OAHU ISLAND TARGET FORMERLY USED DEFENSE SITE: QUESTIONING THE CONCEPTUAL SITE MODEL

Julie Ange, P.E.
Chief, Environmental Protection and Utilities Branch
U.S. Army Engineering and Support Center, Huntsville
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AGENDA

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Site Overview and History

CSM from the RI through DD
- RI approach that led to development of initial CSM
- Inconsistencies in the CSM
- CSM elements that were known but not fully considered in FS and DD

Remedial Action (to date)
- Approach and outcome
- Revised CSM

Lessons Learned

Questions

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ACRONYM LIST

Conceptual Site Model (CSM)

Data Quality Objective (DQO)

Decision Document (DD)

Digital Geophysical Mapping (DGM)

Feasibility Study (FS)

Formerly Used Defense Site (FUDS)

Land Use Controls (LUCs)

Malaekahana State Recreation Area (MSRA)

Munitions and Explosives of Concern (MEC)

Munitions Constituents (MC)

Munitions Debris (MD)

Material Potentially Presenting and Explosive Hazard (MPPEH)

Munitions Response Site (MRS)

Project Delivery Team (PDT)

Remedial Action (RA)

Remedial Investigation (RI)

Remote Operated Vehicle (ROV)

Request for Proposal (RFP)

Systematic Project Planning (SPP)

Target of Interest (TOI)

Visual Sample Plan (VSP)

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SITE OVERVIEW

Oahu Island Target FUDS Property

Target Islands and Surrounding Waters MRS

- 57.28 acre MRS off the northeastern coast of Oahu adjacent to Mālaekahana State Recreation Area and Laie Point
- Consists of the islands of Kihewamoku, Mokualai, and Pulemoku and waters surrounding each island

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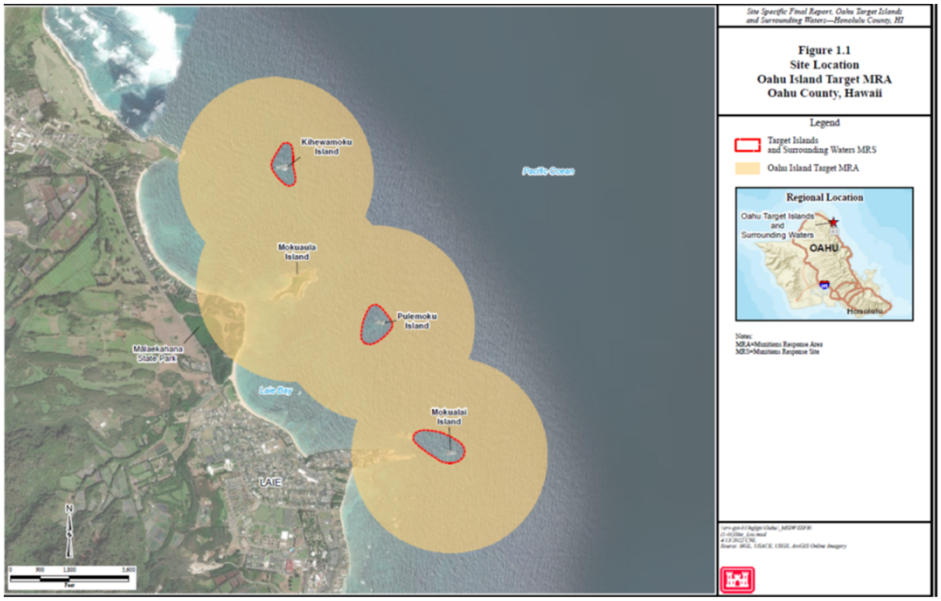
SITE LAYOUT: OAHU ISLAND TARGET



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HISTORICAL MILITARY USE

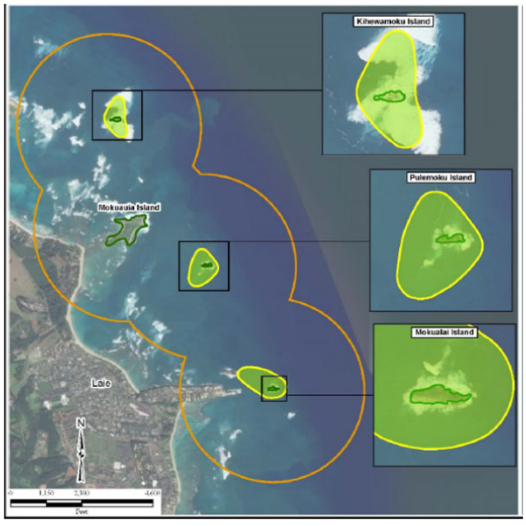
May 1943 – US Army obtained use permit from Territory of Hawaii - Board of Agriculture and Forestry for Mokuauia Island (12.5 acres).

Army Air Corp and Air Force used Mokuauia Island as a bombing target.

US Army obtained a separate permit to use islands of Kihewamoku, Mokualai, and Pulemoku as bombing targets from 1943 to 1952.

1952 – Surface cleanup of Mokuauia Island performed.

February 1953 – All four islands formally transferred back to the Board of Agriculture and Forestry.



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INVESTIGATIONS PRIOR TO RI

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1982 – 1983 – US Navy Explosive Ordnance Disposal Clearance

- Located and disposed of over 70 WWII vintage bombs including 250-lb general-purpose (GP) bombs, 500-lb GP bombs, 750-lb Demolition bombs, and an 8-in projectile in the waters surrounding Kihewamoku Island. No ordnance items were found on the islands themselves.

2008 –Site Inspection for the Oahu Island Targets Munitions Response Area

- Visual inspection found no MEC or other pertinent features such as craters, target remnants, land scars, or surface staining of the smaller islands
- Only MD observed: metal fragments, two spotting charge pieces, and a brass small arms casing
- Soil sampling on Mokuauia did not reveal any indication of MC contamination

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REMEDIAL INVESTIGATION

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RI field activities were conducted from September 5 to October 18, 2012.

No further inspection of the islands was conducted for the RI.

Combination of visual snorkel transects, side scan sonar, and SCUBA transects.

