portion of the Park that is away from most Park activities (Figures 2 and 3). This reinterment site consists of eight concrete electrical pull boxes arranged in two rows of four boxes, with a buffer area of 30 m around the electrical pull boxes. These concrete pull boxes are bottomless, so that anything placed in the boxes is in contact with the natural ground surface. Natural basalt cobbles and small boulders have been stacked up along the sides of the boxes and on top of the boxes to mask the concrete core, and give the appearance of a traditional stone platform (Figures 4 and 5). This platform measures ca. 4.5 by 5.5 x 0.75 m high.

At the request of the SHPD, the reinterment site has been assigned the Stat Site No. of 50-80-06-7568. The GPS coordinates, based on NAD 83 datum/ Zone 4, of this site are:

Easting:	619993.085
Northing	2379504.619

The 1995 reinterment of 67 sets of remains utilized four of the eight concrete boxes. The 2006 reinterment of 32 sets of remains required one concrete box, and the 2008 and 2012 reinterments also required one concrete box each. Thus one concrete box remains empty and available for reinterments. Once a concrete box has been filled, the lids were cemented, so that the remains are secure

The Department of Parks and Recreation has begun the process of acquiring eight additional electrical pull boxes to build another reinterment facility adjacent to the existing facility. The placement and construction of the new reinterment facility will be done in consultation with the recognized descendants.

The Department of Parks and Recreation continues on-going consultations with recognized descendents, as well as other descendents that come forward. This group of descendents ensures adherence to culturally appropriate treatment of remains recovered at the Park.

A cleared area buffer is being maintained around the reinterment site. This buffer measures between 10 and 20 meters from the reinterment platform (Figures 3-5). The Department of Parks and Recreation has taken on the responsibility of maintaining the site area and keeping the grass and bush controlled, so that the area will maintain a clean appearance. Monthly maintenance (weed-whacking and bush clearance) is being undertaken by Department.

Security of the reinterment site is maintained by its isolation from Park activities and because of the type of reinterment facility (concrete boxes with cemented lids. Maintenance of the site will be performed by the Department of Parks and Recreation.

Landscaping and planting around the site is undertaken by lineal descendants.

Access to the reinterment site for recognized descendants will be available during Park operation hours. After hour access will be granted to recognized descendants upon advance request to Park staff.

In order to provide perpetual protection for the reinterment site, the City and County will be entering into a reburial agreement with the State Historic Preservation Division (SHPD), and the reinterment site location and all appropriate determinations will be recorded in the Bureau of Conveyances. A draft reburial agreement is presented in Appendix A. If any of the signatory parties change in the future, a new burial site component of an archaeological data recovery plan may be need to be written

FUTURE INADVERTENT DISCOVERIES

Because of on-going erosional forces along the eastern beach, additional inadvertent discoveries of human remains will undoubtedly occur in the future. Any inadvertent discoveries of human remains will be treated according to law (HRS 6E) and Administrative Rules (§13-300). Specifically, in the event of any inadvertent discoveries of human remains, the SHPD (692-8015) and the Police (Kaneohe Station – 247-2166) shall be notified immediately in compliance with HRS Chapter 6E 43.6 and Hawaii Administrative Rules §13-300-40 [the Medical Examiner's Office has previously indicated that they would like the police to handle these discoveries]. In addition, recognized descendants will be contacted informing them of the discovery and seeking input on the disposition of the remains. If it is determined that the remains are over 50 years old, then the disposition of these remains shall be with the SHPD, with input from the recognized descendants. The SHPD shall determine if the remains should be left in place or removed for re-burial in the reinterment site. The timing of the reinterment of remains shall be made with consultations of the recognized descendants. Reinterment of remains will take place at least once a year with recognized descendant's involvement.

In the event that the SHPD determines that the remains should be relocated, the SHPD will determine on a case by case basis where the remains will be temporarily curated. Temporary curation of the remains may be at the Kualoa curation facility, which is the preference voiced by the descendants, so that the remains stay within the *ahupua`a* of discovery. All activities and actions related to the discovery and treatment of human remains will be conducted in a sensitive and appropriate manner, following provisions found in HAR §13-300-32(e).

