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Section 1 Introduction

1.1 Project Background

The totality of the archaeological sites on Kaho`olawe yield a detailed and complex record of nearly one thousand years of the human history of an entire island. The protection of these sites was a significant factor in designing this Unexploded Ordnance (UXO) Clearance Project, which includes the clearance of unexploded ordnance and environmental restoration that will allow for the reasonably safe use of the identified priority areas of the island. Furthermore, this UXO clearance and environmental restoration project is:

Large — The estimated cost of the contract is $280 million. This represents the largest single UXO clearance and environmental restoration operation in the United States. The clearance and restoration efforts are to be performed on this remote island comprising 11,655 hectares (28,800 acres).

Complex — Activities require the integration of various disciplines: UXO clearance, environmental restoration, historical and cultural preservation, natural resources protection, and construction. These disciplines must be integrated into a seamless work effort in order to perform the clearance and restoration within the estimated budget, logistics framework, and legislated schedule.

Remote — This is a remote, uninhabited island with little or no supporting infrastructure. Existing infrastructure will be augmented to support clearance and restoration activities, including: potable water supply, waste disposal, inter- and intra-island transportation, and billeting.

Lengthy — This contract began in 1997 and will continue through 2004. This will be one of the longest single efforts of this type and complexity in the United States.

1.1.1 Setting of Kaho`olawe Island

Kaho`olawe Island, located 151.3 km (94 miles) southeast of Oahu and 9.7 km (6 miles) southwest of Maui, contains approximately 11,655 hectares (28,800 acres), is 17.7 km (11 miles) long, 11.3 km (7 miles) wide, and has a peak elevation of 450 m (1,477 feet) (Figure 1).

1.1.2 Use of Kaho`olawe Island

As stated in the Cultural Resources Management Plan for Kaho`olawe Archaeological District, "Kaho`olawe is also of great significance to native Hawaiians and others who, in addition to acknowledging its importance in yielding data regarding Hawaiian cultural heritage, consider it of significance as a symbol of cultural survival and regeneration. It is considered by some to be a *wahi pana* -- a sacred place -- to be used for education, awareness, and experience in Hawaiian culture, as a place to carry on traditional customs and practices, and as a *pu`uhonua* -- a place of refuge and spiritual regeneration." (Ogden Environmental, 1995) Temples, or large heiau, and shrines are found on Kaho`olawe. Traditional accounts indicate that Kaho`olawe was closely associated with several deities, including Kanaloa, the god of the ocean, the deep sea, and of navigation and carving. Kaho`olawe is thought to have been an ahupua`a of Maui and to have been divided into smaller sections called ‘ili which were occupied and worked. Beginning somewhere around AD 1000 the island was settled and small communities were established along the coast. In time, greater use of the inland areas for cultivation occurred and the original dryland

environment changed to an open savanna of grasses and trees as a result of vegetation clearance for firewood and agriculture. As many as 100 or more people may once have lived at Hakioawa, the largest settlement on the island. The archaeological and historic resources of the island are valuable treasures that provide insight into the island and its past inhabitants.

Pre-Contact Period (Pre-1778)

Mo`olelo (traditional Hawaiian oral lore), mele (chants), and archaeological data provide the background for what is known about the pre-contact period on Kaho`olawe. Most prominent scholars believe the people from East Polynesia settled in the Hawaiian Islands between A.D. 200 - 500. This is evident by their language, culture, social organization, and technology. The original settlers brought with them domestic plants and animals: sweet potatoes, taro, pigs, dogs, and chickens.

The pre-contact history of Kaho`olawe began around A.D. 1000, based on radiocarbon dates from habitation sites (Hommon, 1982 and Rosendahl et. al., 1987). Small communities were established along the coast. In time, greater use of inland areas occurred for cultivation of dryland crops and adz quarrying, and the original dry forest environment changed to an open savannah of grassland and trees as a result of vegetation clearance for firewood and agriculture (Spriggs, 1991). From approximately A.D. 1500 – 1600, dryland agriculture was practiced on a small scale on inland slopes and coastal gulches.

Geographically, Kaho`olawe was a distinct ahupua`a (land division based on land use) of the Honua`ula moku or district on Maui. The ahupua`a of Kaho`olawe was subdivided into smaller land divisions called `ili, which were occupied and worked by commoners. Kaho`olawe was probably managed by a local chief representing the Maui district chief. Traditional accounts indicate the inhabitants of Kaho`olawe maintained close ties to Maui. Estimating the population of Kaho`olawe is difficult, but reportedly the maximum population was no more than a few hundred during this period.

From early island maps (ca. 1895), it is evident that Kaho`olawe was once divided into twelve `ili; however, the exact boundaries of each `ili are not defined. The boundaries of the twelve `ili were approximated and consolidated into eight contemporary `ili on the Kaho`olawe Use Plan Land Use Map. These eight `ili are shown on Figure 1. “Lua Makika, or Lua Moaula (sic Pu`u Moa`ulanui), is not considered an `ili, but is viewed as the piko or center of the island from which most of the `ili radiate.” (Kaho`olawe Use Plan, December, 1995)

Early Post-Contact Period (1779-1858)

Kaho`olawe is poorly described in early historical accounts. The descriptions that exist from late 18th century explorers indicate that it was a dry island, lacking the flourishing cover of many of the larger islands and probably having a relatively small population (Spriggs, 1991). From 1779 to 1841 Kaho`olawe is described by various sources as having a small population, estimated at below 100, with fishing as the main economic activity (Silva, 1983). In the 1790’s, Captain Vancouver gave goats to the Maui chief Kahekili as a gift. Kahekili reportedly took some of these goats to Kaho`olawe to multiply.

Figure 1: Kaho`olawe Island Map

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Penal Colony Period (1826-1853)

The first missionaries arrived in Hawaii in 1820. During this period, the Protestant faith made great inroads with the Hawaiian royal families and the general population throughout all of the islands. Protestant schools were established, and prodigious numbers of Hawaiians took to the western educational systems, particularly mastering the abilities of reading and writing in the English and Hawaiian languages. Beginning in 1828, a school was established on-island, teaching 28 "scholars" (students). The school remained in existence until 1837. In 1829, Ka`ahumanu, the favorite wife of Kamehameha I, and Kuhina Nui ("prime minister") of the Kingdom, proclaimed her famous "Edict of 1829" in which followers of the Catholic religion were to be banished to Kaho`olawe as one of several identified punishments. Whether or not a penal colony was established on Kaho`olawe prior to, or as a result of, the Edict of 1829 still remains a question.

As early as 1832, adults and youth were sent to Kaho`olawe as part of their sentencing. Men were sent to Kaho`olawe (women were sent to the island of Lanai) for such crimes as "rebellion, theft, divorce, breaking marriage vows, murder, and prostitution." Headquarters for the penal colony was located at Kaulana Bay. On May 2, 1853, the law which established Kaho`olawe as a penal colony was repealed. (Kaho`olawe Island Conveyance Commission, 1991).

Early Ranching Period (1858-1910)

In 1848, Kamehameha III initiated the land reform known as the "Great Māhele." The traditional Hawaiian concept of land stewardship was replaced by the western legal concept of land ownership. Ownership of lands was divided between the King and his Ali`i (nobles), with portions set aside for government use and processes established for private individuals to be awarded land. Kaho`olawe was considered land of the government ("Government Lands"). In 1858, the government issued the first of many ranch leases for the island. The number of sheep and wild goats (introduced prior to 1858) soon grew to be a problem as soon as 1875, many parts of the island were denuded due to overgrazing.

Under the joint resolution of annexation, approved July 7, 1898 (30 Stat. 750) and pursuant to the Hawaii Organic Act of 1900 (31 Stat. 141), the island was ceded and transferred from the Republic of Hawaii to the United States. Title to Kaho`olawe was held by the United States after Hawaii's annexation in 1898. Under the Organic Act of 1900, the territorial government was authorized to use and possess the island until the federal government acted. Kaho`olawe continued under territorial management with a ranch lease until 1910.

Cattle and sheep were introduced to the island within the first 50 years of ranching. Goats were introduced to the island more than 60 years before the ranching period. Throughout the ranching periods, the uncontrolled grazing of cattle, sheep, and goats had a serious impact on the environment of the island and substantial loss of soil through accelerated erosion. As an example, by the late 1890's, there were 900 cattle and 15,000 sheep on the island.

Forest Reserve (1910-1918)

The Territorial Board of Agriculture proclaimed the island a Forest Reserve in August 1910. Revegetation efforts were met with little success, and since the Forest Reserve designation prohibited the hunting of goats on the island, the proliferation of goats continued to degrade the island. Realizing that the goats represented the major threat to the island and that forestry efforts were futile in the presence of goats, the Territorial Governor withdrew Kaho`olawe from its Forest Reserve designation in 1918 and transferred the island to the Commissioner of Public Lands for management purposes.

Late Ranching (1918-1952)

In December 1918, the Commissioner of Public Lands leased the island to cattle ranchers -- Eben Low and Agnus MacPhee. Low, MacPhee, and Harry Baldwin (a Maui businessman) formed Kaho`olawe Ranch, which continued as leasee until 1952. In an effort to control the goat population and soil erosion, the Commissioner of Public Lands required Kaho`olawe Ranch to eliminate the goats, limit cattle to no more than 200, and encouraged the use of the non-native tree, kiawe (*Prosopis pallida*), in revegetation efforts. The ranch headquarters was built at Kūheia and a water system of cisterns was established.

Military Period (1941-1993)

In May of 1941, Kaho`olawe Ranch signed a sublease for a portion of the island with the U.S. Navy for $1.00 a year up to 1952 when the Ranch's lease expired. Seven months later, on the day following the Japanese attack on Pearl Harbor (December 8, 1941), the Territory of Hawaii was placed under martial law. The military took over the entire island, and ranching operations ended.

Ship-to-shore bombardment of the island commenced in 1941 and intensified starting on October 21, 1943, when the USS Pennsylvania conducted rehearsals for the Gilbert Islands invasion. In preparation for additional landings across the Pacific, the Navy ran ship-to-shore fire control training operations at Kaho`olawe. From 1942-1943, American submarine commanders tested torpedoes by firing them at the shoreline cliffs at Kanapou. Additional torpedoes were test fired from 1943 to the 1960's.

Under Executive Order 10436 (signed on February 20, 1953), President Dwight D. Eisenhower reserved the island for the use of the United States for naval purposes, except for 23.3 acres on the southern end previously reserved for lighthouse purposes. The Order directed the Navy to eradicate, or reduce to less than 200, all cloven-hooved animals; to allow the Territory of Hawaii to initiate soil and reforestation studies; and, when the island was no longer needed for naval purposes and without cost to the Territory of Hawaii, to render the island reasonably safe for human habitation.

During the Korean War era, weapons usage shifted from naval projectiles to air-dropped, general purpose bombs. Targets and mock airfields were built on-island for practice air attacks and strafing runs.

The Statehood Admission Act of 1959 recognized the Territory of Hawaii as the 50th state of the United States.

Operation Sailor Hat was an underwater and surface high-explosive test program conducted in 1965 by the U.S. Navy Bureau of Ships (BuShips) under the sponsorship of the Defense Atomic Support Agency (DASA). This program consisted of two series of underwater explosions, three surface explosions at San Clemente Island, California, and three surface explosions at Kaho`olawe Island, respectively. The three 500-ton Trinitrotoluene (TNT) charges were constructed on the beach above the water line on the southwest coast of Kaho`olawe. The crater resulting from the first detonation was subsequently backfilled and is no longer visible. The second and third detonations were conducted at the same site; the result is the present "Sailor's Hat" crater. Sailor's Hat crater has formed an aquatic ecosystem which has become habitat for two endemic species of shrimp: *Halocaridina rubra* and *Metabataeus lohena*.

By 1967, Kaho`olawe was a testing and training range for the air war over Vietnam. The need for protection from North Vietnamese surface-to-air missiles led to the construction of surface-to-air targets and target airfields on the island. The entire island was used as a weapons range with no restrictions on target locations.

By the late 1960's, additional portions of the island were equipped with various types of targets for both ships and aircraft. However, the accidental dropping of bombs on Maui, coupled with numerous complaints of noise from the live fire activities, led the Navy to re-evaluate the on-island target placements. This lead to the designation of the Naval Gun Fire Range on the northern slope and the relocation of the practice air fields and aerial bombardment targets to the central southern third of the island. The dividing lines between these areas were the troop safety lines which demarcate the impact area, leaving the target zone to include the central one third of the island. These targets varied in size from six foot rock pyramids to mock airfields covering acres.

In 1976, the members of the Protect Kaho`olawe `Ohana (PKO) filed suit in Federal District Court, *Aluli et al. V. Brown* (civil suit no. 76-0380), seeking to enjoin the Navy's bombing activities on Kaho`olawe. In 1977, the Federal District Court ordered a partial summary judgment in favor of the *Aluli et al.*, and the Navy was required to conduct an environmental impact statement and supply an inventory of, and protect, the historic sites on the island.

In 1980, a settlement Consent Decree and Order was reached in the *Aluli et al. v. Brown* civil suit. Under the Consent Decree and Order, the Navy agreed to survey and protect historic and cultural sites on the island, clear surface ordnance from 10,000 acres, continue soil conservation and revegetation programs, eradicate the goats from the island, limit ordnance impact training to the central third of the island, and allow monthly PKO accesses to the island. Through those monthly accesses, the PKO has regularly visited the island for religious and cultural purposes, as well as revegetation and conservation programs.

On March 18, 1981, the entire island was listed on the National Register for Historical Places and designated the Kaho`olawe Archaeological District. The Kaho`olawe Archaeological District contains 544 recorded archaeological/historical sites and over 2,000 features, as well as previously unrecorded features associated with traditional and historic Hawaiian land use, ranching, and military activities.

In 1990, President George Bush issued a Memorandum to Secretary of Defense, Richard Cheney, which directed the Secretary to discontinue use of Kaho`olawe as a weapons range effective immediately. Section 8118 of Public Law 101-511, enacted by Congress in 1990, established the Kaho`olawe Island Conveyance Commission to recommend terms and conditions for the conveyance of Kaho`olawe from federal jurisdiction to the State of Hawaii. The law prohibited the use of the island for weapons delivery training until after the final Kaho`olawe Island Conveyance Commission report was delivered to Congress. The Commission submitted its final report with findings and recommendations to Congress in March 1993, and dissolved six months later in September 1993. During the same period, the Navy in consultation with the State Historic Preservation Office, the Protect Kaho`olawe `Ohana, and the County of Maui met and developed a Cultural Resources Management Plan for the Kaho`olawe Archaeological District. That document was finalized in January 1995. (Ogden Environmental, 1995)

Current Period (1993-Present)

In 1993, Senator Daniel K. Inouye of Hawaii sponsored Title X of the Fiscal Year 1994 Department of Defense Appropriation Act (PL 103-139, 107 Stat. 1418. 1479-1484). Title X authorized conveyance of Kaho`olawe and its surrounding waters to the State of Hawaii. It also provided for the "clearance or removal of unexploded ordnance" and environmental restoration of the island, to provide "meaningful safe use of the island for appropriate cultural, historical, archaeological, and educational purposes, as determined by the State of Hawaii."

Hawaii Revised Statutes, Chapter 6K, created the Kaho`olawe Island Reserve Commission (KIRC) to have policy and management oversight of the Kaho`olawe Island Reserve. The statute requires that the island (including waters extending seaward two nautical miles from the shoreline) be used solely and exclusively for the following purposes:

1) preservation and practice of all rights customarily and traditionally exercised by the native Hawaiians for cultural, spiritual, and subsistence purposes
2) preservation and protection of its archaeological, historical, and environmental resources
3) rehabilitation, revegetation, habitat restoration, and preservation
4) education

Additionally, the island is to be preserved in perpetuity for the above uses; commercial uses are strictly prohibited.

As directed by Title X, a Memorandum of Understanding (MOU) between the Navy and the State of Hawaii was prepared to govern the conveyance of the island to the State of Hawaii with six specific agreements (regulatory framework; site protection; public participation; security; emergency communication; and regular interval clearance and removal of newly discovered, previously undetected ordnance). The Navy and the Governor of the State of Hawaii executed the MOU on May 6, 1994. Pursuant to Title X and the MOU, title to the island of Kaho`olawe was transferred to the State of Hawaii on May 9, 1994.

Under the MOU, the Navy retains access control to the island until clearance and environmental restoration activities are completed, or November 11, 2003, whichever comes first. The State, through the KIRC, is the primary stakeholder and landowner, responsible for the long term restoration and management of Kaho`olawe for appropriate cultural, historical, archaeological, and education purposes. The State holds statutory, regulatory, and enforcement interest in the protection of public health and the environment. The MOU further provides in Section VIII.C(5)(b) that "The access to Kaho`olawe that was afforded under the 1980 Consent Decree, described at Section I.C., remains in effect so long as that Consent Decree remains in effect."

The regulatory process set forth in the MOU maintains that the Navy shall proceed with the cleanup in consultation with the KIRC and in a manner consistent with the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Section 300 et seq.

On December 13, 1996, the Naval Facilities, Engineering Command, Pacific Division, solicited a Request for Proposals entitled, *Cost-Plus-Award-Fee Contract for the Unexploded Ordnance Clearance Project, Kaho`olawe Island Reserve, Hawaii* (Solicitation No. N62742-95-R-1369).to conduct unexploded ordnance clearance and environmental restoration of Kaho`olawe Island (Clearance Contract). The Clearance Contract was awarded to the Parsons-UXB Joint Venture (PUXB) on July 29, 1997.

1.2 Purpose of Cleanup Plan

The purpose of the Cleanup Plan is to describe the: timing, planning, methodology, technologies, implementation of operations; cleanup of hazardous and other waste; and protection of historical, cultural, and religious sites, features, and artifacts from clearance activities planned for the removal of unexploded ordnance and environmental restoration of Kaho`olawe Island Reserve.

The Cleanup Plan is a comprehensive document, and the designated mechanism for facilitating public understanding of the entire cleanup process. The public has opportunity to comment on the plan, and those comments will be considered in the decision making process. The resulting

final Cleanup Plan will serve as the Action Memorandum, as typically required by the Comprehensive Environmental Response, Compensation, and Liability Act, Public Law 96-510, 42 U.S.C. § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986, Public Law 99-499 (CERCLA), which will formalize commencement of UXO clearance operations on Kaho`olawe Island Reserve.

1.3 Project Plans

The size, complexity, and duration of this UXO clearance and environmental restoration project, and the need to establish clear and concise project direction to a large and varied project team led to the development of three levels of project plans (Figure 2).