13 munitions items were located and destroyed, including 5-inch and 6-inch projectiles, 20-pound fragment bombs, and 3.5-inch rocket warheads

Highest MEC density approximately 3 items/acre.

Oahu Island Target Munitions Response Area was divided into two Munitions Response Sites

- Target Islands and Surrounding Waters (57.28 acres) – “Project 1 Site” -> FS
- Mokuauia Island and Surrounding Waters – “Project 2 Site” -> NDAI (No DoD Activity Indicated) No Action DD

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RI INVESTIGATION METHOD

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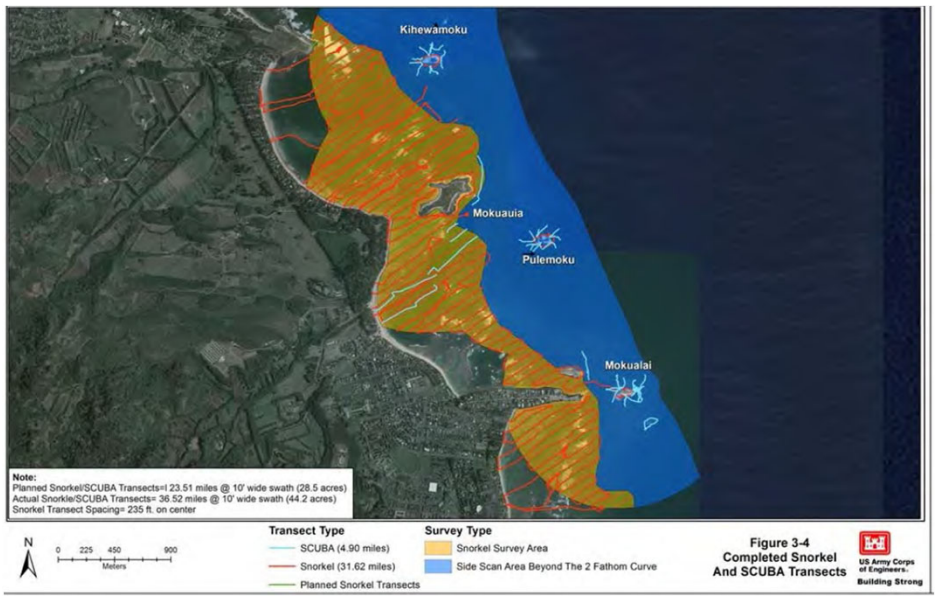

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RI INVESTIGATION METHOD

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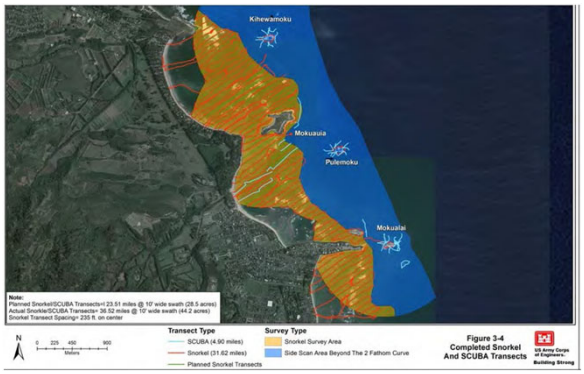
Snorkel Transect Investigation

235-foot spaced transects from shore to approximately at the 2-fathom curve (12 ft depth) on the seaward side

Approx. 29 acres of visual investigation

Snorkeling was the predominant method for the transect investigation since the majority of the transects within this depth range possessed a rock and coral-covered seafloor and provided better conditions for the visual inspection of the seafloor.

The few areas that had sand covered seafloor areas were investigated by SCUBA divers with analog metal detectors.



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RI INVESTIGATION METHOD

Side Scan Sonar Survey

Approx. 710 acres of a side scan sonar from the 8-fathom to the 2-fathom curve.

Sensor was at the 400 kHz setting in a fixed, hull-mounted configuration for the shallower waters and towed in the 1250 kHz configuration in the deeper depths.

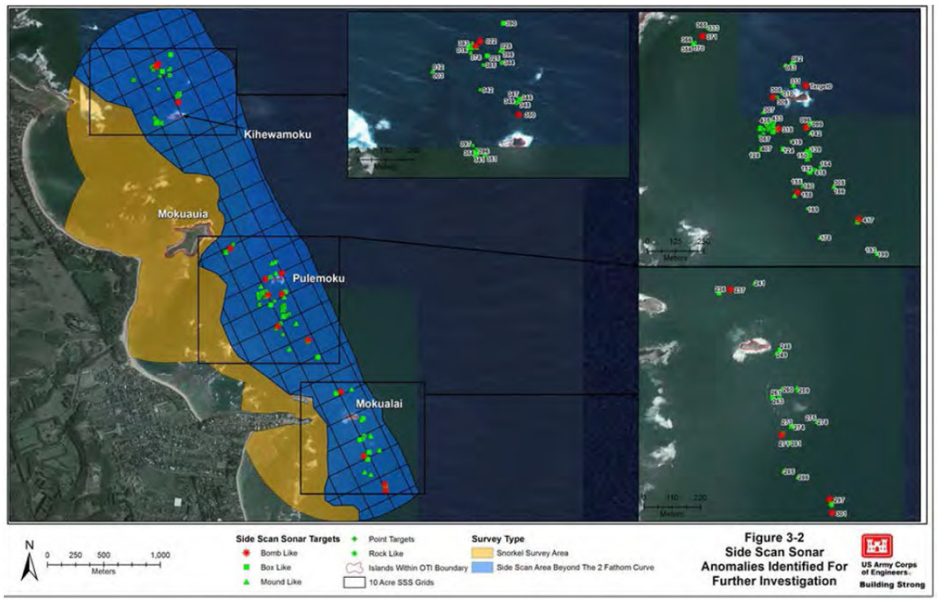
Identified TOI (anomalies with munitions-like features) that were either sitting atop or protruding from the seafloor with the most prominent ordnance-like images were investigated by divers or a ROV.

133 sonar targets were identified that met the criteria as a TOI 100% investigation of all identified TOIs.