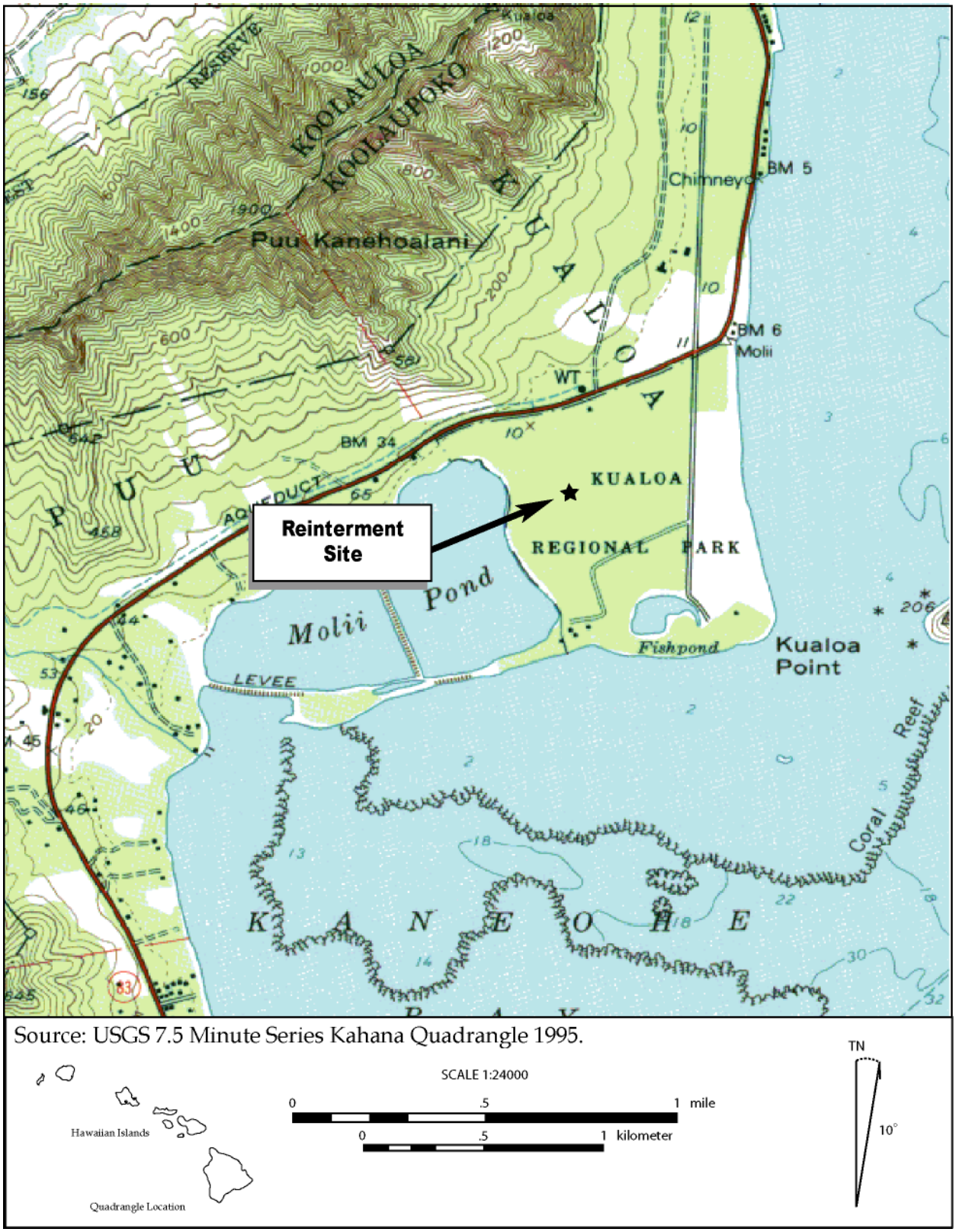

Figure 2. Location of Kualoa Regional Park's Reinterment Site