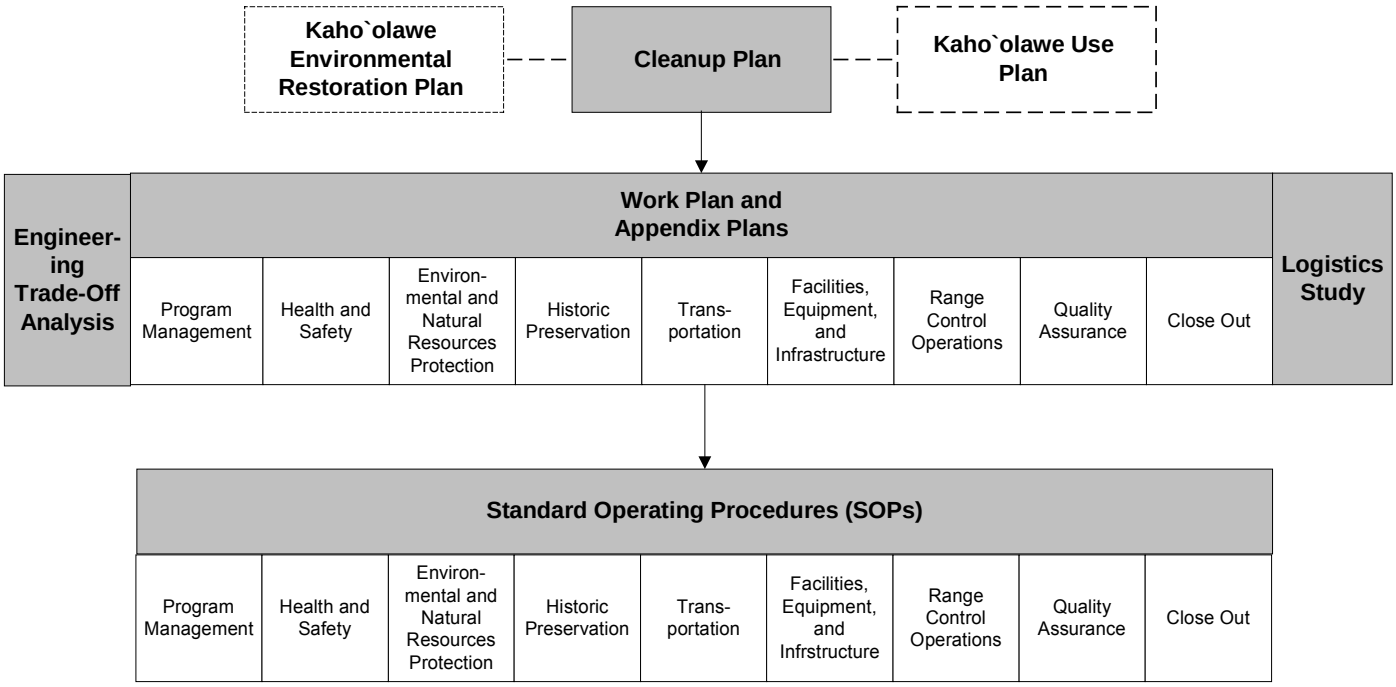
1.3.1 Cleanup Plan

The Cleanup Plan, the first level of the project plan hierarchy, provides the proposed project methodology to meet the requirements of Title X, the Memorandum of Understanding (MOU), and the Regulatory Framework (RFW).

The Memorandum of Understanding states:

> "B. The Cleanup Plan: After the Kaho`olawe Island Reserve Commission (KIRC) submits its use plan to the Navy, the Navy, in consultation with the KIRC, shall develop a cleanup plan for ordnance clearance or removal and environmental restoration. The Navy's cleanup plan shall provide for the removal or clearance of all unexploded ordnance from the surface

Figure 2: Project Plan Hierarchy



of the island in accordance with the Tier I standard described in Section VI.C(1); will be designed to allow the reasonably safe use of Tier II areas for the purposes listed in Section VI.C(2), in accordance with the KIRC's use plan; and shall accommodate, to the extent practicable, the KIRC's selection and priorities of areas to be cleaned up." (MOU VI.B)

This Memorandum of Understanding also specifies that the contents of the Cleanup Plan as:

"D. The elements of the Navy's Cleanup Plan shall include and describe its:

(1) timing, planning, methodology, use of possible technologies, implementation of ordnance clearance or removal and environmental restoration

(2) cleanup of hazardous and other wastes

(3) protection of historical, cultural, and religious sites and artifacts

"The plan shall provide that all reasonable efforts shall be made to avoid harm to historical, cultural, and religious sites and artifacts from the detonation of unexploded ordnance, clearance or removal of ordnance, and cleanup of hazardous waste." (MOU, Section VI.D)

"E. The Cleanup Plan shall further provide for:

(1) independent monitoring by the KIRC

(2) reporting of any incidents harmful to human health, historical, cultural or religious sites, or the environment

(3) temporary cessation of clearance activities during certain scheduled cultural ceremonies, upon reasonable advance notice by the KIRC to the Navy

(4) coordination between the Navy and the KIRC to efficiently conduct environmental restoration" (MOU, Section VI.E)

The Regulatory Framework (RFW) includes the following Cleanup Plan related requirements (RFW, Section III. A. and B.):

- The Navy shall serve as the lead agency for the Cleanup
- The Navy shall develop a Cleanup Plan which will include and describe, among other items, the timing, planning, methodology, use of technologies, implementation of ordnance clearance or removal and environmental restoration
- The Navy shall be wholly responsible for implementation of its Cleanup Plan
- The Navy shall coordinate implementation of its Cleanup Plan with the KIRC's Restoration Plan, to the extent practicable

The KIRC shall be the Navy's single point of contact with the State and will be consulted by the Navy for the review of, and input into, all aspects of planning and executing the Cleanup

The Cleanup Plan will be available for public review and comment, as specified in Section II of the Public Participation Agreement. The KIRC will assist the Navy in presenting the Cleanup Plan in public meetings on Oahu, Maui, Molokai, Lanai, Hawaii, and Kauai.

The Cleanup Plan is a description and summary of the Work Plan, Engineering Trade-Off Analysis, and Logistics Study. The Work Plan, Logistics Study, and Engineering Trade-Off Analysis will be available for reference (at the locations designated in Section 12) during the public participation period of the Cleanup Plan.

1.3.1.1 Kaho`olawe Use Plan

The Kaho`olawe Use Plan provides general guidance to the Navy in developing the Cleanup Plan. The Kaho`olawe Use Plan (December, 1995) establishes an overall vision for the future use of Kaho`olawe; describes guiding principles of land use; and identifies uses, activities, and certain infrastructure consistent with the vision and guiding principles. The vision contained in the Kaho`olawe Use Plan reads:

> "The kino of Kanaloa is restored. Forests and shrublands of native plants and other biota clothe its slopes and valleys. Pristine ocean waters and healthy reef ecosystems are the foundation that supports and surrounds the island.
>
> Nā po`e Hawai'i care for the land in a manner which recognizes the island and ocean of Kanaloa as a living spiritual entity. Kanaloa is a pu`uhonua and wahi pana where Native Hawaiian cultural practices flourish.
>
> The piko of Kanaloa is the crossroads of past and future generations from which the Native Hawaiian lifestyle spreads throughout the islands."

The Kaho`olawe Use Plan describes six use categories and includes a Land Use Map that depicts the proposed location of the uses across the island. The six categories are:

- Kahua Kauhale (Educational and Cultural Centers/Work Camps)
- Kahua Ho`omoana (Overnight Campsites)
- Ho`ōla Hou (Revegetation/Soil Stabilization Areas)
- Kula (Open Lands)
- Kahua Kahiko (Cultural/Historical Preserves)
- Nā Mea Kanu/Nā Holoholona A Me Nā I`a (Botanical/Wildlife Preserves)

The Kaho`olawe Use Plan also identifies an initial prioritization of areas to be cleared of UXO during the Cleanup. These cleanup priorities, and to a lesser degree the Land Use Map, will be reviewed by the KIRC as the cleanup progresses and new information is gained in regards to UXO contamination, clearance technology, and optimum environmental restoration strategies.

1.3.1.2 Kaho`olawe Environmental Restoration Plan

The Kaho`olawe Environmental Restoration Plan provides a general strategy achieving the Kaho`olawe Use Plan's vision for a restored island ecology. The Kaho`olawe Environmental Restoration Plan provides recommendations for re-establishing the island's vegetative cover towards a goal of ecosystems dominated by native flora and fauna. It also envisions strategic environmental treatment to encourage the natural processes.

The Kaho`olawe Environmental Restoration Plan identifies infrastructure needed to support the restoration process. It also identifies close cooperation between the KIRC and the Navy as key to facilitating coordination of cleanup and restoration activities and planning mutually supporting infrastructure improvements.

1.3.2 Work Plan

The second level of the project plan hierarchy is the Work Plan and Appendices, Engineering Trade-Off Analysis, and Logistics Study.

The Work Plan provides a more detailed description of the work to be performed during the UXO clearance and environmental restoration of the Kaho`olawe Island Reserve. The Work Plan includes a description of the work tasks to be completed; the organizational structure and personnel qualifications and responsibilities; and a narrative description of the technical approach, methodology, and top level procedures or processes to be used.

The Work Plan includes the following appendices:

- **Program Management Plan** - This plan establishes the requirements for the Contract Management System and Program Management Office and provides the overall plan for management of Task Orders, safety, quality, schedules, costs, financial and technical reports, reviews, quality submittals, management of subcontractors, dissemination of program policies and procedures, and contract close out.

- **Health and Safety Plan** - This plan outlines applicable safety requirements for all UXO clearance and related operations and will be strictly followed by all subcontractor, suppliers, and support personnel.

- **Environmental and Natural Resources Protection Plan** - This plan includes the protection of land and natural resources -- preventing increased erosion; storm water/sediment runoff control; solid waste management; hazardous material control, management, and disposal; waste water collection, treatment, and disposal; ocean discharge prevention; air pollution control; ozone depleting substance management; enforcement of pollution prevention initiatives; alien species prevention; and endangered species protection. The Engineering Trade-Off Analysis (Section 1.3.3) is an attachment to this plan.

- **Historic Preservation Plan** - The clearance of UXO and associated support activities represent potential impact to the Kaho`olawe Island Archaeological District. This plan outlines the procedures for identifying, documenting, evaluating, and protecting all historic properties that are potentially affected by project activities. The Cultural Resources Management Plan for the Kaho`olawe Archaeological District was used in the development of the Historic Preservation Implementation Plan.

- **Transportation Plan** - This plan addresses inter- and intra-island transportation of personnel, equipment, and supplies.

- **Facilities, Equipment, and Infrastructure Plan** - This plan describes existing facilities and process for implementation of proposed infrastructure improvements. It also describes the operation, maintenance, inspection, and reporting requirements for each support element.

- **Range Control Operations Plan** - This plan addresses all aspects of range operations and control. Specifically, this plan includes, but is not limited to, health and safety, access control, camp operations, range control, communications, range operation and maintenance, island security, UXO operations/processes, and coordination of construction operations.

- **Quality Assurance Project Plan** - This plan promotes the implementation of the three phases of control in all on-island activities. It includes the

development and maintenance of records, logs, data, documents, and reports necessary to provide objective evidence of the quality system to allow confident certification of the results of UXO clearance activities.

- **Close Out Plan** - This plan details the processes and procedures to manage the closure of activities. Closure activities will occur throughout the project's life cycle and include the closure of geographical work areas, task orders, and the contract.

1.3.3 Engineering Trade-Off Analysis

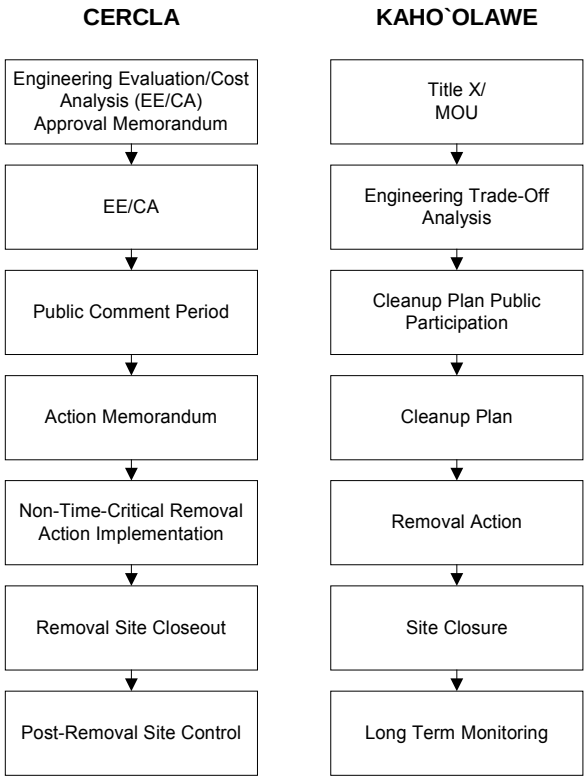
Title X and the Memorandum of Understanding serve as the Approval Memorandum for conducting an Engineering Evaluation/Cost Analysis (EE/CA) or Engineering Trade-Off Analysis (ETA), as required under CERCLA. An ETA was completed consistent with the purpose of this cleanup. The ETA was conducted for (1) the treatment and disposal of UXO that is safe-to-move, UXO-related remnants, and target materials, and (2) other removal actions. The purpose of the ETA was to recommend treatment/disposition and removal action(s) based on an evaluation of effectiveness, implementability, and cost. Preparation of the ETA followed the substantive documentation and administrative requirements established within the CERCLA Non-Time Critical Removal process and the National Oil and Hazardous Substance Pollution Contingency Plan.

In accordance with the MOU, the cleanup will proceed in a manner consistent with the Comprehensive Environmental Response, Compensation, and Liability Act, Public Law 96-510, 42 U.S.C § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986, Public Law 99-499 and any subsequent amendments thereto, and the National Oil and Hazardous Substance Pollution Contingency Plan, 40 Code of Federal Regulations (CFR) Section 300 et seq. and any subsequent amendments thereto (Figure 3).

The response action process outlined in the National Oil and Hazardous Substance Pollution Contingency Plan, which applies to response actions with a planning period of at least six months, known as CERCLA Non-Time Critical Removal Actions, is applicable to this project.

Where appropriate, Environmental Protection Agency documents (such as the "Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA" EPA/540-R-93-057, Publication 9360.0-32, PB93-963402, August 1993) and the final version of the Department of Defense (DoD) rule for appropriate response actions for closed, transferred, or transferring ranges (DoD Range Rule) and its implementing guidance will be utilized.

Figure 3: CERCLA Non-Time Critical Removal/Kaho`olawe Process



1.3.4 Logistics Study

The Logistics Study responds to the significant challenge to provide necessary, efficient, affordable, and safe logistics support for the execution of the UXO clearance and environmental restoration efforts. The Logistics Study:

- Evaluates the functionality of the existing facilities and determines cost-effective upgrades
- Includes a detailed cost and time analysis of various approaches to the logistical challenges addressing the diversity, remoteness, and uniqueness of the island and the work to be performed
- Helps minimize any impacts to the environment, natural resources, and historic properties
- Is consistent with the Kaho`olawe Use Plan (December, 1995)
- Determines the most effective logistics support alternatives
- Is supportive of the Environmental Restoration Plan to the maximum extent practicable

1.3.5 Standard Operating Procedures

The third level of the project plan hierarchy consists of Standard Operating Procedures, which provide procedures to operating personnel describing how to implement and accomplish

individual work tasks that are identified in the Work Plan. These Standard Operating Procedures will ensure that the work processes do not create conditions that constitute an unacceptable risk to the health or safety of personnel or the environment.

Each Standard Operating Procedure will be clear, concise, and specific. They will be prepared at a level that is easily understood by the personnel using them. Each Standard Operating Procedure will define a specified way to perform the task and describe the interrelated resources and processes that transform input(s) into output(s). Standard Operating Procedures will be prepared using step-by-step procedures to ensure safety concerns related to hazardous operations, standardized outputs, and repeatable results when the procedure is used by one person or a team of personnel.

The Standard Operating Procedures will be submitted to the Navy for their review and comment. In addition, the Standard Operating Procedures will be reviewed and agreed upon by PUXB's Health and Safety Manager, Project Quality Control Manager, Range Control Operations Officer, Senior Project Manager, and appropriate functional area manager. The appropriate supervisors and operations personnel will verify by their signature that they have read and understand the Standard Operating Procedures

1.4 Applicable or Relevant and Appropriate Requirements (ARARs)

1.4.1 Legal and Regulatory Precedents

Key judicial, legislative, and administrative precedents of the Regulatory Framework (RFW), as highlighted in Table 1, are being used to guide the UXO clearance process. The table lists the key judicial, legislative, and administrative precedents in the Regulatory Framework, their respective key elements, and the significance of each with respect to UXO clearance and environmental restoration of the island of Kaho`olawe. The selected UXO clearance process complies with all regulatory requirements.

Table 1: Judicial, Legislative, and Administrative Precedents

Regulation	Key Element(s)	Cleanup Considerations/Effects
JUDICIAL		
Aluli v. Brown 1980 Consent Decree	PKO Access	Established on-island operational schedule and considered monthly and annual PKO accesses
	Soil Conservation	Implementation of erosion control measures
	Goat Control	Eradication of goats was completed
	Archaeological Survey	Resulted in designation of the Kaho`olawe Archaeological District and preparation of a Cultural Resources Management Plan
LEGISLATIVE		
Title X (1993)	Conveyance of Kaho`olawe to the State of Hawaii	Conveyed title to the island of Kaho`olawe to the State of Hawaii on May 9, 1994
	$400 million authorization	Established cleanup funding
	Memorandum of Understanding to be entered into by the Secretary of Navy and the State of Hawaii	Described use-based cleanup and role of State of Hawaii and Kaho`olawe Island Reserve Commission

Regulation	Key Element(s)	Cleanup Considerations/Effects
Chapter 6K, HRS Act 340 (1993)	Established Kaho`olawe Island Reserve and created the Kaho`olawe Island Reserve Commission to manage the island for the State of Hawaii	Defined the Kaho`olawe Island Reserve -- the island and submerged lands and waters extending seaward two miles
ADMINISTRATIVE		
Executive Order No. 10436	Reserved Kaho`olawe Island for use of the U.S. for naval purposes	Eradicated cloven-hooved animals Initiated soil conservation Rendered the island reasonably safe for human habitation when no longer needed for naval purposes
Memorandum of Understanding between the United States Department of the Navy and the State of Hawaii concerning the Island of Kaho`olawe, Hawaii	Cleanup	Defined two-tiered clearance standard and applicability Tier I – removal or clearance of UXO from the surface of the island Tier II - removal or clearance of (subsurface) UXO from no more than 30 percent in aggregate of the surface of the island Required KIRC to prepare a use plan; the Cleanup Plan to be developed based on that use plan Provided for independent monitoring by KIRC Required cleanup certification to the State of Hawaii Required on-island cleanup efforts to be completed by November 11, 2003
	Protection of historic, cultural, and religious sites and artifacts	Required development of Site Protection Agreement
	Access	Provided that Navy will retain access control until November 11, 2003 Permitted KIRC access as requested PKO access under the Consent Decree remain in effect
	Public Participation	Required development of the Public Participation Agreement
	Cleanup Continuations	Stated that procedures for continuing UXO clearance after November 11, 2003 to be developed by May 9, 1998
	Budget	Navy and KIRC confer on budget actions
Regulatory Framework	Applicable Requirements	Listed federal, state, and local regulations that are applicable or relevant and appropriate
	Site Protection Agreement	Allowed UXO clearance and environmental restoration of historic, cultural, and religious sites in consultation with KIRC Provided for avoidance and mitigation procedures for historic, cultural, and religious sites

Regulation	Key Element(s)	Cleanup Considerations/Effects
	Public Participation Agreement	Promoted involvement of the community and assured effective communication with the community

1.4.2 Adopted Regulatory Framework

The Regulatory Framework (RFW) defines the regulatory requirements governing actual UXO clearance and environmental restoration on Kaho`olawe Island. The RFW identifies the respective roles of the Navy and the KIRC, and lists the federal, state, and local requirements the Navy and KIRC agree are applicable or relevant and appropriate to the cleanup and its implementation (Table 2). These requirements are limited to those that are of general application, adopted by formal means, risk based, and have as their purpose the protection of human health and the environment (including the protection of historical, cultural, and religious sites and artifacts).