Side Scan Sonar transects were planned to travel parallel to shoreline but were modified in a Field Work Variance to travel into the seas on the seaward pass, and with the seas on the shoreward pass (perpendicular to the shoreline).

SCUBA transects were added close to islands due to difficulty collecting reliable sonar data.

RI INVESTIGATION – SS SONAR TOI



RI INVESTIGATION RESULTS

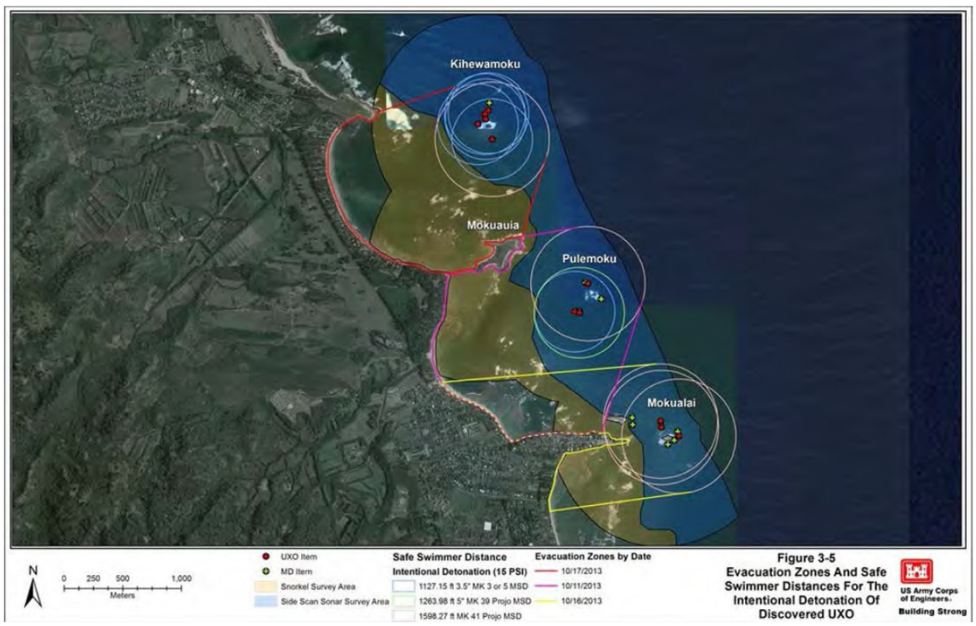


Figure 3-5
Evacuation Zones And Safe Swimmer Distances For The Intentional Detonation Of Discovered UXO

US Army Corps of Engineers. Building Strong

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RI INVESTIGATION RESULTS

Table 3-1: Summary of Qualitative Reconnaissance

Target Islands	UXO Found	MD Found
Kihewamoku Island	*ID 16*: 5-in MK 41 Mod 0 Projectile *ID 17*: 3.5-in MK 3 or 5 Rocket Warhead *ID 18*: 20-lb Frag Bomb AN-M41-A1 *ID 19*: 20-lb Frag Bomb AN-M41-A1 *ID 20*: 20-lb Frag Bomb AN-M41-A1 *ID 21*: 20-lb Frag Bomb AN-M41-A1 *ID 22*: 20-lb Frag Bomb AN-M41-A1	*ID 4*: 5-in Projectile
Mokuauia Island (also known as Goat Island)	None	None
Pulemoku Island	*ID 1*: 3.5in MK 3 or 5 Rocket Warhead *ID 2*: 3.5-in MK 3 or 5 Rocket Warhead *ID 6*: 5-in MK 41 Mod 0	*ID 3 & 9*: 8-in Projectile (1 ea) *ID 5, 26,& 30*: MK 23 Practice Bomb (PB) (1 ea) *ID 23*: MK 23 PB (2) *ID 8*: 3.5-in MK 3 or 5 Rocket Warhead *ID 29*: 5-in Projectile
Mokualai Island	*ID 7*: 6-inch Shrapnel M 1 *ID 14*: 5-in MK 41 Mod 0 projectile *ID 15*: 5-in MK 41 Mod 0 projectile	*ID 10, 25, 27, & 28*: 5-in Projectile (1 ea) *ID 11*: 5-in Projectiles (3) *ID 24*: 5-in Projectiles (3)

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RI DEMOLITION

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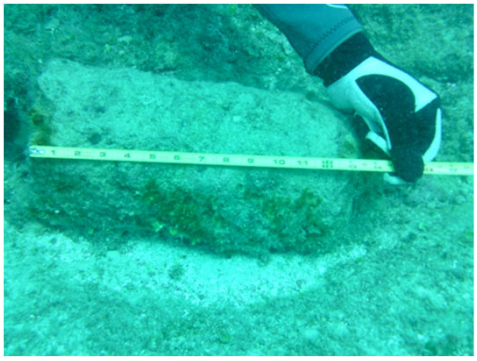
Ordnance items discovered during all phases of the investigation (snorkeling, sandy seafloor investigation, side scan sonar target prosecution) were geo-referenced, which enabled them to be reacquired for disposal by detonation when the investigation was complete. All relocation and detonation operations occurred when the field investigation was completed.

UXO were disposed of by underwater detonation (BIP) with sandbag mitigation (consolidation was planned).

Fragments from the resulting detonation were inspected, processed and packaged as MDAS.

Of the munition debris, four of the items were MK 23 practice bombs with the spotting charges expended. The MK 23 practice bombs that were recovered were inspected, processed and packaged as MDAS. The remaining munition debris was left on the ocean floor undisturbed to remain part of the marine habitat.

Due to heavy marine growth on the UXO and MD items, positive identification could not be certain, and, in some cases, the leftover fragments and debris after the detonation occurred provided enough information to revise the identification of the UXO item.