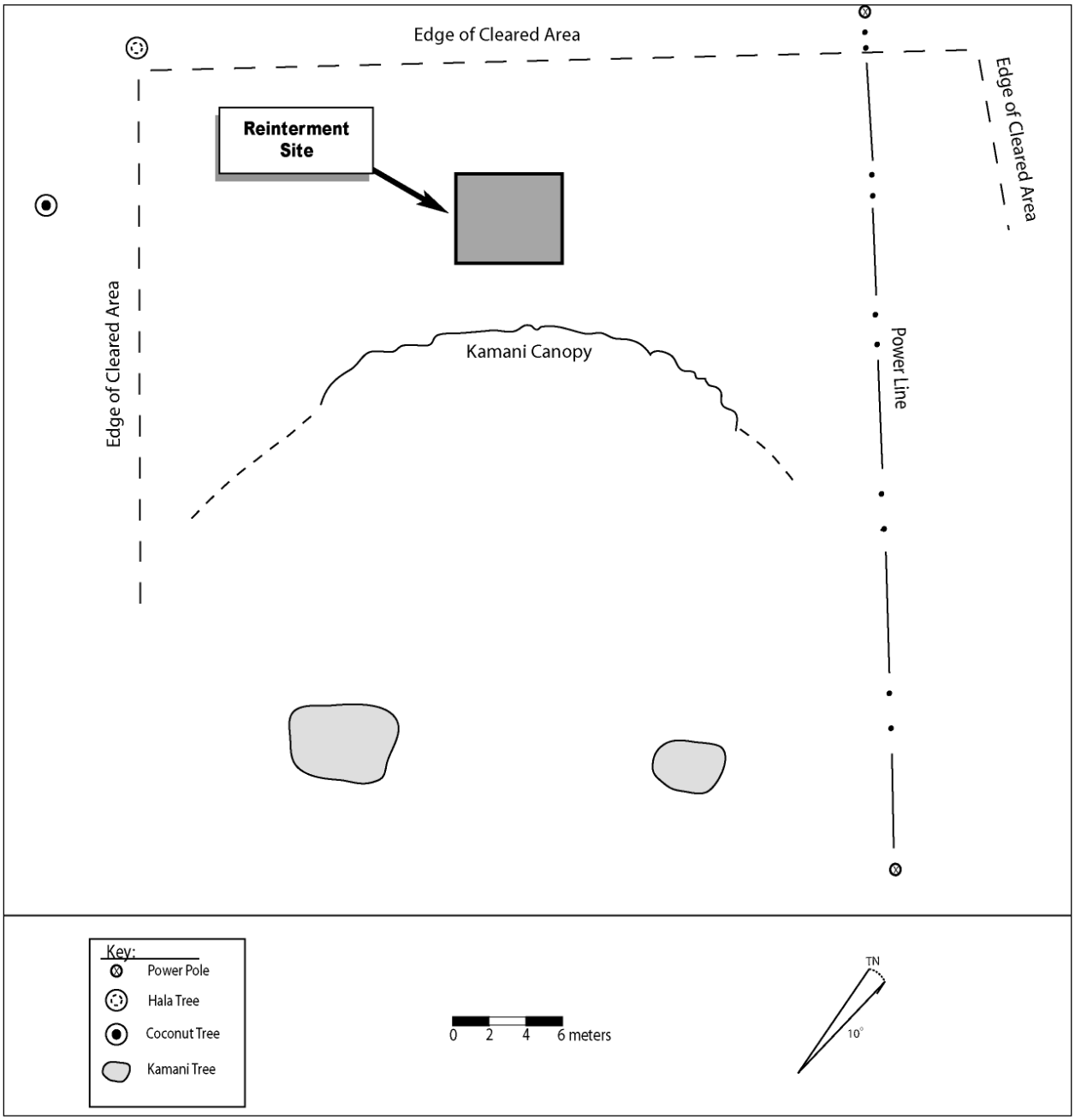

Figure 3. Plan Map of Reinterment Site.