Table 2: Applicable or Relevant and Appropriate Requirements (ARARs)

ARAR	Description
FEDERAL	
Historical, Cultural, and Religious Sites and Artifacts	
National Historic Preservation Act, 1 U.S.C. § 470 et seq. 36 CFR Part 800.	Requires federal agencies to take account of the effect of any federally-assisted undertaking or licensing on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places. Provides for the nomination, identification (through listing on the National Register), and protection of historical and cultural properties of significance. Specific procedures are established for compliance, including initial review authority by the cognizant State Historical Protection Officer.
Environmental Response and Waste Management	
Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. § 9601 et seq. 40 CFR Part 300.	As amended by the Superfund Amendments and Reauthorization Act, CERCLA establishes comprehensive framework within which to identify, investigate, and clean up releases of hazardous substances to the environment. Requires protection of human health and the environment.
Resource Conservation and Recovery Act, 42 U.S.C. § 6901 et seq. 40 CFR Parts 260-270.	As amended by the Hazardous and Solid Waste Amendments of 1984, establishes comprehensive program for managing hazardous wastes. HSWA authorizes investigation and cleanup of past waste sites, creating a corrective action program substantially equivalent to that under CERCLA, although differing and sometimes overlapping requirements exist.
Natural Resources	
Endangered Species Act of 1973, 16 U.S.C. § 1531 et seq. 50 CFR Parts 81, 225, 402, 450-453.	Protects federally-listed species that are considered rare, threatened, or endangered along with their habitat. Provides for recovery, coordination, consultation, law enforcement, and mitigation.

ARAR	Description
Fish and Wildlife Coordination Act, 16 U.S.C. §661 et seq.	Requires coordination with the U.S. Fish and Wildlife Service for technical assistance to protect fish and wildlife resources. In addition, this regulation provides for mitigation and reporting.
Marine Mammal Protection Act, 16 U.S.C. § 1361 et seq.	Provides protection and management for marine mammals and their habitat. Technical assistance and consultation is available.
Marine Protection, Research, and Sanctuaries Act, 33 U.S.C. § 1401 et seq., § 103 (c). 40 CFR Parts 225, 227, 228.	Establishes regulations relating to dumping specific material into open waters and establishes a program for designation and regulation of national marine sanctuaries.
Migratory Bird Treaty Act, 16 U.S.C. § 703 et seq.	Protects migratory birds and establishes a permitting process for legal taking.
Coastal Zone Management and Harbors	
Coastal Zone Management Act of 1972, 16 U.S.C. § 1451 et seq. 15 CFR Part 930; § §930.30 and 930.34.	Establishes goals and a mechanism for states to control use and development of their coastal zone. Authorizes states to administer approved coastal non-point pollution programs.
Rivers and Harbors Act, 33 U.S.C. § 403 et seq. 33 CFR Parts 320-329. 40 CFR Parts 122, 123, 125, 131, 230, 231, 233, 400-469.	Prohibits the unauthorized construction in navigable waters of the United States.
Occupational Health and Safety	
Occupational Health and Safety Act of 1970, 29 U.S.C. § 651 et seq. 29 CFR §§ 1910, 1910.120, 1915, 1918, 1926.	Assures safe and healthful working conditions for men and women by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the states in their efforts to assure safe and healthful conditions; by providing for research, information, education, and training in the field of occupational safety and health.
Air Quality	
Clean Air Act, 42 U.S.C. § 7401 et seq. 40 CFR Part 61. 40 CFR § 52.21 (j). 40 CFR § 52.21 (b) (1) (i) (a). 40 CFR § 60.52.	Addresses air pollution control. Establishes national ambient air quality standards for common air quality pollutants (“criteria pollutants”) and requires States to institute controls with established air quality control regions to achieve the national ambient air quality standards. Requires USEPA to establish air quality control if states fail to do so. Mandates EPA regulation of 138 identified “hazardous air pollutants.”

ARAR	Description
Water Quality	
Clean Water Act, 33 U.S.C. § 1251 et seq. § 301-304, 306, 307, 402, 403, 404(b)(1). 40 CFR Parts 6, 112, 122, 123, 125, 131, 220-225, 227, 228, 230, 231, 233, 400-469. 33 CFR Parts 153, 154, 320-330.	Restores and maintains chemical, physical, and biological integrity of U.S. waters. Also provides for criteria for application permits and review to transport dredge material as part of a proposed dumping operation. The Act requires each state to set standards for non-mobile air pollution sources.
Safe Water Drinking Act, 42 U.S.C. § 300(f) et seq. 40 CFR 141-147.	Creates a system for the protection of drinking water supplies through establishment of contaminant limitations and enforcement procedures. The regulation requires EPA to issue primary drinking water standards to protect public health. Allows EPA to designate Sole Source Aquifers as the principal source of drinking water for communities.
Transportation	
Hazardous Materials Transportation Act, 49 U.S.C. § 1803, 1804, 1808. 49 CFR Parts 107, 171, 172.	Establishes guidelines to transport hazardous materials and substances by land, sea and air. The Act is administered by the EPA through the Department of Transportation.
STATE OF HAWAII	
Historical, Cultural, and Religious Sites and Artifacts	
Hawaii Revised Statutes (HRS), Chapter 6E, Historic Preservation. Hawaii Administration Rules (HAR), Chapter 13-6-146.	Declares that the historic and cultural heritage of Hawaii is among its important assets and that it shall be the public policy of the State to [among other items] conduct activities, plans, and programs in a manner consistent with the preservation and enhancement of historic and cultural property.
Conservation and Resources	
HRS, Chapter 174C, State Water Code.	Provides for the administration of the state water code, through the Commission on Water Resource Management.
HRS, Chapter 179, Flood Control and Flood Water Conservation.	Provides for the coordination by the State of all federal and state flood control projects in Hawaii.
HRS, Chapter 179D, Dams and Reservoirs.	Provides for the inspection and regulation of construction, operation, and removal of certain dams in order to protect the health, safety, and welfare of the State by reducing the risk of failure of such dams.
HRS, Chapter 180C, Soil Erosion and Sediment Control.	Mandates the control of erosion and sediment by county governments, in cooperation with the soil and water conservation districts and other appropriate state and federal agencies.

ARAR	Description
HRS, Chapter 183, Forest Reserves, Water Development and Zoning.	Develops guidance to gather, compile information, and statistics concerning the area, location, character, and increase and decrease of forests in the state. Calls for (among other activities) the gathering and compilation of information concerning trees, plants, and shrubs recommended for planting in different localities, including the care and propagation of trees and shrubs for protective, productive and aesthetic purposes, the management of potential forest reserves, and the reforestation of suitable state lands.
HRS, Chapter 183D, Wildlife.	Provides for the management and administration of the wildlife and wildlife resources of the State through the Department of Land and Natural Resources.
HRS, Chapter 185, Land Fire Protection Law.	Requires that the Department of Land and Natural Resources take measures to prevent, control, and extinguish forest fires on state and private lands within forest resources, game management areas, public hunting areas, and natural area reserves of the State.
HRS, Chapter 187A, Aquatic Resources.	Provides for the administration of aquatic life, aquatic resources, and aquaculture programs of the State, management of public fishing areas, and enforcement of aquatic resources laws.
HRS, Chapter 188, Fishing Rights and Regulations.	Allows the Department of Land and Natural Resources to enforce certain laws pertaining to fishing methods and administer permits.
HRS, Chapter 190, Marine Life Conservation Program.	Provides for the administration by the Department of Land and Natural Resources of all marine waters of the State and enforcement of laws prohibiting their destruction.
HRS, Chapter 195D, Conservation of Aquatic Life, Wildlife, and Land Plants. HAR Chapters 13-121 or 122, 13-124, 13-125.	Protects species that are considered rare, threatened, or endangered and their habitat. Upon federal listing, species are concurrently listed under the Hawaii endangered species act. Also governs allowable take of species (captive propagation, scientific research) and encourages conservation of such species by State agencies.
HAR Chapters 13-121 or 122, 13-124, 13-125.	Prohibits the taking (harassment, harming, or killing), export, possession, selling, delivery, carrying, or transporting of any endangered species.
HRS, Chapter 197, General Provisions Relating to Aquatic Resources and Wildlife.	Establishes the Animal Species Advisory Commission and Aquatic Life and Wildlife Advisory Committee to protect habitats from the deliberate introduction of aquatic life and wildlife and matters affecting the taking and conservation of aquatic life and wildlife.
HRS, Chapter 199, Conservation and Resources Enforcement Program.	Provides the Board of Land and Natural Resources the power to appoint enforcement officers to enforce state conservation and resource laws and rules and regulations.
HRS, Chapter 200, Ocean Recreation and Coastal Areas Programs.	Provides the Board of Land and Natural Resources the power to separately administer ocean recreation and coastal areas programs.

ARAR	Description
Land Use and Coastal Zone Management	
HRS, Chapter 6K, Kaho`olawe Island Reserve. HAR, Chapter 13-260.	Establishes the Kaho`olawe Island Reserve Commission, which shall have policy and management oversight of the Kaho`olawe Island Reserve.
HRS, Chapter 205, Land Use Commission.	Creates a State Land Use Commission to set standards for districting and classifying land boundaries into urban, rural, agricultural, and conservation.
HRS, Chapter 205A, Coastal Zone Management HAR, Chapter 13-222.	Creates a coastal management program that gives full consideration to ecological, cultural, historic, esthetic, recreational, scenic, and open space values, and coastal hazards, as well as to needs for economic development.
Environmental Response and Waste Management	
HRS, Chapter 128D, Hawaii Environmental Response Law. HAR, Chapter 11-451.	Establishes an environmental response revolving fund for response actions associated with oil spills, oil recycling programs, and underground storage tanks. Also establishes a state contingency plan outlining methods and criteria for evaluating the degree of hazard present at a particular site.
HRS, Chapter 128E, Hawaii Emergency Planning and Community Right-To-Know Act.	Establishes a Hawaii State emergency response commission who administers and is responsible for the Emergency Planning and Community Right-To-Know Act of 1986.
HRS, Chapter 342J, Hazardous Waste Management Act. HAR, Chapters 11-260-266, 268, 269, 270, 271, 280.	Ensures that hazardous waste is managed in a manner that protects the health, safety, and welfare of the citizens of the State and protects and conserves the State's natural resources and environment.
HRS, Chapter 342H, Integrated Solid Waste Management. HAR, Chapter 11-58.1.	Provides for the prevention, control, and abatement of solid waste pollution in the State.
Air Quality	
HRS, Chapter 342B, Air Pollution Control. HAR, Chapters 11-59, 11-60.1.	Provides for the prevention, control, and abatement of air pollution and the emission of air pollutants in the State.
Water Quality	
HRS, Chapter 342D, Water Pollution Control. HAR Chapters 11-54, 11-55, 11-62.	Provides for the prevention, control, and abatement of water pollution in the State. Also establishes rules, water quality standards, effluent standards, treatment and pretreatment standards, and standards of performance for specific areas and types of discharges.
HRS, Chapter 340E, Drinking Water Quality. HAR Chapters 11-19, 11-20, 11-21, 11-95.	Provides for the promulgation and enforcement of the State Primary Drinking Water Regulations and State Secondary Drinking Water Regulations.

ARAR	Description
Occupational Health and Safety	
HRS, Chapter 396, Occupational Safety and Health Standards. HAR Parts 2, 3, and 8.	Assures men and women are provided safe and healthful working conditions. Permits and encourages employer and employee to reduce injury and disease arising from employment, institute new programs, and perfect existing programs for safe and healthful working environments.
Transportation	
HAR Chapter 19-11, Airport Site Approval, Airport Licensing, and Airport License Renewal.	Grants administrative power of the State of Hawaii Department of Transportation to approve airport sites, licensing, and license renewals.
LOCAL	
Historical, Cultural, and Religious Sites and Artifacts	
Maui County Code (MCC) Chapter 19.48-19.54, County of Maui Historic District.	Establishes the Maui County Historic Commission.
Conservation and Resources	
MCC, Chapter 20.08, Soil Erosion and Sedimentation Control.	Establishes soil erosion and sedimentation control measures.
Revised Ordinance of Honolulu, Soil Erosion Standards and Guidelines, November 1975.	Establishes soil erosion standards and guidelines.
Revised Ordinance of Honolulu, Supplement I: Soil Erosion Standards and Guidelines, December 1992.	Supplements the Revised Ordinance of Honolulu soil erosion standards and guidelines.
Land Use and Coastal Zone Management	
Maui County Ordinance No. 1052, Maui County General Plan.	Establishes goals, directions, and strategies for meeting the long-term social, economic, environmental, and land use needs of Maui County.
Maui County Ordinance No. 1233, Kaho`olawe Community Plan.	Reflects current and anticipated conditions in the Kaho`olawe region, and advances planning goals, objectives, policies, and implementation considerations to guide decision making in the region through 2010.

Additional applicable or relevant and appropriate references that are contractual requirements within the Clearance Contract are listed in Table 3. Table 3 lists each reference document with corresponding Clearance Contract activity/task and reference.

Table 3: Additional Applicable or Relevant and Appropriate Reference Documents

Reference Document	Contractual Activity/Task	Reference
29 CFR 1910 Camp Safety Program	Base Camp	C.10.1
OPNAVINST 5100.23D Navy Occupational Safety and Health	Base Camp	C.10.2.2
MO-125-Military Custodial Services Manual	Base Camp	C.10.4
NAVFAC P-706 EPS Janitorial Handbook	Base Camp	C.10.4
NAVFACINST 6250.3 Pest Management Services	Base Camp	C.10.6
National Electrical Safety Code Electrical Utility System	Base Camp	C.10.7
FAR Part 45 Government Property	Buildings and Structures Maintenance/Repair	C.10.20.2
PACNAVFACENGCOM P-74 A-E Guide (Nov. 1997)	Planning/Design Engineering	C.7.2.2.3
NAVFAC MO-321 Maintenance Management	Engineering and Maintenance Control Services	C.10.18
Chapter 2 of EPA Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA, August 1993	Engineering Evaluation/Cost Analysis	C.4.2.5.4
Section 300.415 National Oil and Hazardous Substance Pollution Contingency Plan	Engineering Evaluation/Cost Analysis	C.4.2.5.4
OPNAVINST 5090.1B Environmental and Natural Resources Program Manual	Environmental and Natural Resources Protection	C.4.2.4
40 CFR 243 Control and Disposal of Solid and Sanitary Wastes	Environmental and Natural Resources Protection	C.4.2.4
40 CFR 264 Control, Management, and Disposal of Hazardous Waste and Hazardous Materials	Environmental and Natural Resources Protection	C.4.2.5
49 CFR Subchapter C Off-Island Hazardous Waste Disposal	Environmental and Natural Resources Protection	C.4.2.5.1
Material Safety Data Sheet (MSDS) Hazardous Materials	Environmental and Natural Resources Protection	C.4.2.5.2
40 CFR Part 300 Oil and Hazardous Material Spills	Environmental and Natural Resources Protection	C.4.2.5.3
40 CFR 112 Spill Prevention Control and Countermeasure Plan	Environmental and Natural Resources Protection	C.4.2.5.3
NAVFAC-MO 100 Maintenance of Grounds	Fire Protection	C.10.5
NAVSUP Publication 7, Index of Recipes	Food Services	C.10.12.1

Reference Document	Contractual Activity/Task	Reference
NAVSUP Publication 421, Food Service Operations	Food Services	C.10.12.1
NAVMED Publication 5010, Chapter 1, Manual of Preventative Medicine, Food Service Sanitation	Food Services	C.10.12.1
NAVFAC Publication 421 Food Sanitation Program	Food Services	C.10.12.1
DoD 6055.9-STD DoD Ammunition and Explosive Safety Standards	Hazard of Electromagnetic Radiation to Ordnance Analyses and Assessments Health and Safety	C.2.5 C.2.5
Navy OP-5 Ammunition and Explosives Ashore Safety Regulations for Handling, Storing, Production, Renovation, and Shipping	Hazard of Electromagnetic Radiation to Ordnance Analyses and Assessments Health and Safety	C.2.5 C.3.1
Navy OP-3565 Electromagnetic Radiation Hazards, Hazards to Ordnance	Hazard of Electromagnetic Radiation to Ordnance Analyses and Assessments	C.2.5
OPNAVINST 8020.7B Explosive Safety Standards	Hazard of Electromagnetic Radiation to Ordnance Analyses and Assessments	C.2.5
AFI 91-201	Hazard of Electromagnetic Radiation to Ordnance Analyses and Assessments	C.2.5
29 CFR 1910.120 Hazardous Waste Operations and Emergency Response	Health and Safety	C.3.1
29 CFR 1910.142 Temporary Labor Camp	Health and Safety	C.10.1
29 CFR 1910.1200 Hazard Communication	Health and Safety	C.3.1
29 CFR 1910.141 Sanitation Standards	Health and Safety	C.3.4
29 CFR 1926 Health and Safety Regulations for Construction	Health and Safety	C.3.1
DoD 4145.26-M-DoD Contractor's Safety Manual for Ammunition and Explosives	Health and Safety	C.3.1
DDESB Site Safety Plan/Safety Submission	Health and Safety	Government Furnished
EM 385-1-1 (U.S. Army Corps of Engineers Safety and Health Requirements Manual)	Health and Safety	C.3.1
ANSI Z41 Personnel Protection – Protective Footwear	Health and Safety	C.3.5
32 CFR Part 229 Final Uniform Regulations for Archaeological Resources Protection Act of 1979 (ARPA)	Historic Sites	C.1.3.3.7
Federal Historic Preservation standards and guidelines (FR Vol. 48, No. 190, 1983)	Historic Sites	C.5.4.1

Reference Document	Contractual Activity/Task	Reference
36 CFR Part 800.9 Advisory Council on Historic Preservation's (ACHP) Criteria of Effect and Adverse Effect	Historic Sites	C.5.5.2
36 CFR Part 79.9 Curation of Federally Owned and Administered Archaeological Collections	Historic Sites	C.5.6.3
Tri-Service Standards, Part 1-2, A-E GIS Deliverable Standards	Kaho`olawe Island Geographic Information System	JC.6
Chapter 72-State Comprehensive Emergency Medical Services System	Medical Services	C.10.11
Part 4.2, Environmental Requirements	Operation and Maintenance of Petroleum, Oil, and Lubricant Systems	C.10.14
Part 10.3, Hazardous Waste & POL Collection, Accumulation, Transportation and Disposal	Operation and Maintenance of Petroleum, Oil, and Lubricant Systems	C.10.14
NAVFAC-MO100 Maintenance of Grounds	Operation and Maintenance of Petroleum, Oil, and Lubricant Systems	C.10.5
ASTM Designation D3951-95 Standard Practice for Commercial Packaging	Packaging and Marking	D.1.B
MIL-STD-129M Marking for Shipment and Storage	Packaging and Marking	D.2
29 CFR 1910.1200(f) Toxic and Hazardous Substances – Hazards Communication	Packaging and Marking	D.3
29 CFR 1910.1001 Toxic and Hazardous Substances -- Asbestos	Packaging and Marking	D.4
American National Standards Institute/American Society for Quality Control (ANSI/ASQC) E4-1994: Specification Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs	Quality Control	C.7.2.1
MIL-STD-1916 DoD Test Method Standard	Quality Control	C.7.5.3
PACNAVENGCOM P-74-Planning/Design Engineering	Quality Control	C.7.2.2.3
49 CFR Transportation	Security and Transportation Requirements	C.10.16.1
ATF P5400.7 Explosive Law and Regulations	Security and Transportation Requirements	C.10.16.1
DoD 5100.76M Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives	Security and Transportation Requirements	C.10.16.1
DoD 5200.8R Physical Security Program	Security and Transportation Requirements	C.10.16.1
OPNAVINST 5530.13B, 5530.14B	Security and Transportation Requirements	C.10.16.1

Reference Document	Contractual Activity/Task	Reference
FAR and DFARS	Contractual Requirements	C, D, E, F, G, H, and I
HAR 11-20-9, 11-20-10 to 11-20-13, 11-20-19, 11-20-46, 11-20-48, 11-20-34 to 11-20-37	Water System Monitoring	C.10.8.2

1.5 Goals and Objectives

1.5.1 KIRC Vision for Use and Restoration of Kaho`olawe Island

The Kaho`olawe Island Reserve Commission's vision statement for the island (Kaho`olawe Use Plan, December, 1995) encompasses the following concepts:

- **A Restored Island Environment and Associated Ecosystem** – "A unique and historic opportunity to revitalize the island with native plants and biota in an isolated setting and to create a marine sanctuary that can also help regenerate marine life for Maui and Lana`i."
- **Meaningful Access and Human Use of the Island to Support Land Stewardship and Cultural Practices** –"Restoring the island will provide a place and purpose for a new generation of Hawaiians to be trained in both the rights and responsibilities of "kahu o ka 'āina" (stewards of the land). This involves learning to care for the natural resources, only taking what is needed, and observing a kapu to allow the resources to naturally regenerate from season to season and year to year."
- **Statewide Impact and Benefit to Perpetuate Indigenous Hawaiian Culture** – "As more and more people of Hawaii are able to touch and be touched by the island and experience Hawaiian cultural practices, the Native Hawaiian lifestyle will spread throughout the islands. Again, the KIRC and State of Hawaii have a unique and historic opportunity to enhance the recognition and perpetuation of the culture indigenous to the Hawaiian islands and existing nowhere else in the world."