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RI INVESTIGATION RESULTS

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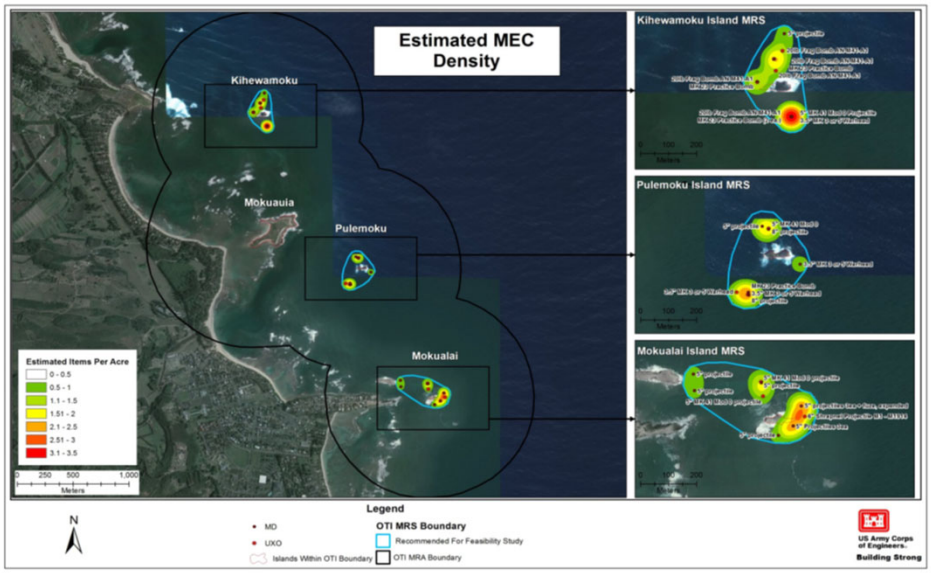

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RI MAJOR CHALLENGE – SEA STATE

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Sea conditions during the majority of the work were extreme.

Wind waves approach the MRS uninterrupted by any land mass, shoal or reef which allows them to reach their maximum size and energy potential when they reach the shoreline.

When wind speeds approached or exceeded 23 mph, or when wind waves combined with large, northern swell waves became excessive, work conditions became dangerous and operations were cancelled.

The majority of work was conducted in 20-kt winds with a 6 to 8-ft wind waves and an additional 3 to 4-ft swell waves which resulted in a Douglas Sea State Code 5 category which is characterized as "*Rough*" with waves that range from ~ 9 - 14 ft in height.

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RI CSM– FACILITY PROFILE

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Location and Area:
MRS is comprised of three small, uninhabited islands bounded by the coastal feature Makahoa Point to the northwest and Laie Point to the southeast, specifically:
- Kihewamoku Island, ~ 2,750 feet east southeast from Makahoa Point
- Pulemoku Island (also known as Pulemoku Rock), ~ 3,900 feet east southeast from Kalanai Point
- Mokualai Island, ~ 450 feet north northwest of Laie Point
- The islands are located in a 2-mile stretch off the northeastern (windward) side communities of Kahuku and Laie, offshore of the MSRA. The three islands, and waters surrounding them, comprise approximately 31.03-acres each for a total of 93.09-acres

Structures:
- There are no structures on the three target islands.
- The closest structures to the three target islands can be found on Laie Point, which is populated by residential housing.

Security:
- The three target island sites have unrestricted access

Boundaries:
- The MRS boundaries are notional and based on fragmentation buffer areas for submerged munitions at 18-m or more.

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RI CSM– PHYSICAL PROFILE

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MRS sites extend to depth of approximately 15-m (approximate depth of water at the MRS outside boundaries).

The near shore zone consists primarily of abrupt cliff lines that drop dramatically into the ocean and proceed to the ocean floor at an average depth of 5-m. At the base of each island, large rocks and boulders, gullies, caves, depressions and pinnacles exist close to the island's edges. Sloping away from each of the islands, the terrain levels into a limestone platform (pavement like surface),and is eroded forming low-relief topography in the form of depressions, ledges and undercuts.

No significant sand areas exist within the target islands MRSs.

MRS has direct exposure to waves from both trade-wind generated seas and long-period north swells.

Reef-building corals do not form extensive depositional reefs in the area but are common, as both individual colonies and small aggregations form patch reefs growing on the fossil limestone platform.

At the terminus of the reef flat, where bottom composition grades into sand flats, corals and other macro-benthos become scarce. Fish assemblages on the reef flat include the typical variety of genera and species found on exposed Hawaiian habitats. The most common fish are from the surgeonfish, butterfly fish, damselfish, wrasse, and goatfish families. Abundance of fish is generally highest in areas of highest relief, where reef structure affords the most shelter. Fish are least abundant on the sand flats and flat areas of the reef platform.

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RI CSM– LAND USE AND EXPOSURE PROFILE

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Beneficial Resources:
• Recreational area

Current Land Use:
• During rare calm ocean periods the target islands may be accessed by swimmers this is considered a rare occurrence

Current Human Receptors:
• Recreational users (adult/child)

Potential Future Land Use:
• No anticipated change in land use

Potential Future Human Receptors:
• No anticipated change in human receptors

Cultural, Archaeological and Historical Resources:
• No cultural or archaeological resources are known to exist within the target islands MRSs

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RI CSM – ECOLOGICAL PROFILE

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Habitat:
- DLNR Properties: State recreation area
- Water acres: Marine underwater habitat/waters are used for water recreation to include fishing (recreational/subsistence)

Ecological Receptors:
- The Hawaiian Stilt, Green Sea Turtle and Hawaiian Monk Seal are all endangered species that may be present within the target island MRSs. The offshore waters are also habitat for the Humpback Whale, which migrates to the area in the winter months. Migration season is October or November (depending on the source) until May.



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RI CSM – MUNITIONS RELEASE PROFILE

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Munitions Type:
- SI Report: Bombs (250 to 750-lbs) and projectiles (8-in)
- RI Report: UXO – 20lb fragmentation bombs, 155 mm Shrapnel projectile, 5” projectile, 3.5’ rockets.
  MD – 8” Projectiles, MK 23 Practice Bombs

Release Mechanism:
- Air dropped or shot from Navy guns or shot from Coastal Artillery

Maximum Probable Penetration Depth:
- UXO items and MD were discovered on the ocean floor surface. Penetration into the flat rock ocean floor is not anticipated.

Associated Munitions Constituents:
- SI Report: MC sampling was not conducted on the Target Islands due to the lack of soil and the islands being inaccessible.