Figure 4. Overview of Reinterment Site.

Figure 5. Close-up of Reinterment Platform.

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APPENDIX A

DRAFT REBURIAL AGREEMENT

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Department of Land and Natural Resources)
State Historic Preservation Division)
601 Kamokila Boulevard, Suite 555)
Kapolei, HI 96707)
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LAND COURT SYSTEM REGULAR SYSTEM

Return by Mail ( ) Pickup ( ) To:

REBURIAL AGREEMENT

This Reburial Agreement dated _____, by and between The City & County of Honolulu Department of Parks and Recreation, whose address is 650 South King Street, Honolulu Hawai'i 96813 ("Landowner") and the STATE OF HAWAI'I ("State") by its Board of Land and Natural Resources whose address is Kalanimoku Building, 1151 Punchbowl Street, Honolulu, Hawai'i 96813.

WITNESSETH

WHEREAS, the Landowner owns real property at Kualoa Ahupua'a, Ko'olaupoko District, Island of Oahu, identified by Oahu Tax Map Key No. [TMK: (1) 4-

9-04: 01] in which property a burial site containing skeletal remains have been re-interred; and further described in "Exhibit A";

WHEREAS, the State, pursuant to Section 6E-43 and 6E-43.6, Hawai'i Revised Statutes, is responsible for regulating the proper treatment of human skeletal remains over fifty years old, at any site other than a known, maintained, actively used cemetery; and

WHEREAS, the parties desire to enter into this Agreement to rebury the human skeletal remains of certain individuals.

NOW THEREFORE, in consideration of the above and the terms and conditions contained herein, the parties agree as follows:

1. The Landowner agrees to allow the skeletal remains of the ancestral Native Hawaiian to be reburied on the Landowner's property identified by [TMK: (1) 4-9-04: 01].

2. The Landowner, upon recommendation from the Department of Land and Natural Resources (DLNR) agrees to establish a 30 meter permanent buffer from the burial platform..

3. The Landowner, upon recommendation from the DLNR, agrees to maintain the area immediately surrounding the burial site by providing grass and bush control to keep a clean appearance. Landscaping and planting around the burial platform will be undertaken by descendants as recognized by the Oahu Island Burial Council (OIBC) in conjunction with State Historic Preservation Division (SHPD).

5. The Landowner agrees to treat the exact location of reburial site as confidential information as provided for by section 6E-43.5, Hawai'i Revised Statutes. The Landowner agrees to identify the location of the reburial site on a map and provide such information to DLNR and SHPD.

6. The Landowner agrees to provide living Cultural and Lineal, as recognized by the OIBC in conjunction with SHPD, access rights to visit the burial site for cultural purposes. The access rights shall be by the most direct route across the Landowner's real property to be determined by the Landowner. Access shall be granted during park hours or after hours by request in advance. Such right of access shall be subject to the rules and policies of the Landowner. Cultural and Lineal descendants are to contact the Landowner or their representatives thereof to confirm dates and times of visitation if after park hours. The request for after hours visitation must be made in writing at least 7 days in advance to confirm date and time.

7. The Landowner, on behalf of itself and its successors and assigns, covenant and agree not to willfully disturb in any manner, or allow the disturbance of in any manner, the repose of the human skeletal remains reburied at its property at [TMK: (1) 4-9-04: 01].

8. In the event the Landowner learns that the human skeletal remains, or any part thereof, are unearthed by natural causes or otherwise, the Landowner agrees to immediately notify DLNR. The Landowner agrees not to handle the human skeletal remains in any manner. DLNR shall take proper action to secure the remains in place.

IN WITNESS WHEREOF, the STATE OF HAWAI'I, by its Board of Land and Natural Resources, has caused the Seal of the Department of Land and Natural Resources to be hereunto affixed and the parties hereto have caused this Agreement to be executed as of the day, month, and year first above written.