The KIRC's Environmental Restoration Plan "strives to develop and support" these concepts.

1.5.2 Purpose Of and Need for UXO Clearance Project

Kaho`olawe is currently considered unsafe for its intended use (archaeological, historical, cultural, religious, and educational purposes), as described in the Kaho`olawe Use Plan (December, 1995). The Navy, through PUXB, will provide clearance of unexploded ordnance and environmental restoration which will provide for public safety and protect human health and the environment based upon the State's planned uses of the island to the extent Congress provides funds for this purpose.

This UXO Clearance Project complies with Title X of the Fiscal Year 1994 Department of Defense Appropriations Act, Section 10001(a), which states that:

> "It is timely and in the interest of the United States to recognize and fulfill the commitments made on behalf of the United States to the people of Hawaii and to return to the State of Hawaii the island of Kaho`olawe. Kaho`olawe Island is among Hawaii's historic lands and has a long, documented history of cultural and natural significance to the people of Hawaii reflected, in part, in the Island's inclusion on the National Register

of Historic Places and in the longstanding interest in the return of the Island to State sovereignty, public access and use. Congress finds that control, disposition, use and management of Kaho`olawe is affected with Federal interest. It also is in the national interest and an obligation undertaken by Congress and the United States under this and other Acts, and in furtherance of the purposes of Executive Order 10436 (1953), to recognize the cultural and humanitarian value of assuring meaningful, safe use of the Island for appropriate cultural, historical, archaeological and educational purposes as determined by the State of Hawaii and to provide for the clearance or removal of unexploded ordnance and for the environmental restoration of the Island for such purpose. Congress also finds it in the national interest and an essential element in the Federal Government's relationship with the State of Hawaii to ensure that the conveyance, clearance or removal of unexploded ordnance, environmental restoration, control of access to the island and future use of the Island be undertaken in a manner consistent with the enhancement of that relationship, the Department of Defense's military mission, the Federal interest and applicable provisions of the law."

Title X anticipates that clearance and environmental restoration activities are to be completed within a ten-year period commencing November 11, 1993.

1.5.3 Project Funding by Congressional Appropriations

Section 10003 of Title X established on the books of the Treasury of the United States the Kaho`olawe Island Conveyance, Remediation, and Environmental Restoration Fund, and authorized to be appropriated into this fund $400,000,000, which may be appropriated as a lump sum or in annual increments.

Subject to the provisions of Section 10003, the Secretary of the Treasury is authorized to provide $45,000,000 of the $400,000,000 to the State of Hawaii for the purpose of long term planning and implementation by the State of (i) such long term planning, (ii) environmental restoration activities, and (iii) the terms and conditions set forth in the Memorandum of Understanding required by Section 10002 of Title X, concerning Kaho`olawe Island and its adjacent waters.

1.5.4 Removal Action Scope

PUXB is providing all personnel, equipment, materials, facilities, and other resources required to perform and support the UXO clearance work. Implementation of the Removal Action encompasses a wide range of services, which includes but is not limited to: UXO clearance activities, base camp operations, general support services, and construction work. The Removal Action includes, but is not limited to, the following activities:

a) Compliance with applicable Federal, Department of Defense (DoD), Navy, State, and local requirements, as identified in the Regulatory Framework, which is consistent with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and its non-time critical removal action process.

b) UXO, UXO remnants, and non-UXO clearance activities to include clearance area/grid pre-investigation/characterization, searching, detecting, positively identifying, removing, certifying, packaging, storing, transporting for disposal, disposing, and documenting results.

c) Conducting multi-media sampling and analysis including air, water, soil, hydrogeological, and geotechnical testing.

d) Range control operations for all on-island activities.

e) Boundary and location surveying including topographic surveys using the Global Positioning System and other approved surveying methods.

f) Escorting by qualified UXO escort personnel of visitors authorized by Commander, Naval Base (COMNAVBASE) Pearl Harbor.

g) Protection of historic properties, including traditional cultural places, which may be affected by project activities.

h) Design, construction, operation, and maintenance of equipment, facilities, and infrastructure to include Government Furnished Equipment, Government Furnished Facilities, and the operation and maintenance of a base camp(s).

i) Design and construction of temporary support facilities to include, but not limited to: fences, signs, site work, roads, buildings, infrastructures, renovations, and repairs of existing facilities. As-built drawings of completed work shall be provided.

j) Transportation of PUXB and Government authorized personnel and resources to, from, and on the island which has no fixed-wing aircraft or seacraft landing facilities.

k) Employment of fully trained and qualified individuals for all aspects of the contract, both on and off island.

l) Administrative record filing, maintenance, and transmittal of all acquired data and information.

m) Development and implementation of a Site Health and Safety Plan.

n) Establishing a Project Management Office and Contract Management System.

o) Status briefings at the request of the Contracting Officer.

p) Providing technical support to the Government of Community Relations.

q) Quality Control of all processes and activities, including planning, execution, and verification of all activities. These activities include, but are not limited to: planning UXO clearance activities; construction; UXO and non-UXO disposal operations; environmental sampling and analysis; historic preservation services and natural resource protection; data management, collection, entry, recording, storage and retrieval; surveying and mapping; documentation; facility operations; and site maintenance.

r) Preparation of Engineering Evaluation/Cost Analysis documentation or an Engineering Evaluation/Cost Trade-Off Analyses, as required for the treatment and disposal of UXO and other contaminated waste products.

s) Environmental and Natural Resources Monitoring Plan and Standard Operating Procedures.

t) Development and implementation of a Kaho`olawe Island Reserve Operations and Maintenance Plan and Standard Operating Procedures.

u) Preparation of a Project Close-Out Plan that includes, but is not limited to: final submittals, data, reports, certifications, maps, as-built drawings, and demobilization requirements.

v) Transporting, handling, and storing explosives for UXO clearance work.

w) Assist the Government in developing the Cleanup Plan discussed in the Regulatory Framework.

1.5.5 Removal Action Goals and Objectives

The Memorandum of Understanding (Section VI.C.) states that, to the extent funds are provided, the goals of this removal action are the:

> "removal or clearance of all unexploded ordnance from the surface of the island" (in accordance with Tier I standards)
>
> "cleanup or environmental restoration (in accordance with Tier II standards) to a condition which allows the reasonably safe use of the site or area for one of the purposes listed below:
>
> - Grassland or other vegetation
> - Trail or road
> - Historical, cultural, or archaeological site
> - Reservoir
> - Heliport
> - Suitable for human habitation"
>
> Particular sites or areas, to total no more than 25 percent in aggregate of the surface of the island, may be specifically identified to be cleaned up to the Tier II standard in order to accomplish the cultural, historical, and archaeological purposes set forth in Title X. An additional 5 percent of the surface of the island may be designated by mutual agreement between the Navy and the KIRC for trails or roads necessary to provide access between sites or areas.

The objectives of UXO clearance and environmental restoration activities are:

- Tier I Clearance – Minimum UXO Tier I clearance criteria are an 85% probability of detection with a 90% confidence level, consistent with terrain and overgrowth characteristics
- Tier II Clearance – Minimum UXO Tier II clearance criteria area are an 85% probability of detection with a 90% confidence level, consistent with terrain and overgrowth characteristics
- No adverse effects to historic properties, environmental, or natural resources
- Safe completion of all operations with no incidents or lost time accidents

1.5.6 Coordinated UXO Clearance and Use/Restoration Objectives

The KIRC provided the Kaho`olawe Environmental Restoration Plan (September, 1997) to assist the Navy in developing a practical approach in which the Kaho`olawe Island Reserve Commission's vision (as set forth in the Kaho`olawe Use Plan, December, 1995) and the United States Navy's goal of completing UXO clearance operations within the content of Title X complement each other to maximize the use of limited funds for the cleanup and restoration of the island.

The approach for this Cleanup Plan was established considering the projected end use of the island of Kaho`olawe (as established in the Kaho`olawe Use Plan); the Navy's determination of UXO removal depth based on projected ordnance penetration; the UXO Clearance

Requirements for Tier I and Tier II Clearance; and the Kaho`olawe Environmental Restoration Plan to the maximum extent possible.

In order to efficiently and safely conduct on-island operations in a manner that complements and supports the end land uses for Kaho`olawe Island and maximizes the area cleared within allocated funding levels, the Navy and KIRC will actively coordinate efforts to ensure plan preparation and on-island activities are consistent with the Regulatory Framework.

1.5.7 Iterative Coordinated Planning Process

The Regulatory Framework recognizes that the development of the specific requirements that apply to each activity will be an ongoing, iterative process, and that it is not possible or appropriate to determine all of the specific applicable or relevant and appropriate requirements at this time. The cleanup of Kaho`olawe Island will be a dynamic process. The Navy will follow the Kaho`olawe Use Plan in development of UXO clearance criteria and scheduling priorities. The KIRC will provide an ongoing review of data derived from clearance activities and recommend, as required, potential land use changes or realignment of clearance priorities. New technologies and methodologies will be continually evaluated for applicability, suitability, and potential implementability on this project. As more information is developed about the cleanup, it may be appropriate or otherwise necessary to add or waive some of the requirements identified in the Regulatory Framework. Accordingly, to the extent practicable considering the urgency of the situation, the Navy and State of Hawaii (KIRC) have agreed to follow the applicable requirements and also to follow a set of criteria and procedures which are consistent with CERCLA and the National Oil and Hazardous Substance Pollution Contingency Plan to determine whether a waiver should be invoked, except as otherwise provided in the Regulatory Framework.

The Kaho`olawe Island Partnership's Guiding Principles (Table 4) reflect the commitment of the Navy, KIRC, and PUXB in planning and implementing on-island operations. The foundation of this relationship is "clear communication."

Table 4: Kaho`olawe Partnership's Guiding Principles

"We, the members of the Kaho`olawe team, dedicate ourselves to cleanup and restore the Island Reserve and commit to cooperate as equal partners, communicate honestly and openly at all levels, and be flexible and responsive.

THEREFORE, we agree to the following:

- Continuous focus and uncompromising commitment to safety.
- To perform work in a timely, cost effective manner that exceeds contract requirements.
- To respect and be sensitive to cultural issues.
- Ensure that project planning and execution addresses continuous Navy and State concerns for both risk management and infrastructure improvements that supports the Project and maximum long term use of the Island Reserve.
- Informing the public and stakeholders on goals and accomplishments to engender understanding and allow maximum participation by Hawaii businesses and workers.
- A fair profit for the contractor based on quality performance.

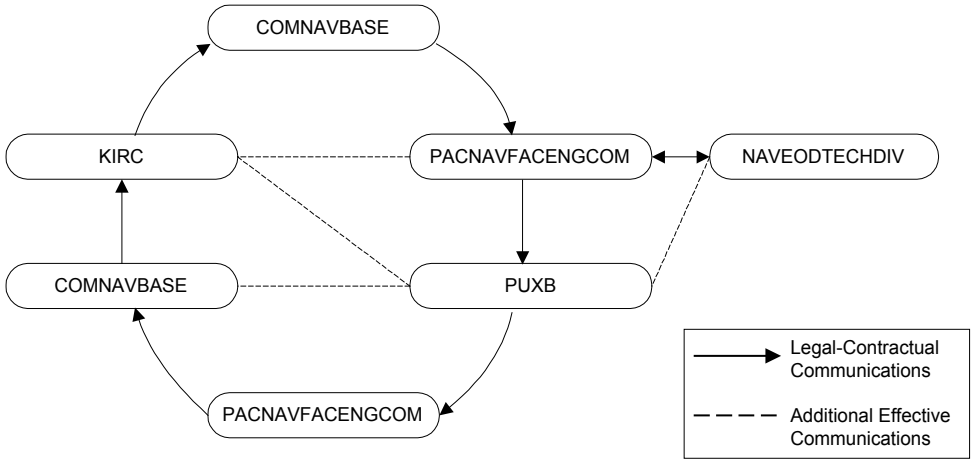
1.6 Project Approach

1.6.1 Project Inter-Agency Relationships

The U.S. Navy, State of Hawaii, and private entities will be working together to successfully complete UXO clearance and environmental restoration of the Kaho`olawe Island Reserve. The principal entities are Commander Naval Base Pearl Harbor; Pacific Division, Naval Facilities Engineering Command; Naval Explosive Ordnance Disposal Technology Division; Kaho`olawe Island Reserve Commission, and Parsons-UXB Joint Venture.

The intricacies of this UXO clearance and environmental restoration project mandate that these agencies maintain clear and concise lines of communication, consistent with the Partnership's Guiding Principles (Table 4). Daily communication will occur among all parties for project planning and implementation. PACNAVFACENGCOM shall provide all official contractual and technical directives during the cleanup. Communication lines are illustrated in Figure 4.

Figure 4: Inter-Agency Relationships



1.6.1.1 Navy

1.6.1.1.1 Commander Naval Base Pearl Harbor

The Commander in Chief, U.S. Pacific Command (USCINCPAC) designated the Commander, Naval Base Pearl Harbor (COMNAVBASE) the Regional Environmental Coordinator, plant account holder for Kaho`olawe, and the Department of Defense point of contact in Hawaii for the restoration and conveyance of Kaho`olawe. COMNAVBASE was directed by the Chief of Naval Operations (CNO) to negotiate with the State of Hawaii a Memorandum of Understanding and additional agreements required by the Memorandum of Understanding and Title X.

COMNAVBASE is the overall Program Manager and lead organization in all negotiation efforts with the State of Hawaii. COMNAVBASE coordinates, manages, and directs the development of the Kaho`olawe project to meet schedule, performance, and cost objectives. Other roles and responsibilities include:

- Lead in all communications, especially those with the DoD, Congressional Delegation, Navy chain of command, State of Hawaii, Kaho`olawe Island Reserve Commission, media, and public

- Compliance with Title X
- Coordinate and develop with the State of Hawaii an acceptable ordnance clearance and restoration standard at various locations on Kaho`olawe
- Complete any needed Navy/State agreements
- Manage program funds
- Control of access to the island
- Coordinate and obtain ordnance clearance certification

1.6.1.1.2 Pacific Division, Naval Facilities Engineering Command

The Chief of Naval Operations directed the Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM) to provide technical assistance to COMNAVBASE.

PACNAVFACENGCOM is the project manager (execution agent) and provides technical and contracting services in support of the program objectives. The organizational structure for PACNAVFACENGCOM is illustrated in Figure 5. PACNAVFACENGCOM responsibilities include:

- Compliance with applicable State and Federal regulations, within the Regulatory Framework established by the Memorandum of Understanding
- Technical support during Memorandum of Understanding negotiations
- Task execution, including but not limited to:
  - Preparation of the Navy's Cleanup Plan
  - Completion of environmental assessments and clearances
  - Determination of the requirements and feasibility for environmental, health, and safety requirements; and constructability assessments; Cost/Risk Assessment Model and Database Record System; clearance technology; awarding the UXO clearance contract and managing contract requirements
  - Generation of contract statements of work; provision of cost estimates and assessments of cost; development of criteria and methodology for evaluation of contract proposals; evaluation of contract proposals and vendor capabilities; establishment of an effective clearance/remediation quality control and quality assurance program; provision of quality assurance monitoring/assessment of clearance and remediation activities; coordination in developing PUXB performance evaluation input from COMNAVBASE, KIRC, and other affected activities; evaluation of construction performance; determination of award fee; review of contractor safety standards for UXO clearance and disposal operations; and development of ordnance identification guides for UXO clearance and disposal operations
  - Provision of technical and budgetary status and technical briefings, as needed; coordination of the application of, and compliance with, DoD Explosive Safety Board requirements; provision of technical consulting, research, and analytical support; and management of funding within PACNAVFACENGCOM

- Assessment and determination of the most feasible contracting methodology to meet program objectives and serve as single point of contact on all contracting matters; provide contracting officer support for award and administration of identified contracts; insure compliance with the statutes and regulations required in contract execution, administration, and closeout; and ensure acquisition information/data is protected and held within proper channels, as stipulated in Federal Acquisition Regulations (FAR)
- Establishment and maintenance of an Administrative Record

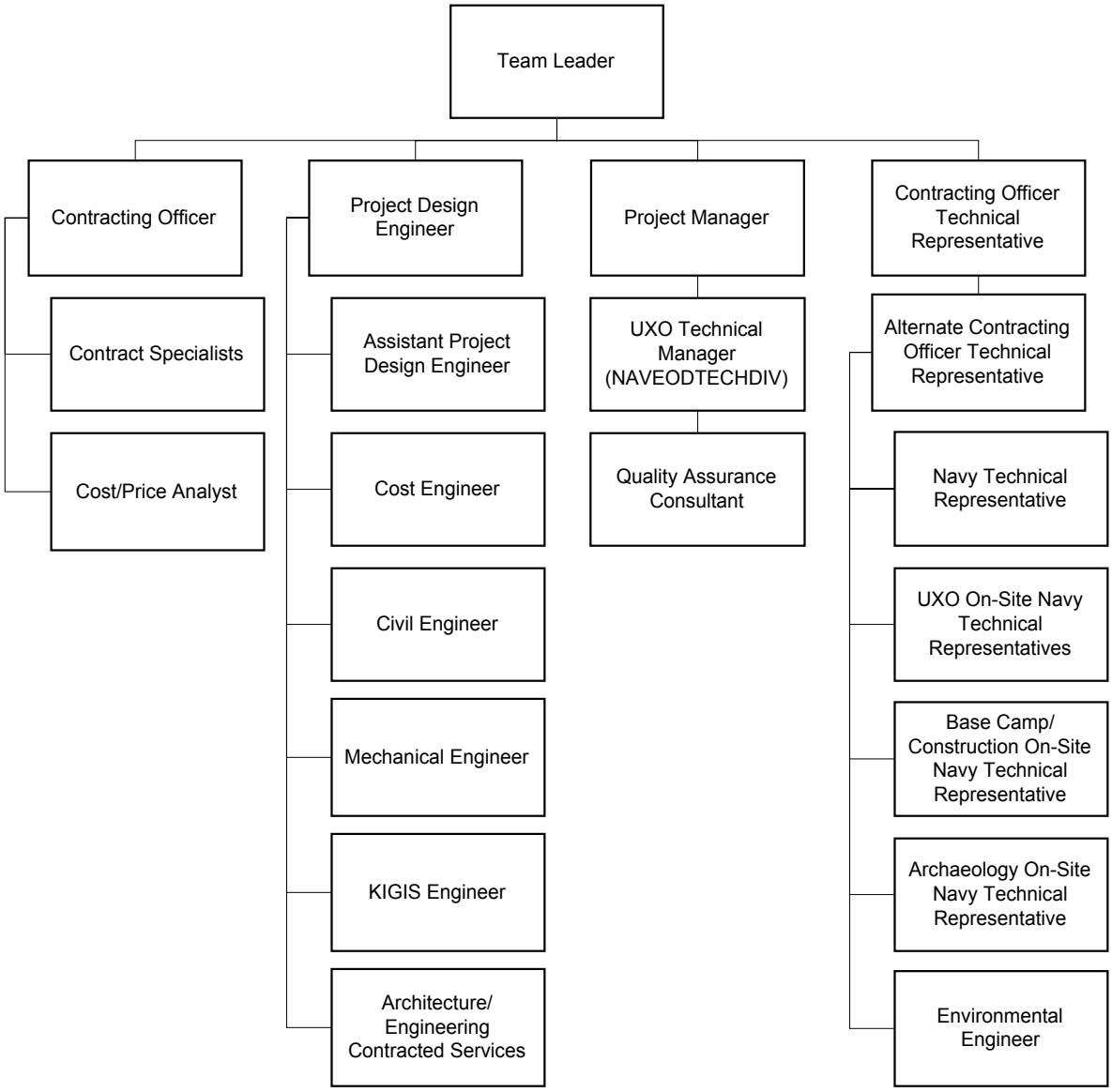
1.6.1.1.3 Naval Explosive Ordnance Disposal Technology Division

PACNAVFACENGCOM identified the Naval Explosive Ordnance Disposal Technology Division (NAVEODTECHDIV) as its technical consultant for the clearance, disposal, and remediation of unexploded ordnance on Kaho`olawe Island.