Transportation Mechanisms and Migration Routes:
- Direct contact by humans or wildlife with munitions on the seafloor

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RI CSM – PATHWAY PROFILE

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Pathway Analysis:

• Because the waters in the MRS are frequented by fishermen, divers and snorkelers who may encounter UXO on the seafloor, the pathway is complete.

• The MC associated with the ordnance that is potentially present on the seafloor is undetectable due to the undersea environment, so the migration pathway is considered incomplete.

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OTHER SITE ACCESSIBILITY CONSIDERATIONS

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From the MEC HA:
The distance to the islands and the depth of water is a considerable barrier.

To interact with munitions requires boating or swimming to where the munitions exist and to descend to the ocean floor (SCUBA or free dive).

Shallowest UXO and MD was at approximately 16-ft.

Dropping a boat anchor on UXO is also possible

- Nearest boat ramp is 6 miles from MRS and shallow water of the channel from the boat ramp to sea limits vessel size.
- Sea state during most of the year is under small craft warnings or marginal for small boats to be underway along this coast line.

Due to these reasons the locations for the munitions (which are located on the ocean floor) are not frequented by a large numbers of people.

Under the Baseline assessment or No Action scenario the properties would be considered to be sites with "*Very Limited Accessibility*."

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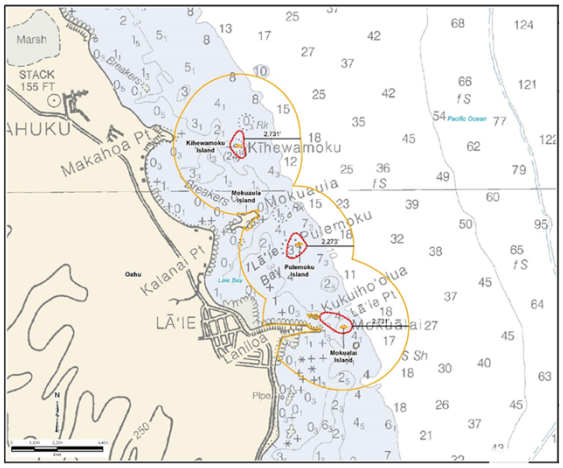
OTHER SITE ACCESSIBILITY CONSIDERATIONS

Site User Interviews:

3 interviews conducted

All interviewees access Mokualai and dive around the island when seas are calm

One also dives and spear fishes around Pulemoku when conditions are favorable



Safe Swimmer Distances

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FS TECHNOLOGY SCREENING

Remedial Alternative	Process Option		Description	Effectiveness	Implementable	Cost	Consider Further	Rationale
Land Use Controls	Institutional Controls	Signage	Provide awareness of the UXO hazard present and guidance on accessible areas, restrictions on intrusive activities, and opportunity to emphasize procedures if site users encounter UXO, opportunity to emphasize the 3 Rs (recognize, retreat, and report). ***MSRA Coastline Signage.*** Signs would be placed at intervals along the MSRA coastline and warn of the subsurface hazards on the seafloor around the offshore islands.	Moderately High	Yes	Low	Yes	Highly effective approach to mitigate exposure if written in the language of the reader. Signage reminding visitors of the explosive hazards are appropriate. Only effective if visitors can understand the message of the sign and modify their behavior to follow the guidance.
		Educational Controls	Provides potential site users and with awareness of potential MEC hazards.	High	Yes	Low	Yes	Would have to identify potential target island users at community meetings or marinas with boat launch facilities.
Removal Technology	Manual using UXO SCUBA divers		Divers manually search the seafloor around each target island.	High	Yes	High	Yes	Allows for close visual inspection during removal, close inspection of encapsulated munitions items and investigation of seafloor obstacles. Most dangerous of removal action method.
Disposal Technology	Blow-in-Place (BIP)		Detonation of MEC item at location found with no movement by personnel once deemed unsafe to move. Potentially destructive of sensitive resources (coral)	High	Yes	Moderate	Yes, only if MEC can't be moved.	May be needed for MEC items deemed unsafe to move or affixed to the seafloor by sea growth.
	Consolidated Shot		Multiple MEC items detonated at one location with one explosive shot. Only applicable if item is deemed safe to move. Location for demolition can be chosen for no impact to sensitive resources. Fewer explosives required than for BIP as donor explosives shared for items.	High	Yes	Moderate	Yes, only if MEC can be moved.	Reduces production downtime and amount of explosives needed. Only applicable for items safe to move. If necessary, mitigation will be used to lessen impacts to extent practicable.

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ARARS

Table 2 – Applicable or Relevant and Appropriate Requirements

Requirement/Citation	Description	Applicability to Site
RCRA, Subpart X – Miscellaneous Units **40 CFR § 264.601 (Environmental Performance Standards)**	Requires miscellaneous units for the management of hazardous waste, such as open burning/open detonation units, to be located, designed, constructed, operated, maintained, and closed in a manner that will ensure protection of human health and the environment.	MEC recovered during a remedial action at the MRS may need to be consolidated for disposal. Permits are not required for on-site response actions conducted under CERCLA. Only the substantive requirements of Subpart X are considered ARARs.
Endangered Species Act **16 USC § 1538(a)(1)(B); 50 CFR §17.21(c)(1)**	Prohibits the take of species listed as threatened or endangered under the Act.	Endangered species are potentially located within the MRS. Consultation is not an ARAR because it is an administrative requirement.
Marine Mammals Protection Act **16 USC § 1372(a)(2)(A)**	Prohibits the take of any marine mammal in waters or on lands under the jurisdiction of the United States.	Humpback whales and Hawaiian monk seals may be present in the MRS.
Rules Regulating the Taking and Selling of Certain Marine Resources, Stony Corals **HAR § 13-95-70**	Prohibits the breaking or damaging, with any implement, any stony coral from the waters of Hawaii.	Corals are present in the MRS.
Rules Regulating the Taking and Selling of Certain Marine Resources, Live Rocks **HAR § 13-95-71**	Prohibits breaking or damaging with a crowbar, chisel, or any other implement, any live rock.	Live rock is present in the MRS.