STATE OF HAWAI'I

By _____
Chairperson, Board of Land and Natural Resources

By _____
Member, Board of Land and Natural Resources

LANDOWNER
City & County of Honolulu
Department of Parks and Recreation

By _____
Authorized Representative

APPROVED AS TO FORM:

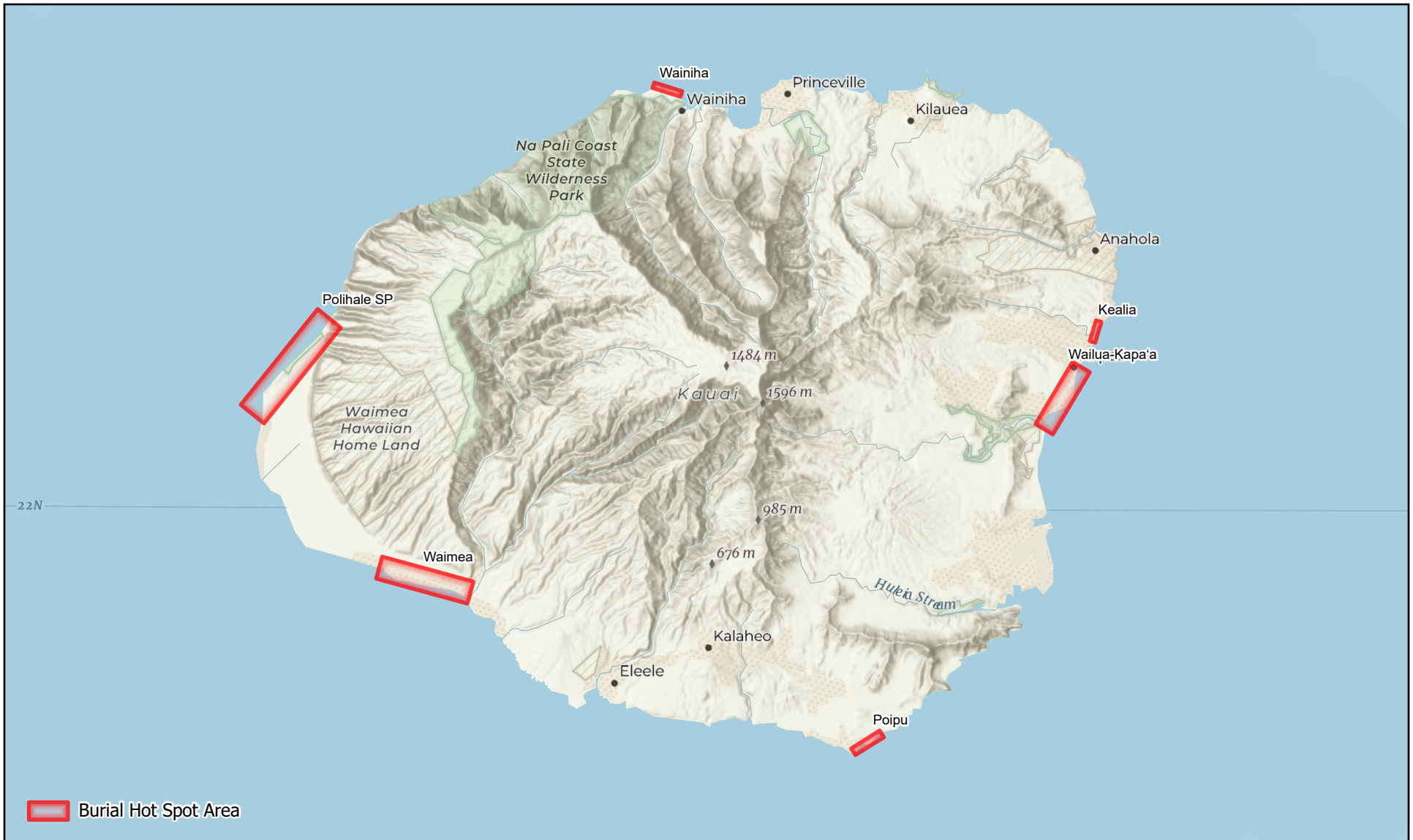
_____
Deputy Attorney General

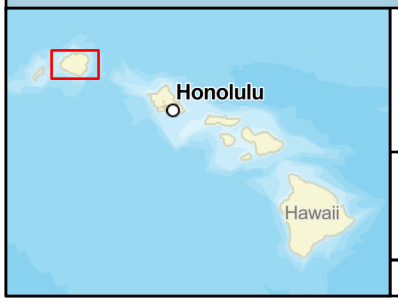
Dated: _____

STATE OF HAWAI'I)
) SS.
COUNTY OF)

On this _____ day of _____, 20___, before me personally appeared _____ to me known to be the person described in and who executed the foregoing instrument and acknowledged that _____ executed the same as _____ free act and deed.

_____
Notary Public, State of Hawai'i





Burial Site "Hot Spots" Vulnerable to Sea Level Rise

Sea Level Rise, Government Owned Parcels, TMK, and Soils data sourced from the Hawai'i Statewide GIS Program. Burial data from DLNR SHPD. This map is not intended for sharing with the public or media.

Basemap credits:Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere, Date: 10/22/2025

Island of Kaua'i

N

0 5 10 Kilometers

0 2.5 5 Miles

Crall, Rebecca E

From: Kat, Michael A <michael.kat@honolulu.gov>
Sent: Thursday, November 20, 2025 5:20 PM
To: Crall, Rebecca E
Subject: [EXTERNAL] RE: DLNR- Office of the Chair - HCR 122 Working Group Meeting #3 10.29.25 from 12noon-1pm
Attachments: draft BSC_kualoa bp.pdf

Hi Rebecca,

Unfortunately, I wasn't able to find someone available to fill in for me in my absence.

Could you please pass along a few notes to rest of the members for me?

Summary of Discussions with DPR Staff (Kualoa Beach Park & Mauna Lahilahi / Pōkaʻi Bay)