NAVEODTECHDIV will execute taskings within, but not limited to, the following areas:

- Acquisition, correlation, and maintenance of archival data, studies, and information concerning the prior use and history of ordnance on Kaho`olawe Island; completion of site surveys to acquire ordnance and explosive contamination data; and monitoring, integration, and archive ordnance data generated during Kaho`olawe clearance and remediation efforts.
- Completion of assessments and/or analyses of current/emerging ordnance and explosive clearance and remediation technologies, as applicable to Kaho`olawe Island; completion of analyses of clearance feasibility; and establishment of in-situ test areas on Kaho`olawe to assess and validate existing, proposed, and emerging technologies.
- Provision of technical assistance during the generation of contract statements of work, cost estimates and assessment of cost; development of criteria and matrices for the evaluation of contract proposals; participation in the evaluation of contract proposals and vendor capabilities; assistance in the establishment of an effective clearance/remediation quality control and quality assurance program; provision of quality assurance monitoring/assessment of clearance and remediation activities, contractor safety standards for UXO clearance and disposal operations, and ordnance identification guides as necessary for employment during UXO clearance and disposal operations.
- Provision of technical inputs to PACNAVFACENGCOM for inclusion into the Navy Cleanup Plan; technical, status, and budgetary reports as required; and technical briefings as needed. Assistance in coordinating the application of, and compliance with Department of Defense Explosive Safety Board requirements as necessary; assurance that acquisition information/data is protected and held within channels as stipulated in Federal Acquisition Regulations; and provision of technical consulting, research, and analytical support to the Kaho`olawe effort as needed.

Figure 5: PACNAVFACENGCOM Organizational Structure



1.6.1.2 State of Hawaii

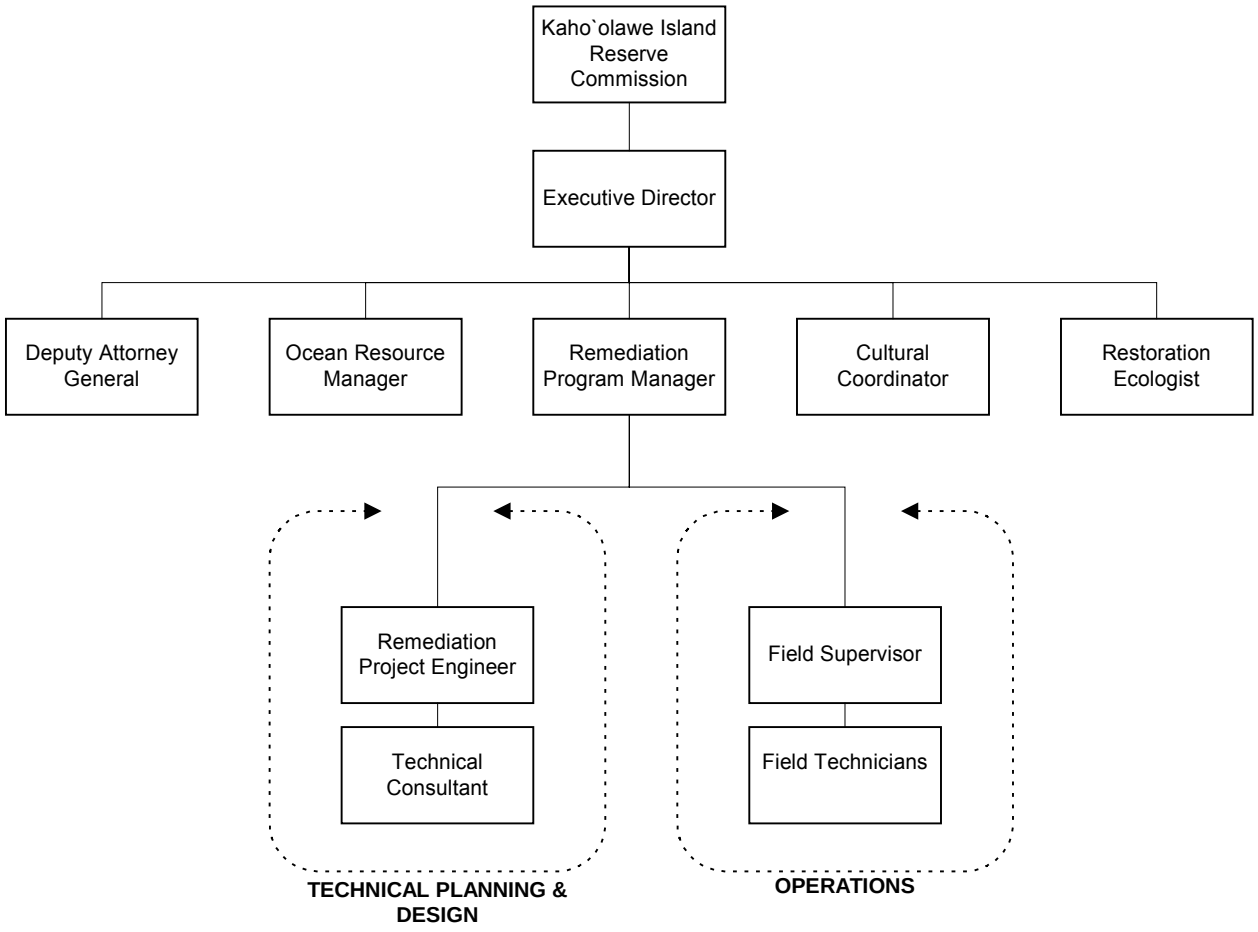
The State of Hawaii is the land owner and sovereign government entity responsible for the long-term restoration and management of Kaho`olawe. The Kaho`olawe Island Reserve includes the island of Kaho`olawe and the submerged lands and waters extending seaward two nautical miles from the shoreline. The KIRC oversees the departments and agencies of the State with respect to control and management of the Kaho`olawe Island Reserve.

The KIRC is comprised of seven members appointed by the Governor of the State of Hawaii -- one member of the PKO; two members from a list provided by the PKO; one trustee or representative from the Office of Hawaiian Affairs; one Maui County official; the Chair of the State Board of Land and Natural Resources; and one member from a list provided by native Hawaiian organizations.

The KIRC's organizational structure is depicted in Figure 6. The KIRC's function and responsibilities in the cleanup include:

- Serve as the Navy's single point of contact with the State and will be consulted by the Navy for the review of, and input into, all aspects of planning and executing the cleanup.
- Prepare, in consultation with the Navy, and submit a detailed Use Plan to the Navy for the entire island of Kaho`olawe, which specifically identifies the uses to which each site or area on the island will be put (Kaho`olawe Use Plan, December, 1995). As part of this Use Plan, the KIRC shall select sites or areas and identify the priority of those sites or areas that are to be cleaned to the Tier II standard.
- Develop a Restoration Plan, in consultation with the Navy, (Kaho`olawe Environmental Restoration Plan, September, 1997) and coordinate it with the Navy's development of the Cleanup Plan.
- Designate certain areas as off-limits, or for limited access only, for the protection of historical, cultural and religious sites and artifacts, if required, in consultation with the Navy.
- Determine, in consultation with the Navy, the priority of clearance.
- Assist the Navy in the identification of traditional cultural properties.
- Assist the Navy in the assessment, and determination of treatment, for historic properties potentially impacted by the Cleanup.
- Provide cultural orientation to all project workers.
- Conduct any ceremonies or cultural protocol needed.
- Maintain responsibility for the disposition of uncovered human remains.
- Independently monitor the Cleanup project.
- Participate in the contract performance evaluation process.
- Cooperatively plan, with the Navy, all infrastructure improvements.
- Cooperatively develop, with the Navy, erosion and runoff control standards.

Figure 6: KIRC Operational Organizational Structure



1.6.1.3 Parsons-UXB Joint Venture

The Pacific Division, Naval Facilities Engineering Command issued the Request for Proposal for the Unexploded Ordnance Clearance Project on Kaho`olawe Island Reserve, Hawaii on December 13, 1996. Proposals were submitted by March 28, 1997. After carefully evaluating the proposals based on technical understanding, corporate experience and past performance, management, resources, and cost, the Pacific Division, Naval Facilities Engineering Command awarded the contract (Clearance Contract) to the Parsons-UXB Joint Venture (PUXB). The Clearance Contract was awarded on July 29, 1997.

PUXB, a business registered in Hawaii, is a joint venture of Parsons Infrastructure & Technology Group (headquartered in Pasadena, California) and UXB International, Inc. (headquartered in Ashburn, Virginia). The PUXB team includes five additional team members: Dyncorp (located in Reston, Virginia) and four Hawaii-based companies – Cultural Surveys Hawaii; Royal Contracting Company; Austin, Tsutsumi & Associates; and the University of Hawaii. These team members were chosen solely on the basis of their qualifications and expertise.

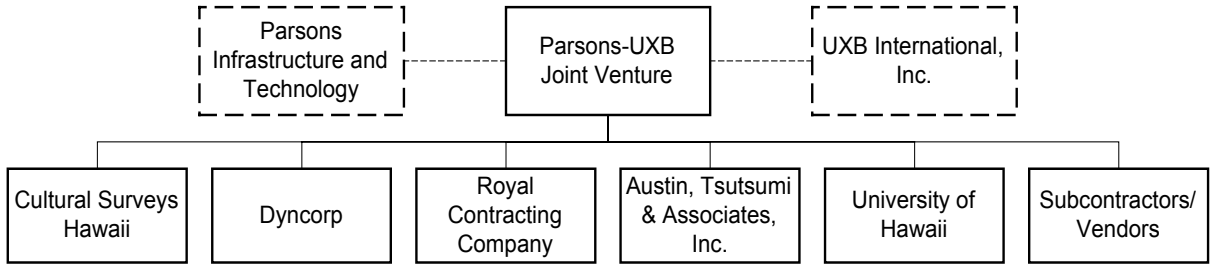
PUXB's seamless organization integrates the joint venture partners and team members to promote clear lines of responsibility and authority, while ensuring there are no redundant layers

of management. PUXB's team members will work to comply with the unique UXO and non-UXO related technical and regulatory requirements of the contract scope of work. Team member participation will be delineated on a task-by-task basis. Members participating in a task order will mutually agree upon the technical approach for that task order, and the work assigned to each team member will remain with that team member for the duration of the task order. Team members report directly to the Program Manager or Senior Project Manager, depending on their functional areas of responsibility and assigned work elements.

PUXB's management team will organize, maintain, supervise, and direct a thoroughly trained, capable, and qualified work force to effectively perform the objectives of the contract and subsequent task orders. PUXB's recruitment initiatives focus on (1) filling vacancies from our existing project organization (2) recruiting from the local community (3) filling positions from our team's corporate resources. Team members will recruit, hire, and promote all applicants for employment based on merit and qualifications, regardless of race, religion, national origin, age, gender, or handicap.

Figure 7 illustrates the organizational structure of PUXB's carefully selected and structured team. The following brief descriptions indicate each team members' area of expertise and area of responsibility on this project.

Figure 7: PUXB Team Member Organizational Structure



Parsons Infrastructure and Technology, Inc. – For 50 years, Parsons Infrastructure and Technology, Inc. (Parsons) has been one of the world's largest project management, engineering, and construction firms. Parsons' areas of responsibility include compliance with the Regulatory Framework; UXO documentation; sampling; design of infrastructure; data management; health and safety; program management; contract management system; EE/CA preparation; environmental planning, status briefings; community relations; and natural resource protection.

UXB International, Inc. – Founded in 1984 as the first civilian UXO contractor in the U.S., UXB International, Inc. (UXB) has more than 14 years of UXO experience. UXB is responsible for UXO clearance activities; range control; escort of visitors; health and safety; program management; handling and storing explosives; UXO and historic property protection quality control; status briefings; and community relations.

Cultural Surveys Hawaii -- Cultural Surveys Hawaii (CSH) is a leading Hawaii archaeological small business with 14 years of experience. CSH has UXO and Kaho`olawe experience, and will conduct all historic preservation activities.

Dyncorp – Dyncorp has 50 years of facilities management experience, servicing populations from 50 to 40,000 personnel. Dyncorp will oversee the operation and management of Base Camp.

Royal Contracting Company – Royal Contracting Company (Royal) is an Hawaiian-owned small business with 36 years of experience in the construction industry. Royal will conduct road improvement operations and on-island construction activities.

Austin, Tsutsumi & Associates, Inc. – Austin, Tsutsumi & Associates, Inc. (ATA) is an Hawaiian small business with 62 years of engineering and surveying experience in Hawaii. ATA will provide civil engineering and land survey services.

University of Hawaii – The University of Hawaii (U of H) possesses academic and operational experience in erosion control, stormwater/sediment runoff control; plants for revegetation and stabilization, and means for controlling invasive pests. The U of H will provide consultation services in the areas of environmental and natural resources.

Subcontractors/Vendors -- PUXB knows that Small Businesses, Small Disadvantaged Businesses, Women-Owned Small Businesses, native Hawaiian-Owned Businesses, and Hawaiian-Based Businesses will provide an important source of project innovation and productivity. PUXB will, to the maximum extent possible, use local and small businesses located in Hawaii. Therefore, PUXB will implement aggressive outreach, subcontracting, and mentoring activities.

To date, PUXB has identified over 300 Hawaiian-based firms that are available to support the project. Some of the services they will provide include hazardous waste transport for disposal; transportation services (air-fixed wing, air-helicopter, and barge/landing craft); sample laboratory analysis; inter-island transport of explosives; fuel; food supplies; communication systems; remnants salvage; construction supplies; architectural services; and other supplies.

1.6.1.3.1 PUXB Management Offices

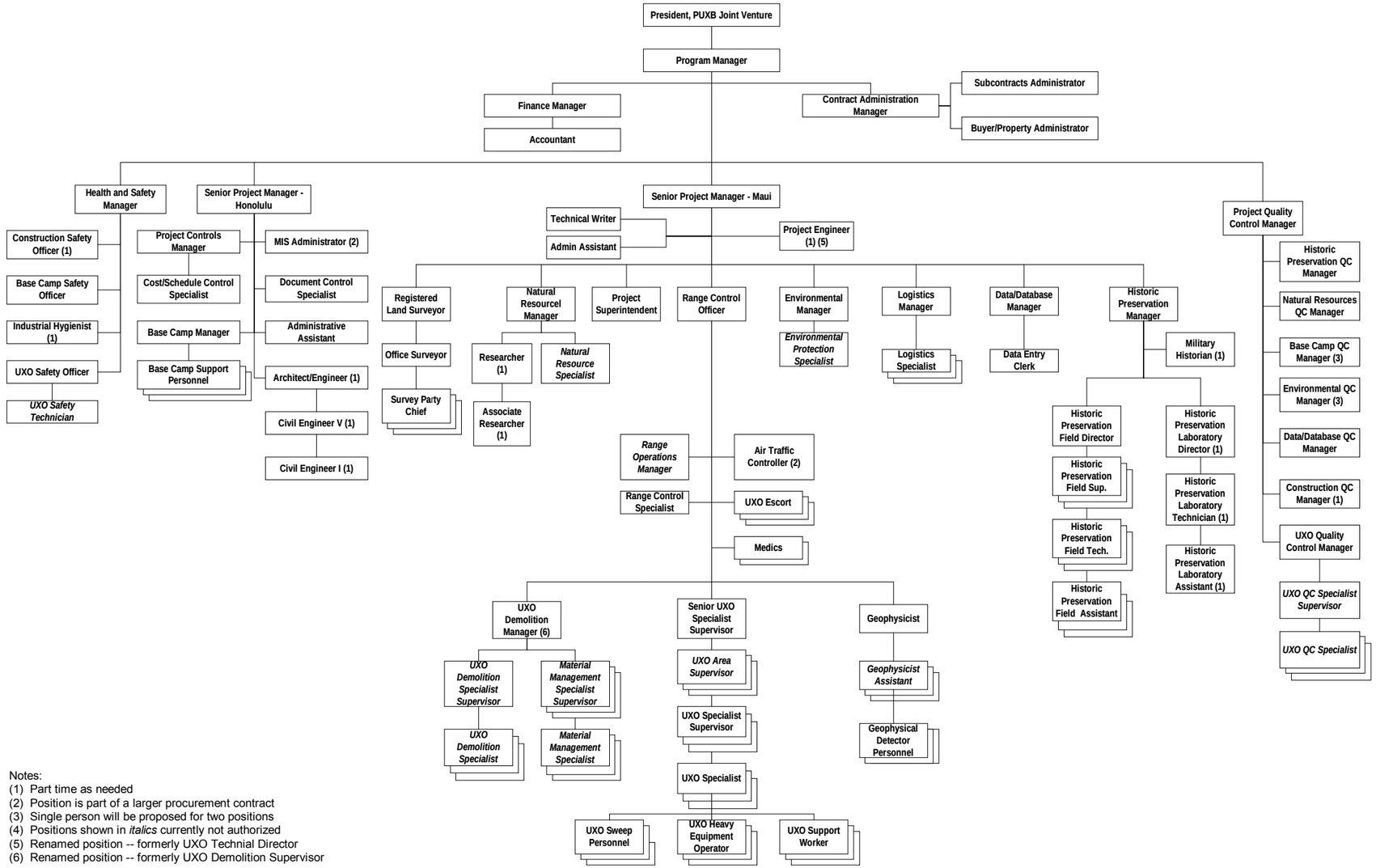
The PUXB team members will collectively plan, manage, execute, and monitor the task orders of this project. PUXB's management team is the core of our personnel plan, as illustrated in Figure 8. These management team members will be strategically located for efficient interaction with the Navy.

PUXB's Program Management Office (PMO) is configured to create a flexible environment that is responsive to the Navy's expectations. The PMO is comprised of three locations with the following responsibilities.

- The ***PMO - Honolulu*** (located at Pearl Harbor, Oahu) will serve as the overall program management office for this contract. This office's management responsibilities include interface with the Navy; community relations (as requested); task order planning; prime contract management; subcontracting and procurement management; cost and schedule control and reporting; computer network management; financial management; cost reporting; infrastructure design; project management, base camp management, and closeout management.