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ALTERNATIVES CONSIDERED

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARS	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, Volume	Short-Term Effectiveness	Implementability	Cost (Present Worth)
Alternative - 1 No Action	Not protective of Human Health and the Environment.	Not applicable	No reduction in MEC source. No Long-Term Effectiveness and Permanence	No reduction in volume of MEC	Not effective in the short-term	No action associated with this alternative.	$0
Alternative - 2 Land use Controls – Coastline Signage and educational materials	Protective of Human Health and the Environment.	Compliant with ARARs	No reduction in MEC source. Long-Term Effectiveness and Permanence depends on site users understanding of the educational information and warnings.	No reduction in volume of MEC. Signs would provide site users an awareness of the hazard present and instruction on what to do if MEC is encountered on the seafloor. Educational materials distributed to targeted businesses/facilities.	Does not involve any onsite action beyond installation of signage at intervals along Maalaahana coastline locations where MEC is not present. Site workers would not be exposed to explosive hazard during implementation.	Most implementable of all alternatives that involve action.	$1,212,759
Alternative - 3 Surface/Subsurface/Seafloor MEC Removal, LUCs	Protective of Human Health and the Environment.	Compliant with ARARs If MEC is deemed unsafe to move, and blow-in-place detonation would damage live rock or coral, MEC will be left in place.	Long-Term Effectiveness and Permanence depends on percentage of seafloor cleared of MEC within each target island area. Goal is 100% removal which will provide both permanence and long term effectiveness. Provides most reduction of MEC on seafloor.	Removes identified volume of MEC from the seafloor surface and subsurface in each target island removal action area. It is possible some MEC may be left in place if encrusted in coral or if coral is growing on it.	An exclusion zone would be installed around the target island(s) while the removal action was ongoing, thereby preventing access to the site by visitors. Potential hazards to the divers from MEC during operations will be addressed by strict compliance to the approved Work Plan, and by the use of qualified and experienced UXO Divers.	Implementable but most labor intensive (and potentially expensive) option. Also most perilous to site workers due to hazards inherent to diving and explosive demolition operations. Demolition phase will require coordination with USACE, DLNR (Parks and Forestry & DOCARE), NOAA, HDOH, USCG, Honolulu Fire and Police Departments.	$4,743,546

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OAHU TARGET ISLANDS MRS DD

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Selected Remedy:

MEC removal from the surface and subsurface of the seafloor and LUCs
- MEC removal from the surface and subsurface of the seafloor throughout the Target Islands MRS
- No further investigation of the islands
- Implementation of LUCs consisting of signage and explosives safety education program

Remedial Action Objective:

Provide protection to human health by reducing or mitigating the potential hazards posed by MEC associated with the reasonably anticipated future use.

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RECEPTORS/SITE USE PER THE DD

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Executive Summary:

Recreational uses include primitive camping and rustic cabins for rent.
The water surrounding the islands is used for diving, snorkeling and fishing.
Private residences are located on Laie Point.

Decision Summary:

The water surrounding the islands is used for diving, snorkeling and fishing.

Potential Receptors and Exposure Pathways:

The primary receptors at the Target Islands MRS are anticipated to be site visitors and recreational users (e.g., SCUBA divers and fisherman).

The MRS is open to the public and heavily used.

Potential exposure to MEC could occur via direct contact of receptors to MEC present on the surface or in the subsurface seafloor. MEC on the seafloor subsurface could also migrate via natural processes (i.e., wave action) to the seafloor surface.

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REMEDIAL ACTION OVERVIEW

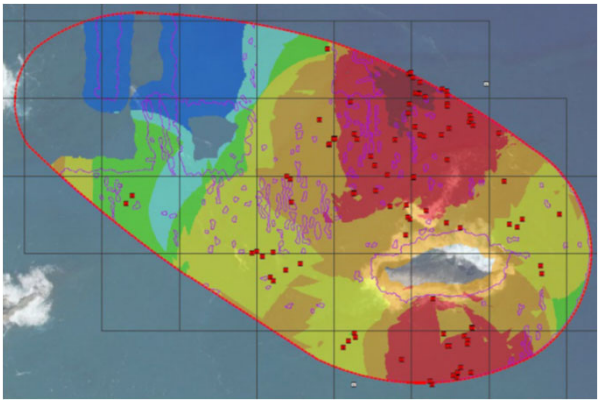
Implement remedy of seafloor clearance and educational outreach LUCs.

Installed signs at Malaekahana State Recreation Area and distributed educational materials.

Completed survey of current MRS boundaries.

Survey identified 215 MPPEH items including projectiles, rockets, and 20-lb fragmentation, 100-, 300-, and 600-lb bombs.

Pilot tested underwater use of Vulcan low-order deflagration disposal method.



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REMEDIAL ACTION PROJECT STAKEHOLDERS

Project stakeholders involved in project planning included:

USACE Huntsville Center

USACE Honolulu District

Hawaii Department of Health, Hazard Evaluation, and Emergency Response

Hawaii Department of Land and Natural Resources, Department of Aquatic Resources

National Oceanic and Atmospheric Administration, National Marine Fisheries Service

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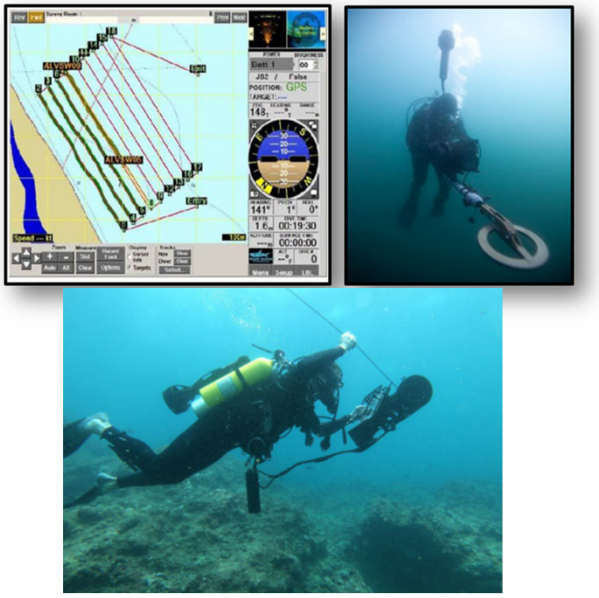
REMEDIAL ACTION APPROACH

Diver instrument-aided surveys were conducted during the calm weather seasons occurring March through October 2019, and again from March through May 2021.