Kualoa Beach Park

- **Contract management challenges:** Park staff do not manage the monitoring contract with Pacific Legacy directly; procurement is handled by DDC. This separation has complicated oversight and coordination.
- **Pacific Legacy monitoring inconsistencies:** Monitoring frequency has decreased from monthly, to every other month, to "as needed." Funding lapses make scheduling difficult, although Pacific Legacy has continued monitoring voluntarily in some cases.
- **Inventory facility updates:** The Kualoa repository has been recently renovated, and the reinterment vault has additional capacity. Staff are opposed to take on iwi originating from outside the park due to long-term stewardship responsibilities.

Mauna Lahilahi / Pōkaʻi Bay

- **Concerns about new reinterment responsibilities:** Staff are hesitant to support installation of a new vault without long-term maintenance funding. There is concern that a one-time funded project would create ongoing expectations without sustained resources.
- **Erosion issues:** Portions of Pōkaʻi Bay are eroding rapidly (~10 ft/year). There is concern that the newly constructed revetment may be accelerating erosion.
- **Native planting feasibility:** While vegetation could help slow erosion, irrigation infrastructure is either absent or non-functional, limiting feasibility without additional investment.
- **Existing reinterment site at risk:** Staff reported an existing buried reinterment site near Mauna Lahilahi that may be threatened by future shoreline erosion, potentially requiring relocation.