- The ***Maui Technical Office (MTO)*** (located at Kahului, Maui) will serve as the technical support office and logistics staging site for personnel and equipment. This office will provide technical design and support of all UXO and related activities on Kaho`olawe. This office's management responsibilities include: Regulatory Framework compliance; staging island access and logistics; environmental planning; historic preservation, quality control, and safety programs; data and database management; data entry; task order planning; land survey; and task order documentation.

Figure 8: PUXB Organizational Structure



Notes:
(1) Part time as needed
(2) Position is part of a larger procurement contract
(3) Single person will be proposed for two positions
(4) Positions shown in *italics* currently not authorized
(5) Renamed position -- formerly UXO Technial Director
(6) Renamed position -- formerly UXO Demolition Supervisor

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- The ***Range Control/Operations Center (RC/OC)*** (located on Kaho`olawe Island) serves as the operations management office. The RC/OC will schedule, coordinate, and control all island operations, camp operations (through the Base Camp Manager); health and safety; access control; range control; communications; operation and maintenance; island security; UXO operations/processes; and construction operations.

1.6.1.3.2 Technical/Contractual Interfaces

Table 5 illustrates the primary technical and contractual interfaces between the Navy and PUXB. These interfaces are established across functional elements in both organizations. Other interfaces may occur as the requirements of the contract or specific task orders require. Technical discussions may occur between the technical staffs of all stakeholder organizations at any of the shown elements. However, discussion of contractual issues can occur only between the contracting elements of the Contractor and the Navy.

Table 5: Navy and PUXB Interfaces

Navy Team Organizational Element	Parsons-UXB Organizational Element
Team Leader	Program Manager
Project Manager	Program Manager
Contracting Officer	Program Manager
Contracting Officer	Contract Administration Manager
Project Design Engineer	Senior Project Manager – Honolulu
Contracting Officer's Technical Representative	Senior Project Manager – Maui
Navy Technical Representative	Range Control Operations Officer

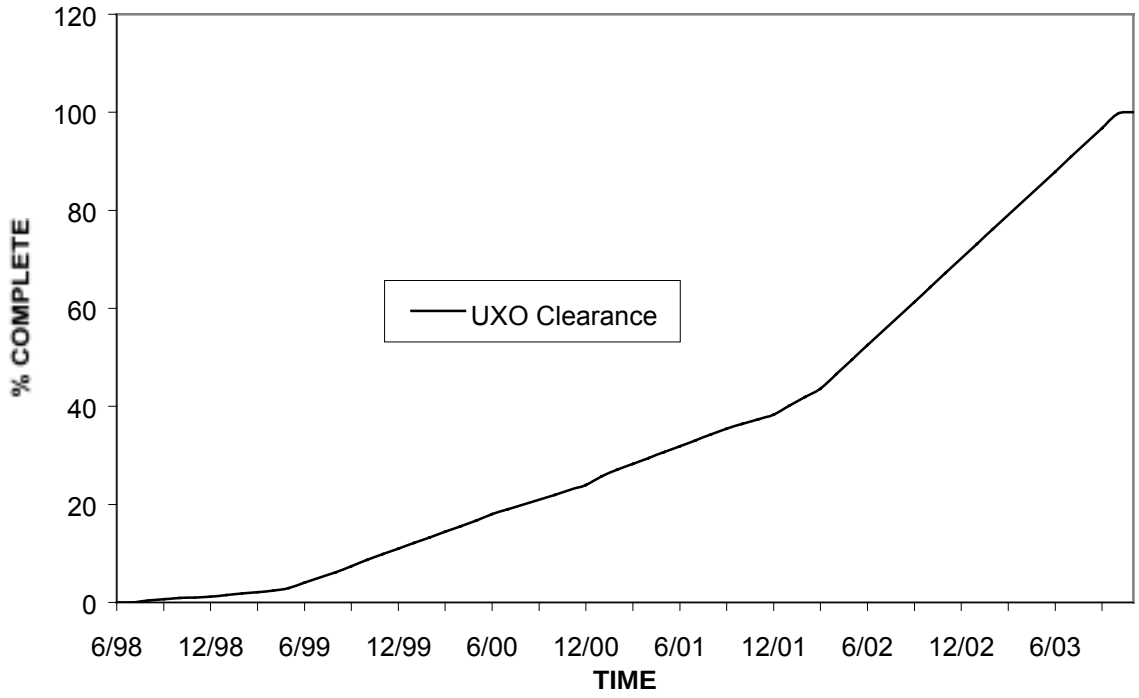
PUXB's Program Manager (located in the PMO – Honolulu) will handle formal reporting, control, and contractual changes. The two Senior Project Managers will process changes or additions to the task orders issued under the prime contract. The Senior Project Managers are authorized to discuss baseline changes in cost, schedule, or scope of work. If the Contracting Officer authorizes a contractual change that address varying site conditions or specific tasks not addressed in the Work Plan, a Work Plan Addendum will be written to support the changes and submitted to the Navy for review and approval.

Informal, continuous, day-to-day communications will take place at the levels of engineer-to-engineer and accountant-to-accountant. PUXB will also maintain informal communications with KIRC representatives when determining the impacts operations may have on historic properties or environmental and natural resources. This will alleviate a central point of contact for purposes of day-to-day issues, and communications. Exchanges of data, discussions, telephone conversations, and meetings will be formally documented in a timely manner and the outcome disseminated to all participants; PUXB will ensure the information is distributed accordingly.

1.6.2 Cleanup Schedule

The preliminary cleanup schedule is shown in Figure 9. The cleanup schedule anticipates continuous task order issuance, level loading of task activities, and phasing consistent with the

Figure 9: Preliminary Cleanup Schedule



priorities in the Kaho`olawe Use Plan (December, 1995). The preliminary cleanup schedule provides a foundation for future planning of subsequent task orders. As each task order is delivered, PUXB will:

- Develop task order specific work schedules and submit them with the task order proposal
- Submit a supplemental Work Plan Addendum, if required, to address varying site conditions or specific tasks not addressed in the primary Work Plan
- Ensure that the Standard Operating Procedures associated with each task are in place to provide clear, concise procedures to operating personnel for implementing and accomplishing individual work assignments

The following assumptions were considered in developing the preliminary cleanup schedule:

- Completion of all on-island tasks on or before November 11, 2003
- Clearance activities phased in accordance with the priorities identified in the Kaho`olawe Use Plan
- UXO clearance in accordance with current Tier I and Tier II standards
- Proven production rates within work areas consistent with various types of terrain, geology, vegetative cover, and contamination density
- Construction of logistical support improvements prior to mobilization for major UXO clearance efforts

- Concurrent work area activities providing flexibility in relocation of workforce, as required, to avoid interference with endangered or protected species
- Limited on-island work during Makahiki opening and closing ceremonies
- Monthly Protect Kaho`olawe `Ohana accesses
- Funding and task order issuance which provide for a level loaded work force (approximately $30 million in the base year and $40 million each option year)
- Coordination of UXO clearance, restoration, and other management activities with the KIRC

1.6.2.1 Activity Phasing

Early progress in priority areas will be achieved by performing surveying and mapping, UXO characterization, natural resource and environmental assessments, and historic property surveys prior to UXO clearance personnel initially mobilizing on-island. The survey and assessment teams will always maintain a lead of several Grid Map Units ahead of the UXO clearance operations. This will maximize productivity and minimize personnel standby time.

1.6.2.2 Work Area Phasing

PUXB's work schedule incorporates the phasing of UXO clearance activities consistent with the priorities defined in the Kaho`olawe Use Plan. The priority areas listed in the Kaho`olawe Use Plan (December, 1995) may change; therefore, the KIRC will be actively consulted in determining the priority cleanup areas.

1.6.2.3 Work Schedule

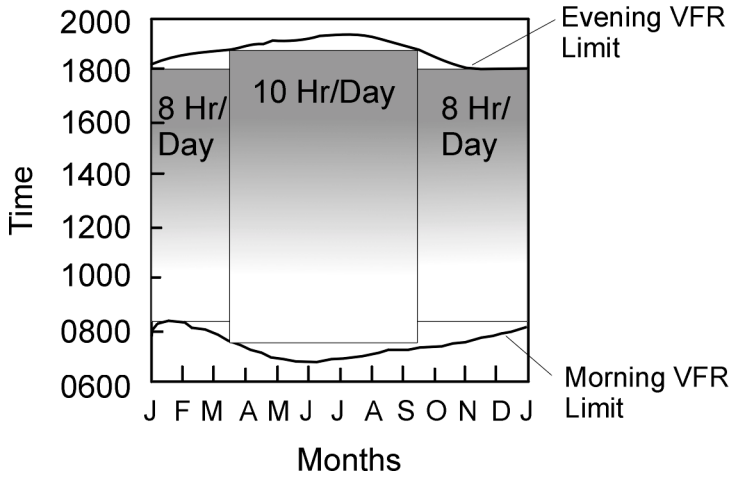
PUXB has incorporated the following guidelines into the work schedule:

1.6.2.3.1 Work Day/Week

In conjunction with the development of the preliminary cleanup schedule, PUXB evaluated alternative daily and weekly work schedules. Clearance and restoration activities can only be accomplished during daylight. In addition, air transport of personnel will only be performed during visual flight rule (VFR) conditions. Figure 10 shows the available daylight and the morning and evening VFR limits over a one year period.

Based on this information, PUXB determined that a combination of 8-hour and 10-hour work days would be the most effective work schedule over the course of a year. From April through September, a 4-day per week, 10-hour workday schedule will be used. This allows a 20% reduction in the number of inter-island and intra-island personnel movements and reduces the amount of loss time spent each week preparing to begin work at the beginning of each day and ending the work at the end of each day. From September through April, a 5-day per week, 8-hour workday schedule will be used. The analysis of inter-island transportation alternatives (Section 5.1.3) assumed that during one-half of the year the 4-day schedule will be used and during the remaining one-half of the year the 5-day per week schedule will be used. Normalizing these two work schedules (averaging five work days per week for 26 weeks and four work days per week for the remaining 26 weeks each year) gives an average of 4.5 work days per week over one year.

Figure 10: Monthly VFR Limits Schedule



1.6.2.3.2 Work Day

The legal interpretation of the Portal-to-Portal Act and associated legal precedents concludes that the workday begins and ends at the work site. Therefore, since Kaho`olawe Island is the work site, a work day for this project begins with arrival of each employee on Kaho`olawe Island and ends with their departure from the island for non-overnight personnel. For overnight personnel, the work day will conform to prescribed on-island working hours.

1.6.2.4 Work Limitations

The above work schedule has been established as the most cost-efficient while causing the least amount of interference with the following events approved by the Navy:

- **Restoration Coordination** -- The KIRC desires to commence restoration activities in each of the work areas as UXO clearance activities are completed. KIRC restoration activities and personnel movements will be based on negotiated agreements and policies between COMNAVBASE and the KIRC. The Range Control/Operations Center will subsequently coordinate and schedule these activities with ongoing UXO clearance activities.

- **Ceremonies**

  Makahiki – During the Makahiki celebration periods, PUXB's operations and activities will not intrude or be noticeable to Makahiki participants along the Makahiki route or at selected cultural sites.

- **Limitations on Work Areas --** The KIRC, in consultation with the Navy, can designate certain areas as off-limits, or for limited access only, for the protection of historic properties and artifacts.

1.6.2.4.1 Public Access to Reserve Waters (Troll Fishing)

The public may have access to Kaho`olawe Island waters for troll fishing, as scheduled and permitted by the KIRC. (HAR §13-260-4) Currently, the public has access two weekends per month.

1.6.2.4.2 PKO-Navy Consent Decree Access

PUXB will coordinate its activities with the Navy during PKO access periods.

1.6.2.4.3 Endangered Species

Work will be scheduled to avoid disturbance of endangered species. Some of the island's beaches are known to be used as resting places by several endangered species, including the Hawaiian monk seal, the green sea turtle, and the hawksbill turtle. It is possible that the turtles also use the beaches for nesting. The island is also considered to be the home of the endangered dark-rumped Petrel (`ua`u) and the native Hawaiian owl (pueo).

1.6.2.4.4 Weather Delays

Inclement weather conditions can delay or suspend operations. When this occurs and an entire day of operations is lost, the schedule located in Table 6 will prevail for making up the lost work day within the same week as the delay. A minimum of one day break is required, to maintain worker focus and work place safety, after each 40-hour work cycle for all explosive or explosive-related operations.

Table 6: Schedule Make-Up Days

Work Week	Delay	Make-Up Work Day
Four 10-hour days (Monday – Thursday)	1 or 2 day delay	Friday and/or Saturday
Five 8-hour days (Monday – Friday)	1 day delay	Saturday

1.6.2.4.5 Holidays

PUXB will not conduct operations on the holidays observed by the Federal Government and listed in Table 7 without prior approval from the Contracting Officer. Should any of the holidays occur on a Saturday or Sunday, that holiday will be observed in accordance with the practice observed by the Navy personnel on the project.

Table 7: Holiday Schedule

Name of Holiday	Time of Observance
New Year's Day	January 1
Martin Luther King, Jr. Birthday	Third Monday in January
President's Day	Third Monday in February
Memorial Day	Last Monday in May
Independence Day	July 4
Labor Day	First Monday in September
Columbus Day	Second Monday in October
Veteran's Day	November 11
Thanksgiving Day	Fourth Thursday in November
Christmas Day	December 25

1.6.2.5 Mobilization

Mobilizations are based on task order awards. The following mobilizations were structured to take place in a systematic manner to promote a smooth transition of resources.

1.6.2.5.1 PMO Mobilization/Transition

PUXB recruited and staffed several positions to: establish the PMO - Honolulu and the Maui Technical Office in Kahului; define requirements for the computer wide area network and Kaho`olawe Island Geographic Information System (KIGIS) hardware (with subsequent installation); develop the project-specific Work Plan and Appendices, Standard Operating Procedures, Logistics Plan, and Engineering Trade-Off Analysis; and assist the Navy with development of the Cleanup Plan.

1.6.2.5.2 Base Camp Mobilization/Transition Plan

Mobilization of Base Camp entailed a turnover period with the previous contractor from September 22-30, 1997 to ensure a smooth transition of camp operations.

As a member of the PUXB team, Dyncorp will operate the Base Camp during the UXO Clearance Project. In accordance with the requirements contained in the Removal Action Scope, responsibilities include operational control of the camp; and accounting and management of Government Furnished Equipment, Government property, and PUXB equipment and supplies.

From October 1, 1997 through June 30, 1998, Base Camp is being operated at a reduced level of activity (steady-state or caretaker status). The primary focus is on maintaining the Base Camp facilities, ensuring uninterrupted availability of utility services (including potable water, electricity, and solid waste collection), and providing an on-island presence for meeting safety/security standards set by the Government.

Base Camp is maintained 24-hours-a-day, 7-days-a-week. PUXB currently utilizes a shift concept that entails two crews of three to four persons, each working a 10-hour day, 8-day rotation with six days off. Shifts change each Monday.

1.6.2.5.3 Task Order Specific Mobilizations

PUXB will systematically mobilize additional personnel to Kaho`olawe Island Reserve as each task order is issued and authorization to proceed is received.

1.6.3 Task Orders/UXO Clearance, Removal, and Disposal

PUXB will provide all personnel, equipment, materials, facilities, and resources through task orders, as specified in the contract. During the project, multiple task orders may be in some phase of the task order life cycle at any one time.

PUXB's task order management plan will use the following tools and techniques to ensure effective and efficient management of each task order that comprises the project's work.

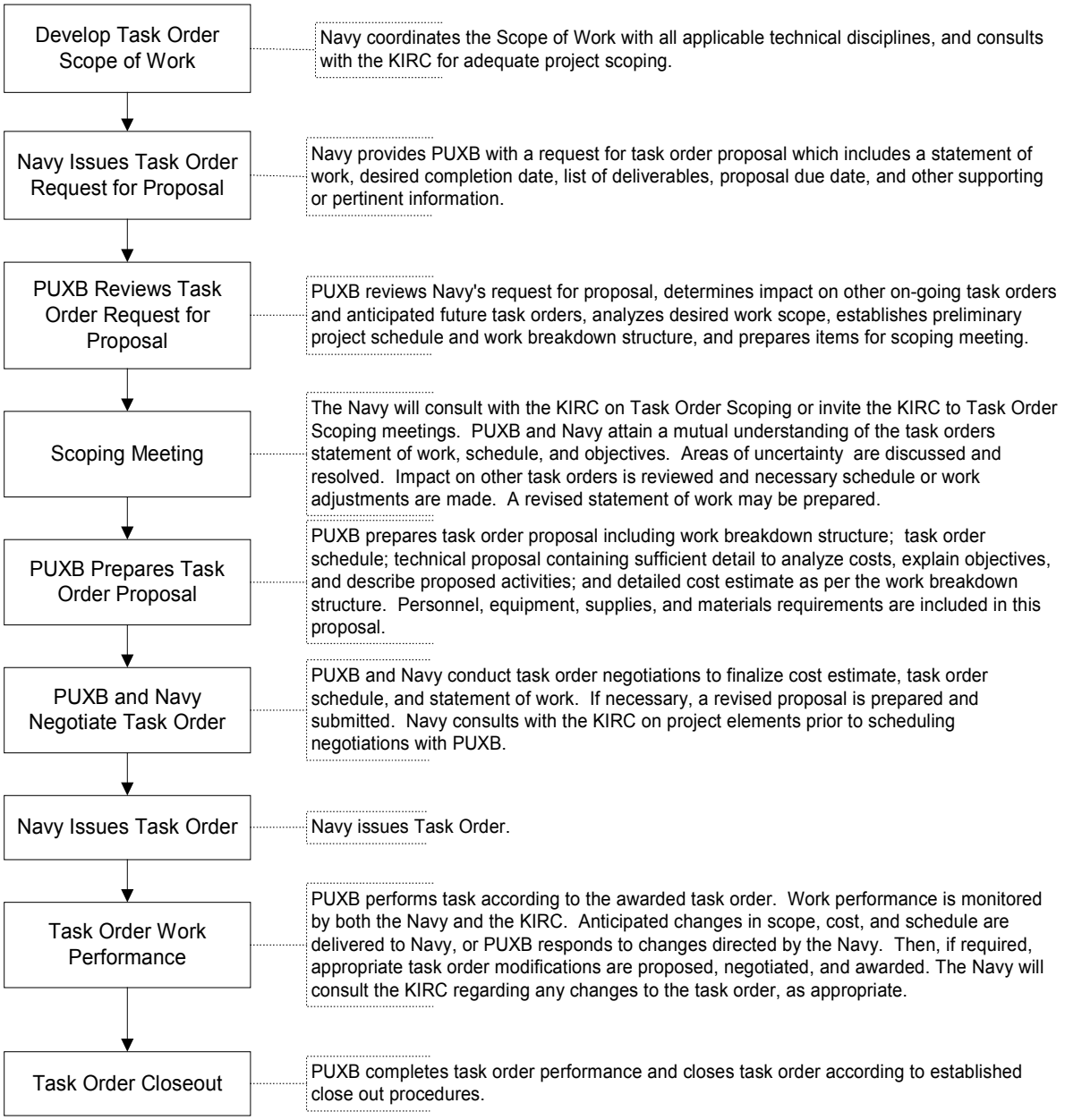
- Division of each task order into manageable subtasks or work elements
- Detailed cost and schedule projections for subsequent comparisons to actual performance
- Assignment of a responsible Senior Project Manager to each task order with task managers assigned depending on the size and breadth of the work

- Use the Contract Management System for periodic task order performance measurement and feedback

Each task order will follow the life cycle process shown and described in Figure 11.

The key to effectively managing staff fluctuations is to accurately forecast staff needs on an appropriate time scale. PUXB's tool for accurately forecasting staffing requirements will be a labor-loaded schedule which will be updated on an as-needed basis (construction requirements will be tracked daily; UXO requirements will be tracked monthly; etc.). Equipment and supplies will be ordered on a just-in-time basis.