The planned transects were designed to section each island's surrounding survey area into 210-ft square survey sections. Within the survey sections transects were set at a 7-ft clearance lane.

Divers cleared the lanes by following the transects on their dive board while sweeping their analog detector (Ebinger 725K or Minelab Excalibur II). During this survey, the field team visually looked for the occurrence of MD or MEC.

Actual transects were recorded on the team's Shark Marine GPS equipment.



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REMEDIAL ACTION APPROACH

Survey conducted by a dive team of five people; one diver in the water conducting the survey and remaining personnel providing dive support on the surface.

Survey diver swam over the transect locations. When a suspicious metallic item was visually spotted or detected with the analog detector the diver inspected the item. If the item was suspected to be a MEC, it was photographed, labeled as MPPEH, and the area surrounding the MPPEH was videoed to determine the presence of sensitive aquatic benthic species.

Due to the heavy marine growth items were not able to be identified; instead "best guess" identification was made based on measurements and historical knowledge.

Survey operations were conducted whenever the sea state was calm enough to allow safe diving due to the small number of days available.

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REMEDIAL ACTION APPROACH

Stakeholders expressed concern with demolition using high-explosive donor charges and use of bubble curtains for blast mitigation during the SPP process.

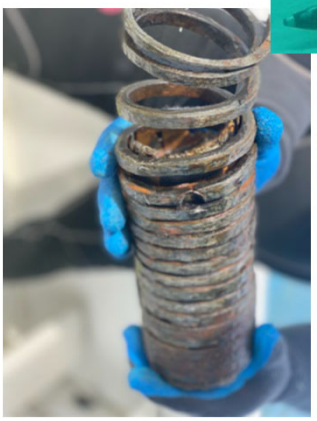
The contractor team determined the bubble curtain would not be implementable due to the highly-dynamic underwater environment and strong wave-induced surge.

Moving MPPEH cemented to seafloor is not ideal.

Consolidation on land was not possible due to lack of suitable land within the MRS to conduct operations.

Demolition operations were deferred until the PDT could reach agreement on suitable demolition methods.

PDT gained concurrence on proceeding with Alford Technologies Vulcan Low-Order Detonation (Vulcan) System which consumes explosives through deflagration without detonation. Use of this technology was limited by the end of the field season.



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REMEDIAL ACTION RESULTS SO FAR

Dive teams surveyed 55.8 acres of ocean floor surrounding the three islands, through analog survey where accessible or visual observations near shore where high surge prevented safe access.

215 MPPEH discovered within the MRS. MPPEH density up to 16 items/acre, average is ~ 4 items/acre.

Conducted a pilot shot using the Vulcan System to assess the impacts to the nearby benthic communities. One MEC item was destroyed on 15 September 2021 at Kihewamoku Island with very low impact to surrounding coral and marine species.

One demolition event successfully destroyed two MEC items on 27 September 2021 off the coast of Kihewamoku. A second demolition activity was attempted on 1 October 2021; however, was abandoned due to unfavorable weather conditions that moved in during demolition setup.

Weather continued to prevent further demo activities and the field team demobilized two weeks later as it was anticipated conditions would continue to worsen.

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REMEDIAL ACTION RESULTS SO FAR

Identified additional types of MPPEH: 3- and 4-inch projectiles, 81mm mortars, 7.2-inch rockets, 100-pound bombs, 300-pound bombs, and a 600-pound bomb.

Indicated potential for additional MEC to be present beyond the MRS boundaries.

- Areas at all three islands where the concentration of MPPEH warrants additional survey outside the MRS boundary to determine the full extent of potential MEC.
- 5-inch projectile (Item #28) was discovered outside the MRS boundary at Mokualai when divers were swept outside the MRS by a strong current.

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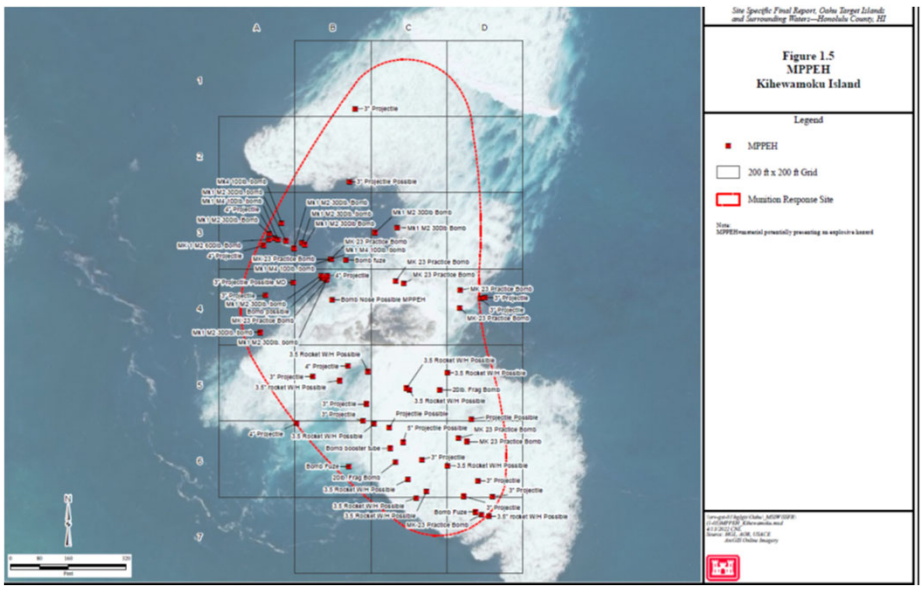
KIHEWAMOKU MPPEH