Michael A. Kat
Department of Planning & Permitting
650 South King Street, 7th Floor
Honolulu, Hawaii 96813
Phone: (808) 768-8013

From: Crall, Rebecca E <rebecca.e.crall@hawaii.gov>
Sent: Monday, November 17, 2025 3:09 PM
To: Kat, Michael A <michael.kat@honolulu.gov>
Subject: RE: DLNR- Office of the Chair - HCR 122 Working Group Meeting #3 10.29.25 from 12noon-1pm

Aloha Michael,

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIA'ĀINA

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA

P.O. BOX 621
HONOLULU, HAWAII 96809

DAWN N.S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RYAN K.P. KANAKAʻOLE
FIRST DEPUTY

CIARA W.K. KAHAHANE
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

AGENDA

HCR122 HD1
Working Group Meeting #5

December 10, 2025
12 noon – 1pm
Zoom Link: https://zoom.us/j/96249855186

HCR122 HD 1 (2025) Requests "The Department of Land and Natural Resources to Establish A Collaborative Working Group to Survey, Identify, and Monitor Culturally Sensitive Shorelines Impacted by Erosion"

1. **Opening protocol** (given by WG member) **and introductions**
2. **Re-cap of meeting #4** *(5 min)*
    a. WG member comments on notes/recommendations for task #3?
3. **Review of Draft Working Group Report to be submitted to the 2026 Legislature**
    a. Comments/Edits on report
    b. Review list of Enclosures to be included with the report
        i. Anything to be added or removed from enclosure list?

        **This will be a public document posted on the Capitol and DLNR websites.*
    c. Re-cap any key/ additional recommendations
    d. If no major edits – vote on final draft/contents of report.
4. **Final comments from Working Group members**
5. **Closing & Adjournment**

Mahalo for your willingness to serve and participate in this working group!

Meeting materials from all HCR 122 meetings are available via the HCR 122 Working Group Member Shared folder

Requirements listed in HR118 HD1/HCR122 HD1:

1. *The collaborative working group* is requested to determine a process to address iwi kūpuna exposed along shorelines, ensuring their protection from adverse impact.

2. *The collaborative working group* is requested to assess public lands near culturally sensitive areas were iwi kūpuna were exposed along shorelines to determine locations that may be designated as suitable reinterment sites.

3. The *Department of Land and Natural Resources* is requested to consider the appropriate methods of funding to support the collaborative working group, including for the construction of secure and culturally appropriate reinterment vaults in areas designated by the collaborative working group to ensure the respectful and permanent protection of iwi kūpuna.

4. The *collaborative working group* is requested to submit a report of its findings and recommendations, including any proposed legislation, to the Legislature no later than twenty days prior to the convening of the **Regular Session of 2026** *(December 2025)*

Notes from
HCR122 HD1 Working Group Meeting on

December 10, 2025
12:00pm – 1:00pm
Held via Zoom

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HCR122 HD 1 (2025) Requests "The Department of Land and Natural Resources to Establish A Collaborative Working Group to Survey, Identify, and Monitor Culturally Sensitive Shorelines Impacted by Erosion"

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Agenda

- Opening protocol (given by WG member) and introductions
- Re-cap of meeting #4 (5 min)
    - WG member comments on notes/recommendations for task #3?
- Review of Draft Working Group Report to be submitted to the 2026 Legislature
    - Comments/edits on report
    - Review list of enclosures to be included with the report
        - Anything to be added or removed from the enclosure list noting this will be a public document posted on the Capitol and DLNR websites
    - Re-cap any key / additional recommendations
    - If no major edits – vote on final draft/contents of report
- Final comments from Working Group members
- Closing & Adjournment

Working Group Attendees

- SHPD Designee: **Jessica Puff**, SHPD Administrator
- SHPD Representative**: Noah Gomes**, DLNR SHPD Ethnographer on behalf of Jordan "Kea" Calpito**,** SHPD History & Culture Branch Chief
- Representative of City & County of Honolulu: **Michael Kat**, Department of Planning & Permitting
- OCCL Designee: **Tiger Mills** (Kimberly T. Mills), OCCL Staff Planner
- Representative of the County of Hawai'i: **Laura Acasio,** Office of Sustainability, Climate, Equity, and Resilience as Administrator