Figure 11: Task Order Process



1.6.4 Quality Assurance/Cost Effectiveness

It is PUXB's policy to provide reliable, defect-free products and services in a timely and cost-effective manner that promotes the achievement of excellence in the workplace while maintaining the safety of all personnel, the public, and the environment.

The responsibility and authority for attaining quality resides with the line organization. It is the responsibility of all PUXB personnel, through the concept of worker empowerment, to provide work practices, goals, and employee interactions that promote an environment where communication is open, barriers to performance are identified and corrected, and a safer, more productive, and cost-effective workplace exists.

The PUXB quality control organization is responsible for verifying and documenting the adequacy of the quality program through performance inspection and surveillance of project activities. Functional area quality control managers and their staff will regularly assess field and functional activities through the use of documented surveillance and inspection. PUXB's Project Quality Control Manager will verify the effectiveness of the program by performing surveillance of quality control staff operations and review and certification of clearance operations.

PUXB's Quality Assurance Project Plan (QAPP) was prepared in compliance with the requirements of American National Standards Institute (ANSI)/American Society for Quality Control (ASQC) E4-1994, Specifications and Guidelines for Quality Systems for Environmental Technology Programs. The QAPP establishes quality control requirements to ensure that risks and environmental impacts are minimized and that safety, reliability, and performance are maximized through the application of effective management systems commensurate with the risks associated with the operation and/or its provided services. The QAPP includes quality management systems for the following elements:

- Program Management (Project Control, Procurement, Human Relations, and Community Relations)
- Personnel Training and Certification
- Quality Improvement (Nonconformance/Corrective Action Control and Readiness Reviews)
- Document and Record Control
- UXO Clearance and Range Control Operations
- Explosive Safety
- Historic Preservation
- Environmental and Natural Resources Protection
- Environmental Sampling and Analysis
- Base Camp Operations
- Surveying, Mapping, and Geodetic Data
- Design/Construction
- Transportation Logistics

- Conduct of Inspection and Surveillance
- Data Acquisition/Data Management
- Management and Independent Assessment

1.7 Public Participation

The Navy and the KIRC, on behalf of the State, developed an agreement regarding public participation, in accordance with the requirements of the MOU. This Public Participation Agreement also serves to meet the substantive requirements of CERCLA as related to the development of a Community Relations Plan.

Through implementation of the Public Participation Agreement, community involvement and communication with the community is promoted through providing information in a timely manner, soliciting public comments, and considering those comments in the decision-making process.

The Navy shall make the Cleanup Plan readily available to the public for a review and comment period of not less than 30 calendar days.

- During the comment period, the KIRC will assist the Navy in presenting the Cleanup Plan in public meetings on Oahu, Maui, Molakai, Lanai, Hawaii, and Kauai.
- The KIRC will sponsor and provide notice of the meetings in consultation with the Navy. The Navy may provide additional notice in consultation with the KIRC. PUXB will support the Navy when the Cleanup Plan is presented for public comment and when the Navy attends the KIRC meetings.
- The Navy will solicit public comments and prepare written responses to significant comments.
- The Cleanup Plan, public comments, and written responses will be included in the administrative record file.

At the KIRC's public meetings, the KIRC will afford the Navy, by way of a published agenda item entitled "Navy Report," an opportunity to: (1) provide the public with updated information concerning the cleanup, (2) receive public comments, and (3) respond to significant public inquiries raised regarding the cleanup.

The Navy will establish an Administrative Record file and publish a notice of its availability for public inspection and comment in a major local newspaper.

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Section 2 Site Characterization

2.1 Site Description and Background

2.1.1 Site Location

Kaho`olawe Island is located 151.3 km (94 miles) southeast of Oahu and 9.7 km (6 miles) southwest of Maui. The Kaho`olawe Island Reserve includes the island and waters extending seaward 3.2 km (2 nautical miles) from the shoreline.

2.1.2 Type of Facility and Operational Status

Kaho`olawe Island is remote and uninhabited, without permanent facilities or utilities, and includes only few dirt roads and foot trails. Temporary facilities to support a limited number of people exist at Honokanai`a on the southwestern end. Limited facilities also exist near Lua Keālialalo (LZ Seagull) and at Hakioawa at the northeastern end. A further discussion of each of the areas and their existing facilities is found in Section 2.1.9.

2.1.3 Topography, Geology, and Soils

Kaho`olawe Island is a single volcanic dome composed of thin-bedded pahoehoe and `a`a basalt with a few thin local beds of fire fountain debris and several cinder cones (Stearns, 1940). The largest and most prominent cone, Pu`u Moa`ulaiki, is located on the northwestern slope of the volcanic dome's summit. The base rock is tholeiitic basalt, containing up to 20% of the mineral magnetite, which has unusually strong magnetic characteristics.

Figure 1 shows the existing topography of the island.

The introduction of ungulates (hooved animals) beginning in the late eighteenth-century has resulted in the rapid denuding of the island's vegetation, substantial environmental degradation, and massive soil erosion down to the hard saprolitic hardpan resulting from subsequent winds and rain. In addition, military activities, such as bombing, road cutting, and burning, contributed to the level of soil erosion. The island surface on the plateau (from about 700 feet elevation to the summit) is mainly deeply eroded basalt and void of vegetation. The soil on the leeward side of the summit has a mantle of windblown material. The perimeter has mainly shallow soil and rock outcrops.

"Kaho`olawe lies at the apex of a naturally occurring wind tunnel, with Haleakala and the peaks of the Island of Hawaii forming the base points. Northeast trade winds blow most of the year, and are funneled onto the windward side of Kaho`olawe. These strong winds blow loose soil up from the western side of the island. Winds "sand blast" plants in exposed areas, and create depressions of loose soils." (Kaho`olawe Environmental Restoration Plan, 1997)

2.1.4 Water Resources

2.1.4.1 Marine/Ocean Waters

Consistent with federal regulations, the waters around Kaho`olawe have been designated a "danger zone" by the Corps of Engineers, Department of the Army (USACE) and access is restricted except as authorized by COMNAVBASE (32 CFR 763 and 33 CFR 334.1340).

The Board of Land and Natural Resources and the KIRC adopted emergency rules effective May 6, 1994 to September 6, 1994 to further define the reserve boundary to two nautical miles

from shoreline due to imminent peril to public health and safety based on the presence of unexploded ordnance and hazardous material on the island and in surrounding waters. Hawaii Administrative Rules §13-260 divided the reserve into two marine zones: zone A includes the waters from the shoreline to a depth of 20 fathoms; zone B includes the waters from a depth of 20 fathoms out to 2 miles from the shoreline.

The State of Hawaii has classified the marine waters surrounding Kaho`olawe as Class AA (HAR §11-54). By definition, these waters are to remain "in their natural pristine state ... with an absolute minimum of pollution or alteration ... from any human-caused source or actions" (HAR §11-54-03). No effluent discharge is allowed in these waters in depths less than 10 fathoms. Controlled allowable uses include oceanographic research, the support and propagation of shell fish and other marine life, conservation of coral reefs, and wilderness areas compatible recreation and aesthetic enjoyment. The Department of Health has further classified the bottom environments into Class I and II marine benthic communities. Specific standards and regulations exist for each type of marine bottom environment. (HAR §11-54)

In 1997, KIRC developed an Ocean Management Plan to provide a tool to manage the ocean waters and its resources. Concurrent with preparation of the Ocean Management Plan, the KIRC surveyed the intertidal and subtidal regions for marine macroalgae and invertebrates. This study, "Determination of Baseline Conditions for Introduced Marine Species in Nearshore Waters of the Island of Kaho`olawe, Hawaii" (1998), found that Kaho`olawe's reefs and inshore waters are pristine within the Hawaiian Island Chain in regards to alien species.

The waters within three nautical miles of Kaho`olawe were once considered for inclusion into the Hawaiian Islands Humpback Whale Sanctuary (NOAA, 1997). These waters were viewed as suitable to be added to the sanctuary due to the unexploded ordnance.

2.1.4.2 Surface Water Runoff

"It generally rains from November through February. In "normal" years the island receives very little precipitation during the dry season, March through October. Much of the rainfall on Kaho`olawe comes in short, heavy downpours and very little water soaks into the ground as there is little vegetation to facilitate this process. Periodically, the island receives more rainfall than normal, but the lack of a complete rainfall record makes wet years difficult to predict." (Kaho`olawe Environmental Restoration Plan, 1997)

There are no permanent streams on Kaho`olawe, but numerous rainfall runoff gullies start near the Lua Makika summit. There are no permanent ponds, lakes, or standing water impoundments on the island. However, due to the island's dry setting, all of the stream beds can be considered intermittent streams. (Gon, et. al., 1992)

2.1.4.3 Wetlands

Wetlands located on federally-owned land primarily come under the jurisdiction of the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers. The most relevant federal policies regarding wetlands are Executive Order 11990, Protection of Wetlands (42 USC 4321) and Sections 401 and 404 of the Federal Water Pollution Control Act (Clean Water Act, 33 USC 1341, 1344). Though Kaho`olawe is owned by the State of Hawaii, these federal regulations are still applicable. (L. Silva, personal conversation, 1998)

Under normal circumstances, an area delineated as a wetland must display indicators of all three of the following parameters: (1) supports predominantly hydrophytic plant species, at least periodically, (2) the substrate is undrained hydric soil, and (3) the soil is saturated or inundated at some time during the growing season, typically for a period greater than 2 weeks (Corps of

Engineers Wetland Delineation Manual, January 1987 revised edition). Wetlands function as habitats to important wildlife, flood control, natural water purification through sediment trapping, nursery habitat for wildlife and plant species, recreational areas, and contribute to the maintenance and recharge of the groundwater resources.

Though no formal wetland delineation has taken place on Kaho`olawe, some areas serve as potential wetlands by definition (e.g., Base Camp, Lua Makika, heads of some gulches). The substantive requirements of Sections 401 and 404 of the Clean Water Act (33 USC 1341, 1344) will be complied with and wetland delineations completed. All substantive requirements under the permitting process will be met when operations infringe upon designated wetland areas. The Navy and KIRC will be informed of the wetland determination as a part of the Area Assessment recommendations and findings submitted for the Review Board approval, and a map of the delineation will become an attachment to the Environmental Conditions Report.

2.1.4.4 Island Groundwater

According to the Protect Kaho`olawe Foundation Water Resources Study of 1990 and the Kaho`olawe Island Water Supply Study (GKO and Associates, 1997), groundwater in usable quantities may exist only as a brackish or saline basal lens which will require substantial demineralization to achieve potable quality.

Basal, probable dike-impounded, and perched groundwater occur on Kaho`olawe; however, due to infrequent and insufficient rainfall the interior lens is anticipated to be thin. No permanent or sizable perched-water bodies are believed to exist on the island. A few dug wells at the mouth of Hakioawa Gulch show that a thin lens of tidally influenced brackish groundwater exists along low elevation coastal areas.

2.1.5 Air Resources

Kaho`olawe lies in the rain shadow of Haleakala, on East Maui. In addition to the low precipitation, Kaho`olawe is the windiest of the Hawaiian Islands (Stearns, 1940). Deflected by Haleakala, the persistent northeasterly tradewinds accelerate across the `Alalakeiki channel.

2.1.5.1 Climate and Meteorology

"Kaho`olawe Island is generally characterized as hot, dry, and windy. However, records of climatic data are sparse, due in part to limited access during the last fifty-plus years of military use as a gunnery range.

The average yearly temperature is 78° Fahrenheit at sea level … Kaho`olawe lies partly in the wind shadow of the Haleakala volcanic shield on the neighboring island of Maui. … As moisture rich sea level air rises and moves around Haleakala nearly all the moisture is removed.

Rainfall on Kaho`olawe is variously estimated to average from 10 inches per year (less than received on the open ocean) to 25 inches per year, however, few continuous periods of rainfall records are available." (Kaho`olawe Island Water Supply Study, 1997)

2.1.5.2 Regional Air Quality

The prevailing weather pattern is for tradewinds out of the northeast, which bring exceptionally fresh, clean air across the island chain. Like the other main Hawaiian Islands, Kaho`olawe is susceptible to volcanic off-gas conditions during Kona weather, or periods of southern and southwesterly winds. During infrequent periods of Kona (southeasterly) winds, a deterioration of air quality results due to volcanic gasses emitted from active volcanic activity at Kilauea volcano on the Island of Hawaii. Volcanic off-gas is a serious health hazard to children, elderly, and

individuals with known respiratory problems. Wind borne dust generated during periods of dry windy conditions, may create a potential health hazard due to the presence of particulate matter from eroding soil.

2.1.6 Natural/Biological Resources

The waters surrounding the island are used by a variety of animals, including whales and dolphins. Some of these animals are protected by federal law, such as the monk seal, green sea turtle, and humpback whale. The island beaches are known to be used as resting areas for the endangered Hawaiian monk seal and nesting sites for the threatened green sea turtle. On land, Kaho`olawe is the only known habitat for the rare Palupalu O Kanaloa (*Kanaloa kahoolawensis*) and other endangered plant species.

Recent KIRC observations have identified the rare Blackburn's Sphinx moth *(Manduca blackburni*) on Kaho`olawe. Blackburn's Sphinx moth was proposed as an endangered species on April 2, 1997 (62 FR 15640-15646).

2.1.6.1 Vegetation

"Five native plant communities are described for the island with one of the best examples of the Ma`o Coastal Dry shrubland in the state. However, most of the plants on Kaho`olawe are aggressive, hearty alien species. Several small native plant communities do exist. Natal redtop, buffelgrass, kiawe, and other alien species dominate most vegetated areas, competing not only with native plants, but also posing a serious fire hazard. The relatively few native plants (when compared to alien flora) severely limits Kaho`olawe's seed supply for natural regeneration.

'Hardpan' soils lack many of the nutrients and soil microbes necessary for plants to survive. In upland areas, a hard, polished crust covers the landscape, making it impossible for seeds to germinate and take root. In pockets of loose, eroded soil, revegetation is occurring, but alien species dominate – partly because of the limited number of native plants on the island." (Kaho`olawe Environmental Restoration Plan, 1997)

2.1.6.2 Marine and Terrestrial Wildlife

Many of the island's coastal regions provide sheltered habitats for protected animal species. Important areas for native fauna are at Honokanai`a, Kuheia, Lae o Kuikui, and Hakioawa.

The humpback whales, spinner dolphins, green sea turtles, and leatherback turtles that utilize the surrounding waters are protected by a number of federal wildlife laws, such as the Marine Mammal Act. The Hawaiian monk seal is protected under the Endangered Species Act.

Habitats for land-based wildlife (Hawaiian owl *(pueo)*, Hawaiian hoary bat *(`ōpe`ape`a)* and cliff nesting seabirds) also exist on the island.

2.1.6.3 Threatened and Endangered Species

Under the Endangered Species Act (16 U.S.C. § 1531 et seq.), an endangered species is defined as any species that is in danger of extinction throughout all or a significant portion of its range. Threatened species are defined as any species that are likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Kaho`olawe is an important habitat to the following rare plants and animals:

- Five endangered plants, (*Gouania hillebrandii, Hibiscus brackenridgei ssp. brackenridgei, Neraudia sericea, Sesbania tomentosa, and Vigna*

owahuensis) and one endangered bird *(Pterodroma phaeopygia sandwichensis*, `ua`u, Dark-rumped petrel) have been observed on island.

- One proposed insect, Blackburn's Sphinx moth (*Manduca blackburni*).
- One plant proposed for endangered status is the island endemic *Kanaloa kahoolawensis* (Palupalu O Kanaloa). Identified in 1994, this plant is botany's newest discovery in Hawaii. The only two known plants still thrive on the sea stack `Ale`ale.
- Endangered marine life includes the humpback whale and the Hawaiian monk seal. The green sea turtle, known to nest on the western portions of the island, is considered a threatened species.

2.1.7 Historic Properties

The island was designated the Kaho`olawe Archaeological District and listed on the National Register of Historic Places in 1982. The Kaho`olawe Archaeological District contains 544 historic properties.

The following three categories of historic properties are present on the island and have been previously designated in the Site Protection Procedures.

Hawaiian historic properties include places of Hawaiian occupation and use older than fifty years, which includes prehistoric and early historic properties (including historic properties that have been adopted in modern times for contemporary use). Of the 544 sites recorded during the island-wide survey, most are of the prehistoric or early historic age and are associated with Hawaiian settlement of the island. A majority of these are habitation sites. Other major categories include habitation features, shrines and heiau, lithic quarries and workshops, and petroglyphs. These properties are all evaluated as significant under the National Register of Historic Places guidelines, and combined, comprise the Kaho`olawe Archaeological District.

Historic properties associated with the Ranching Era include modifications and structures associated with the Kūheia ranch complex and other ranch infrastructure elements throughout the island (fences, roads, water control and collection features, etc.).

Military historic properties are detailed in Paragraph 2.1.7.2.

2.1.7.1 Traditional Cultural Places

Traditional cultural properties are defined as properties of cultural importance which meet the criteria of the National Register of Historic Places. A number of properties that fit these qualifications are documented by Reeve (1993) who provides legendary and historic context. Places and sites at Kamohio, Kanapou, Hakioawa, Kealaikahiki, and other areas are described. In some cases, these correspond to recorded archaeological sites.

As stated in the Site Protection Agreement, the KIRC will provide recommendations to the Navy for the identification of properties of traditional, religious, and cultural importance, and the assessment of any cleanup activity that may affect such properties.

2.1.7.2 Historic Military

This category includes only those structures associated with the post 1941 military presence on the island that are identified as eligible or potentially eligible. In 1996, Collin Denfeld conducted

a survey of the military properties on the island (Denfeld, 1996). The survey identified several of these historic properties that were eligible or potentially eligible for the National Register of Historic Places under the significance criteria of "A" (association events that have made a significant contribution to the broad patterns of our history) and "C" (distinctive characteristics of a type, period, or method of construction):

- two observation towers (and generator shelters) built in 1942-1943, one located at LZ Seagull and the other located 2,000-feet northwest of Honokanai`a Bay.
- three shelters at the tower near Honokanai`a (associated with events to broad patterns of our history – refinement of naval gunnery in World War II)
- three aircraft at their crash-sites on Kaho`olawe may be eligible for inclusion on the National Register. (Further research recommended using crash cards and other information including in-field recording. Aircraft could possibly be made available to museums (Denfeld, 1996)).
- Sailor's Hat and nearby camera stands.

2.1.8 Debris Stockpile Areas

On-island debris stockpile areas include:

- **Waikahalulu Gulch Refuse Area** – Located approximately 5 miles northeast from Base Camp along K-1 Road, Waikahalulu Gulch is a temporary storage area for materials collected during previous military range clearance operations.
- **Bulky Waste Storage Area** – This is a temporary waste storage area, located 2,500 ft. west of Base Camp, of waste generated by previous Base Camp operations.
- **Target Vehicle Staging Area**- This area is located near the current Explosive Holding Area and was used to stage target vehicles prior to moving them on to the range.
- **Former LCU Staging Area**- Located near the Honokanai`a Bay beach at Base Camp, this temporary storage area contains material collected during previous military range clearance operations.
- **Trailer East of LZ Seagull**- Located east of LZ Seagull and LZ Eagle, this trailer contains material collected during previous military range clearance operations.

It is anticipated that other ordnance explosive refuse sites may exist and will be identified as UXO clearance operations progress.

2.1.9 Existing Infrastructure

2.1.9.1 Honokanai`a Base Camp

The Navy improved the Base Camp at Honokanai`a (Base Camp) in 1986 to support implementation of the provisions of the 1980 Consent Decree (*Aluli v. Brown*). Additional

improvements to Base Camp were completed during the UXO Model Clearance Project (Model Project), which was conducted from September, 1995 through January 1996. The additional improvements included electrical system upgrade, potable water system improvements, gray water facility upgrades, and sanitation facilities construction.