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PULEMOKU MPPEH

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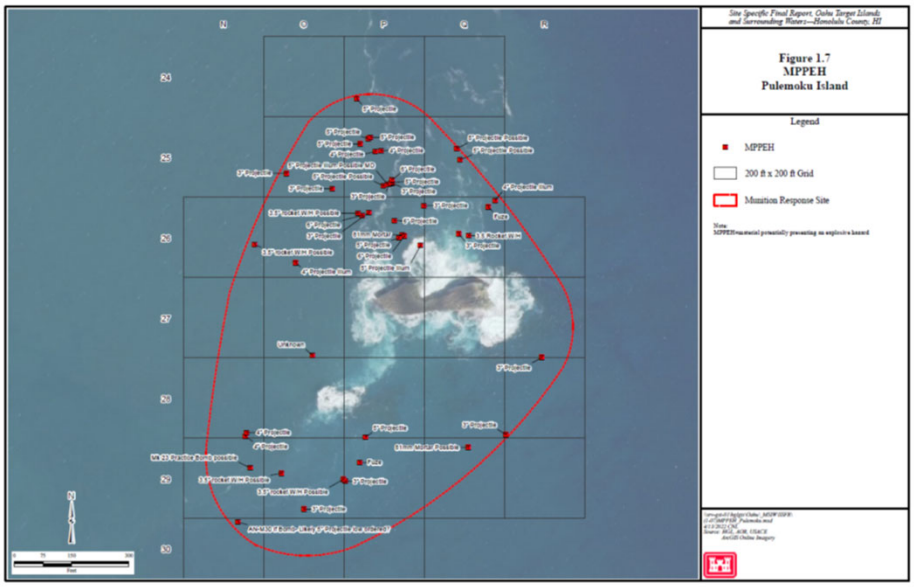

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MOKUALAI MPPEH

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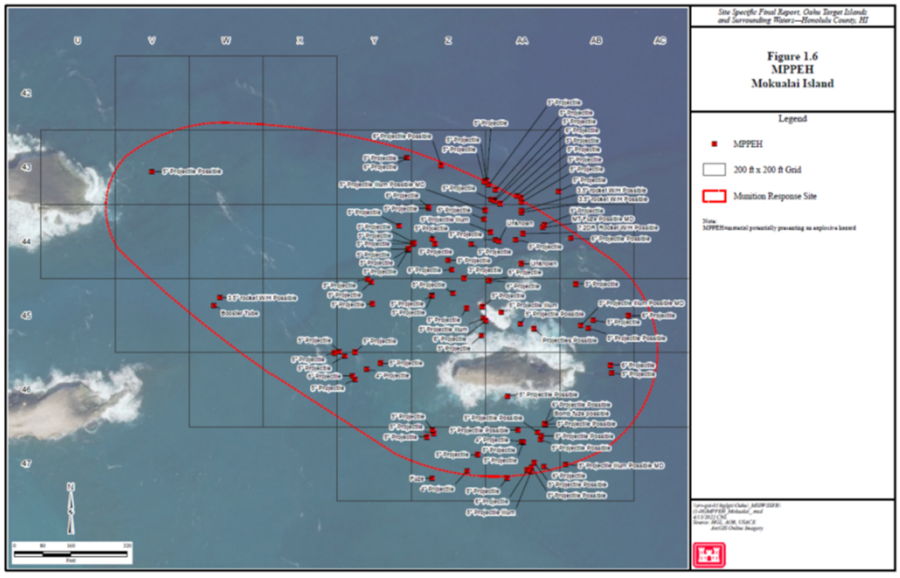

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MPPEH LOCATED DURING RA SURVEY

Table 1.4 MPPEH Types and Quantities

Munition	Quantity		
	Kihewamoku	Pulemoku	Mokualai
Projectiles and Mortars			
3" Projectile	15	11	1
4" Projectile	5	6	3
5" Projectile	2	12	72
6" Projectile	--	4	15
81mm Mortar	--	2	--
Rockets			
3.5" Rocket	12	5	3
7.2" DR Rocket	--	--	1
Bombs			
MK 23 Practice Bomb	11	--	--
20lb. Fragmentation Bomb	2	--	--
M4 100lb. bomb	4	--	--
Mk1 M2 300lb Bomb	10	--	--
Mk1 M2 600lb Bomb	1	--	--
Misc. Munition Components	8	3	7
Total	**70**	**43**	**102**

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DRAFT REVISED CSM

Table 1.5 Revised CSM, Target Islands and Surrounding Waters MRS

Site Details	Known or Suspected Sources of Explosives Hazards	Potential/Suspected Location and Distribution	Source or Exposure Medium	Current and Future Receptors	Potentially Complete Exposure Pathway
NAME: Target Islands and Surrounding Waters MRS **Acreage:** TBD – the original 57.3 acres (1.49 acres of land and 55.79 acres of tidal water) is recommended for expansion due to suspected MEC outside the current MRS boundary. **Suspected Past DoD Activities (release mechanisms):** Bombing targets, May 1941- October 1952 **Current and Future Land Use:** Seabird sanctuaries and recreational (snorkeling, spear fishing, or fishing). Land use not expected to change in the future.	Types of MEC potentially present on the site include: • Projectiles (3-, 4-, 5-, and 6-inch); • Mortars (81mm); • Rockets (3.5 and 7.2-inch); • Bombs (Mk23 practice, 20-lb fragmentation, M4 100-lb, Mk1 M2 300-lb, and Mk1 M2 600-lb); and • Misc. munitions components.	MEC cemented on the sea floor and embedded in coral; very low potential for migration. Sand lenses are typically shallow.	Exposure to MEC could occur via direct contact of receptors to MEC present on the seafloor.	Primary receptors are site visitors and recreational users (e.g., SCUBA divers and fisherman). Future land use is anticipated to be similar to current use.	Exposure to MEC on the surface or in the subsurface seafloor.

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LESSONS LEARNED

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The CSM at the conclusion of the RI was not accurate.
- Not consistent for land use, receptors, or exposure profile
- Didn't fully capture nature or extent
- Glossed over site conditions that could be expected for the remedial action
  - Weather
  - Sea state
  - Protected species

Remedial alternatives in the FS were not implementable as described.
- Didn't consider the full CSM
- Didn't include all reasonable stakeholder concerns

Pre-RFP project scoping SPP meetings to reach consensus on CSM and DQOs for the Remedial Action including all stakeholders would have helped the PDT recognize most of the problems encountered during project execution prior to releasing the RFP.

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QUESTION?

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