- Representatives of the County of Maui: **Layne Krause**, County of Maui, GIS Analyst in Department of ʻŌiwi Resources and **Ms. Kadian Shaw,** Executive Assistant (Office of the Mayor)
- Representative of the County of Kauaʻi: **Mauna Kea Trask**, private attorney and former member of the Kauaʻi/Niʻihau Island Burial Council from 2012 to 2014
- Representative of the Island Burial Councils: **Scott Fisher**, Maui Lānaʻi Islands Burial Council
- OHA Representative: **Kūʻikeokalani "Kūʻike" Kamakea-ʻŌhelo**, OHA ʻŌiwi Wellbeing and ʻĀina Momona Director **(AI Notetaker only)**
- Other Attendees:
    - DLNR Staff: Rebecca "Becca" Crall, Outreach Coordinator, serving as working group support.
    - HACBED Staff: Merri Keliikuli, serving as notetaker.

Takeaways

- *Notes Approved for Working Group Meeting* -- notes for the group's meeting on 11/21/25 were approved by Working Group members in attendance.
- *Focus for This Final Meeting of Five* -- Working Group members were reminded this was the final meeting of the Working Group and focus of the meeting is final review of the Draft Working Group Report to be submitted to the 2026 Legislature.
- *Suggested Edits to the Draft Working Group Report* -- suggestions made by Working Group Members prior to the meeting were incorporated into the draft reviewed during the meeting. Additional suggestions presented by Working Group Members during the meetings included the following, for which all attending Working Group Members were in agreement:
    - *Request to Add Meeting #5* -- to the list of Working Group Meetings.
    - *SHPD's Role* -- while it is SHPD's responsibility to record inadvertent discoveries, clarification was made regarding the suggestion that SHPD's role might include oversight and maintenance of vaults. Instead, SHPD's role should be tied to coordination or facilitation of discussions and agreements with relevant stakeholders regarding the maintenance and stewardship of vaults.

        - A question of capacity was also raised and there was agreement that SHPD would determine its needs.
    - *More Appropriate 'Ōlelo No'eau* -- it was suggested 'ōlelo no'eau #2488 be replaced with 'ōlelo no'eau #1261.
        - Change “Ola nā iwi.” (The bones live.)
            - To “I ulu no ka lālā i ke kumu.” (The branches grow because of the trunk.)
            - Without our ancestors we would not be here.
    - *Acknowledgements of Unanticipated Outcome* -- Working Group Members acknowledge the increased opportunities for collaboration between counties and agencies who are actively addressing inadvertent discoveries of iwi kūpuna.
- *Map Repository* -- given the usefulness of the maps produced by SHPD for this Working Group, it was suggested that a repository be an output of this Working Group, serving as a resource to counties and others addressing inadvertent discoveries of iwi kūpuna that others might also help to build.
- *Funding for Vaults* -- Chair Chang reiterated SHPD’s request for funding of $500,000 for burial vaults was not included in the Governor’s budget. It may have been included in the Department’s Green Fee proposal, but this needs to be confirmed. It was noted that costs for vaults are relatively low and interested counties or agencies could find funding elsewhere.
- *Considerations Beyond Scope of This Working Group* -- Working Group Members highlighted the opportunity to use this group’s findings to support other task forces dealing with climate change, such as the group looking at shoreline erosion and its impacts, that might also further these efforts to protect iwi and minimize inadvertent discoveries. The group agreed that while beyond the scope of this working group, the cultural impacts, particularly to iwi kūpuna must be addressed by any coordinated efforts addressing beach erosion or restoration.
- *Gratitude* -- was expressed by all to be included in this Working Group and for the collective efforts of the Working Group Members.

Next Steps

- *All*
    - *Review Final Draft Report* -- and provide comment before deadline (to be established by the Chair/DLNR staff)
- *Mauna Kea Trask* -- to share suggested 'ōlelo no'eau.
- *Becca / DLNR*
    - *Integrate Comments* -- and update the final draft report.
    - *Advance Distribution* -- of the revised draft to Working Group Members for review.
    - *Finalize Draft Report* -- integrate any additional feedback provided by Working Group Members and submit to the legislature by December 26, 2025.