Figure 12 provides a view of existing Base Camp facilities.

2.1.9.1.1 Berthing Area

- **Building 5.** Building 5 is a metal-sided shed-like structure (Butler Building) that sits on concrete blocks with an attached shower (Building 5A). This building is currently used by active duty EOD and contains berthing space.
- **Building 6.** Building 6 is a metal-sided shed-like structure (Butler Building) that sits on concrete blocks. This building is currently used by PUXB Base Camp Support Personnel and contains berthing spaces.
- **Building 10.** Building 10 is a metal-sided shed-like structure (Butler Building) that sits on concrete blocks. This building is currently used by the KIRC and contains berthing spaces and office equipment.
- **Building 11**. Building 11 is a metal-sided shed-like structure (Butler Building) that sits on concrete blocks. This building is currently not in use and contains berthing spaces and a partitioned office space.
- **Building 12**. Building 12 is a metal-sided shed-like structure (Butler Building) that sits on concrete blocks. This building is currently used by the on-island Navy Technical Representative (NTR) and contains berthing spaces and a partitioned office space.
- **Building 13.** Building 13 is a metal-sided shed-like structure (Butler Building) that sits on concrete blocks. This building is currently used as the Galley and houses food preparation, serving, and storage.
- **Building 14.** Building 14 is a metal-sided shed-like structure (Butler Building) that sits on concrete blocks. This building is currently used to house visitors to the island and provides a separate berthing room for females. A partitioned space in this building houses a Sick Bay and storage area for medical supplies.
- **Building 20.** Building 20 is a wooden structure used by active duty EOD and NAVEODTECHDIV personnel for equipment storage.
- **Trailer 20A**. This trailer is a portable metal structure currently used for linen storage.
- **Building 29.** Building 29 is a metal-sided shed-like structure (Butler Building) that sits on concrete blocks and is attached to Building 13 by a covered and enclosed walkway. This building is currently used as a dining hall capable of serving up to 75 people/sitting. Attached to the rear of this building is a berthing space used by the camp cook.

2.1.9.1.2 Administrative Area

- **Building 4 and Shower 4A.** Building 4 is a wooden structure used by the COMNAVBASE Kaho`olawe Project Officer as a berthing and office space. This building contains a kitchenette and attached-screened porch. Shower 4A is an attached shower.

- **Building 15, Trailer 15A, Shower 15B, and Lanai 15C.** Building 15 is a metal-sided shed-like structure (Butler Building) with a wooden Lanai (Lanai 15C) extending off of the south side. This building is used by the PUXB Base Camp Manager as the Base Camp Administrative Office. Additionally, there are four berthing spaces and a kitchen facility. Trailer 15A is a portable metal structure used to store custodial cleaning supplies. Shower 15B is an attached shower located on the west-side Building 15.

- **Pavilion 18.** Pavilion 18 is an open wooden frame structure that has wood floors on a concrete masonry unit foundation. This pavilion contains a picnic table and is used for recreation.

- **Pavilion 53.** Pavilion 53 is an open wooden frame structure that has wood floors on a concrete masonry unit foundation. This pavilion contains weight lifting equipment and is used for recreation.

2.1.9.1.3 Maintenance Area

- **Building 16, Building 16A, and Building 16B.** Building 16 is a metal-sided structure with a concrete floor that houses a carpenter's shop and associated equipment and supplies. The associated storage areas (Buildings 16A and 16B) are located on the north side of Building 16. The western most storage area (16A) is a metal structure where tools were stored. The eastern most storage area (16B) is a wooden structure sitting on cinder blocks. The Seabees previously labeled the building the BU (Builder, Utility) Shop.

- **Building 17.** Building 17 is a wooden structure with a concrete floor that houses tools and equipment for maintaining heavy equipment and changing tires. It is currently used as a motor pool to service and maintain all on-island vehicles. This building contains an enclosed storage area, a corrosive storage cabinet for segregated corrosive material storage, and a storage area outside the building containing oxygen and acetylene cylinders. The Seabees previously labeled the building the EO (Equipment Operator) Shop.

- **Building 22.** Building 22 is a wooden structure with a concrete floor. It houses plumbing and electrical equipment and is used as a utility workshop to service and fabricate plumbing and electrical components. This building was previously labeled by the Seabees as the UT (Utility Technician) Shop.

- **Trailer 24**. Trailer 24 is a portable unit constructed of metal and wood, with a floor of wooden slats. It is used as a flammable storage locker and stores flammable material such as paints and compressed gases.

- **Locker 24A**. Locker 24A is a metal locked storage locker used for pesticide storage.

- **Trailer 24B.** Trailer 24B is a portable metal storage trailer used for storage of dry goods, such as charcoal filters and wood chips for the composting toilets.
- **Building 30.** Building 30 is a wooden structure with a concrete floor that is used for general storage. This building was previously labeled by the Seabees as the CM (Construction Mechanic) Shop.
- **Trailer 30A**. Trailer 30A is located just west and adjacent of Building 30. It is a portable metal trailer used to store vehicle replacement parts.
- **Vehicle-Parking Areas 1 and 2.** Two main vehicle-parking areas are in the Maintenance Area: one just to the west of the Building 21 (Vehicle Parking Area No. 1), and the other between Trailer 30A and Building 17 (Vehicle Parking Area No. 2).
- **Storage Area 60.** Storage Area 60 is located between Buildings 22 and 30. Storage Area 60 has a sand bottom with a sandbag berm on the south and west sides, with the north and east sides sloping up. It previously held fuel and waste oil drums, but is currently inactive and empty.
- **Storage Area 61.** Storage Area 61 is located immediately west of the Base Camp helipads. It is a bermed and lined secondary containment area used as an out-of-specification diesel fuel storage area.

2.1.9.1.4 Electrical Supply System

- **Building 3.** Building 3 is a combination hollow block and wooden structure with a concrete floor. It currently houses two (2) each 60 kW generators that are non-functional. It houses the electrical distribution switchboards, day tank, and maintenance equipment for the diesel generators.
- **Tank 3A.** Tank 3A is a 1,100-gallon diesel fuel above ground storage tank adjacent to Building 3 and located within a bermed and lined secondary containment area. This tank is used as the generator supply tank for the existing Generator 103. Piping between this tank and the Generator 103 was installed during the Model Project.
- **Generators 103 and 104.** Generator 103 is a 175 kW Onan model D6FB and Generator 104 is a leased 125 kW MQ Power Corp. model DCA-125SSK diesel generator. These are 480-volt output diesel generators installed during the Model Project and located outside and to the east of Building 3. The generators are hard-wired to the electrical distribution system in Building 3.

2.1.9.1.5 Water Supply System

Facilities for water production, storage, distribution, and use at the Base Camp include:

- **Building 15D.** Building 15D is attached to Building 15 and houses a 600-gpd reverse osmosis desalination unit.
- **Potable Water Storage Tanks 31 and 32.** Potable Water Storage Tanks 31 and 32 are 6,000-gallon tanks located in the Berthing Area east of Building 13. These two tanks provide potable water storage for the Base Camp and are piped to a distribution system throughout the Base Camp.

- **Water Tower 33 and Shower 19.** This wooden water tower and 600-gallon elevated water tank is used as a supply tank for Shower 19. Shower 19 is an outdoor shower for general use by Base Camp residents.
- **Potable Water Storage Tank 62.** The elevated storage tank located adjacent and to the east of Building 30 in the Maintenance Area (currently inactive).
- **Trailer 100.** Trailer 100 is a metal storage container housing a 9,000-gpd reverse osmosis desalination unit that was installed during the Model Project. This unit is currently inactive.
- **Salt-Water Supply System 101.** The Salt-Water Supply System 101 includes a salt-water storage tank, salt-water suction pump, and associated piping. This equipment was installed during the Model Project for operation with the reverse osmosis system.
- **Potable Water Storage Tank 102.** This 11,000-gallon potable water storage tank is located in the Berthing Area east of Building 13 and was installed during the Model Project. This tank is currently inactive.
- **Leach Field 105.** A 19-ft. x 55-ft. brine leach field installed during the Model Project for brine discharge from the reverse osmosis unit.
- **Shower Trailer 106.** One (1) nine-stall shower trailer with 30-gallon hot water heater is located adjacent and east of Building 13 and used by Base Camp tenants for bathing. This trailer was installed during the Model Project.
- **Eight – 400-Gallon Trailer-Mounted Portable Storage Tanks (Water Buffaloes).** One is currently used as a towed water supply for fire fighting and another is used to supply an eyewash station at Building 17. The other six tanks are currently not in use.

2.1.9.1.6 Gray Water Facilities

The following facilities were installed during the Model Project:

- **Gray Water Storage Bladders**. Three 10,000-gallon gray-water storage bladders are located at the Former LCU Staging area near Honokanai`a Bay beach (currently in use) and two additional 10,000-gallon gray water storage bladders are in storage and available for use.
- **Gray Water Drain and Grease Trap.** An independent drain connects the galley to an activated charcoal filter and gravel french drain located adjacent and to the south of Pavilion 18.

2.1.9.1.7 Sanitation Facilities

The following sanitation facilities were constructed during the Model Project:

- **Composting Toilets 2A, 2B, 2C, 2D, 2E, and 2F.** Six composting toilets with interior solar-powered fans and lights were installed in various locations throughout the camp for use by Base Camp tenants.
- **Building 21.** Building 21 is an abandoned open pit-type latrine with a wooden enclosure.

- **Building 63.** Building 63 is an abandoned pipe type urinal within a wooden enclosure.

2.1.9.1.8 Solid Waste Facilities

- **Temporary Solid Waste Storage Facility.** Solid waste is collected in dumpsters staged in the Former LCU Staging Area adjacent to the Honokanai`a Bay beach.

2.1.9.1.9 Petroleum Oil and Lubricant (POL) Storage Facilities

Current POL storage areas are located at the Base Camp facilities listed in the Table 8.

Table 8: POL Storage Facilities

POL Storage Facility ID	Location	Description
B-1	Fuel Storage Area at the Former LCU Staging Area	Lined berm containing three 55-gallon gasoline drums in plastic overpacks and one unopened 55-gallon gasoline drum.
3	Bldg. 3 – Inside Building 3 (Generator Building)	25 gallon diesel day tank.
3A	Tank 3A – Adjacent to Building 3 (Generator Building)	Lined berm containing a 1,100- gallon diesel above ground storage tank.
17	Bldg. 17 – Inside Building 17 (Motor Pool)	POL storage rack. Six 40-gallon dispenser tanks containing oil.
17	Bldg. 17 – Inside Building 17 (Motor Pool)	POL storage rack. One 40-gallon dispenser tank containing automatic transmission fluid.
17	Bldg. 17 – Inside Building 17 (Motor Pool)	POL storage rack. One 40-gallon dispenser tank containing anti-freeze.
	Mobile	M49C Fuel Truck with 1,200-gallon fuel storage.

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Figure 12: View of Existing Base Camp and Facilities

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2.1.9.1.10 Communication System

The current communications system consists of a combination of telephone and radio systems. The telephone system currently only provides service to Base Camp. The radio system provides partial coverage of the anticipated clearance areas on the island with a limited number of channels or frequencies.

2.1.9.1.10.1 Microwave Telephone System

The telephone system consists of a microwave tower, link on Lanai, dishes, and a multiplexer box, with solar power for electricity. The microwave tower, Tower 1, is located 1.2 miles northwest of Base Camp and handles both telephone microwave transmissions and serves as a radio link. This microwave transmitter communicates with a link located on Lanai, which in turn is connected to a GTE telephone system

Tower 1 is 10.1 meters high and is equipped with a TELCO System telephone exchange with the following equipment:

- 2-wire Foreign Exchange Office
- 2-wire Foreign Exchange Office Defined Network
- 2-wire Foreign Exchange – Station End Channel Unit
- DC Power Unit
- Line Interface Unit for a DCB-24 Digital Channel Bank
- Ringing Generator
- LYNX 6 Digital Microwave Receiver/Transmitter
- Power Supply

The site on Lanai has the same equipment as Tower 1.

The multiplexer box is capable of servicing 24 telephone lines, but is currently configured for eight. This solar powered system requires periodic maintenance to insure uninterrupted communications.

2.1.9.1.10.2 Base Camp Cellular Telephone System

This system consists of two 3-watt transportable bag phones located in Building 15; a 15 dB gain antenna mounted to the radio tower next to Building 15 and connected to one of the bag phones by a single coaxial cable; and a second antenna and coaxial cable mounted to the top of Building 4 and terminating inside of Building 4. This system has the capability to transmit and reach the Maui cellular phone network.

The system in Building 15 has one of the transportable phones permanently attached and powered at all times. The second phone can be interchanged with the attached phone, if necessary.

The system in Building 4 consists of only an antenna and a coaxial cable. One of the transportable bag phones can be connected to the antenna and plugged into an electrical outlet, when needed. The current cellular phone service is configured for transmitting outgoing calls only. The phone system is being transferred to allow incoming calls.

2.1.9.1.10.3 Personal Cellular Telephone System

Personal cellular phones include handheld models of 1-watt transmission power or less. These phone are unable to reach the Maui cellular network directly from Base Camp. The nearest site within Base Camp that a personal cellular phone will work is the Bulky Waste Storage Area.

2.1.9.1.10.4 Radio Systems

The radio network for Kaho`olawe Island consists of two radio communication towers on the island and a third tower at Haleakala.

Radio Network

Tower 1 is located 1.2 miles northwest of Base Camp and handles both telephone microwave transmissions and serves as a radio link. Tower 1 is 10.1 meters high and equipped with an EF Johnson base station with 5 watts of power. Tower 2 is located at LZ Eagle and serves only as a radio link. Tower 2 is 15 meters high and is equipped with an EF Johnson base station with 5 watts of power. There is an additional link, Tower 3, at Haleakala, Maui, which facilitates communications to and from Kaho`olawe.

The 800 MHz radio system consists of 80 Johnson hand-held Viking CL HL83 radios using a Logic Trunk Routing (LTR) trunking format. The radios are currently configured for two channel groups with three channels in one group and one channel in the second group. The second group only provides communications within a small, localized work area. The coverage area is presently K-1 Road, East Maui, Base Camp, Hakioawa, and Kahului Airport on Maui. Areas without any radio coverage include gulches deeper than 20 feet; the windward side of Lua Kealialuna, Pu`u Moa`ulaiki, Keoneuli, Pu`u Koa`e, and Waikahulu Bay beach.

VHF Marine Band Radio

The VHF (Very High Frequency) Marine Band Radio consists of two handheld radios and a single base station mounted in Building 15. These units can be used for emergency or ship-to-shore communications. The U.S. Coast Guard regularly monitors Channel 16 of the Marine Band Radio and will respond to any emergency requests transmitted on this channel. Channel 22 is used for general administrative radio traffic. One handheld unit is used to monitor Channel 16 and the other Channel 22. The base station regularly monitors Channel 16.

2.1.9.2 Hakioawa Camp

Hakioawa Camp contains a heavy concentration of archaeological and cultural sites. The PKO uses this valley as their home base during cultural and educational accesses. A traditionally built *hale halawai* (grass-thatched meeting house) is the only existing walled structure at Hakioawa. Support facilities installed during the Model Project include: four composting toilets, two conex storage containers, and one 600-gallon per day reverse osmosis unit powered by a 20 kW diesel generator. Currently, the reverse osmosis unit and generator are inactive.

Three water catchments and storage tanks were built on the slopes above Hakioawa. The largest and only operational one is located along the South Trail at a location known as Wailuna. This storage tank is connected by plastic irrigation piping to the camp in Hakioawa. The second catchment is located along the north trail at Kealialuna. It is currently non-operational. The third is located near the summit of Pu`u Moa`ulanui along one of the branches of the North Trail and is currently non-operational. Materials for a fourth catchment are staged upslope of the catchment at Kealialuna along the North Trail. A PKO constructed weather station also remains at Kealialuna. This weather station is currently cooperatively operated by the PKO and the University of Hawaii.

2.1.9.3 Kealialalo Observation Post (LZ Seagull)

An observation post at Landing Zone (LZ) Seagull was built to observe troop activities in the western zone of the island. This group of dilapidated buildings includes a reinforced concrete bunker, two partially standing wooden structures, and one pierced steel panel helipad. There is no support infrastructure for electrical power generation, potable water, or sanitary facilities.

2.1.9.4 Transportation

2.1.9.4.1 Roads

The main vehicular access is a rough, unimproved dirt road across the island (K-1 Road), extending from Honokanai`a to Lua Makika. Side roads extend to LZ 3 and LZ Seagull from K-1 Road. Limited vehicular access trails (4-wheel drive capability required) and pedestrian trails provide additional limited access from the primary road system to the southeast, central, and north central plains, and along the western coastline. The roads and trails are weathered and without adequate erosion controls. Vehicular travel along all roads is rough and slow, with an average speed of less than ten miles per hour.

2.1.9.4.2 Aircraft Landing Facilities

There are currently nine helipads in varying degrees of usability interspersed throughout the island. Two are located in Base Camp, one at LZ Seagull, two at Hakioawa, one at LZ Eagle (near Pu`u Kahua), one at LZ 1 (near Lua Makika), one at LZ 3 (west of Kanapou), and one at LZ4 (near Kealialuna). The landing surfaces are constructed of either pierced steel panels or Marston Mats.

2.1.9.4.3 Watercraft Landing Facilities

There are no existing on-island pier facilities to safely transport personnel or cargo from transport vessels to the island. The absence of a pier restricts heavy cargo transport to vessels with shallow water or beaching capabilities. Ocean access is limited to beach landing craft. Currently, Honokanai`a is the only area authorized for beach landing (when tide and surf conditions warrant).

2.1.9.5 UXO/Explosives Storage and Transfer Facilities

2.1.9.5.1 Explosive Holding Area

The Explosive Holding Area (EHA) consists of two portable explosive magazines sited and approved for 4,000 pounds net explosive weight (NEW) storage capacity each. The EHA is used to store ammunition (explosives and initiators) required to detonate UXO/OE recovered during clearance operations.

Security for each magazine consists of a shrouded high security lock that secures the magazine door and a 6-foot high chain link fence with a locked gate. An Explosive Quantity Safety Distance of 1,250-feet is established around the EHA. Safety distances are established by Navy and DoD regulations, based on the maximum approved quantity storage limit for bulk explosive materials in any one location considering separation distances from adjacent bulk explosive storage facilities, inhabited areas, and traffic routes.

2.1.9.5.2 Open Storage Area

The fenced Open Storage Area (OSA) consists of a series of earth-filled geotextile storage cells with a total approved capacity of 20,000 pounds NEW. The OSA was designed for the short-term storage of temporary in-process ordnance and ordnance-related items. An Explosive Quantity Safety Distance of 1,250-feet is established around the OSA.

2.1.9.5.3 OSA Inspection Point

The OSA Inspection Point is located at the junction of K-1 Road and the road to the OSA. This is the point at which all UXO/OE and UXO remnants are visually inspected for determination of disposition. An Explosive Quantity Safety Distance of 1,250-feet has been established around the OSA Inspection Point.

2.1.9.5.4 Ammunition Transfer Points

Ammunition Transfer Points (ATP) are used to transfer in-coming ammunition to the explosive handling vehicle for movement to the EHA and placement in the appropriate explosive magazine. Three Ammunition Transfer Points have been submitted and approved for use by the Department of Defense Explosives Safety Board. The primary ATP is located at LZ Seagull and is used to transfer ammunition from air transport to an explosive hauling vehicle; one ATP is located at the Base Camp helicopter landing pad and will be used as the back-up to the primary ATP at LZ Seagull. The third ATP is the Base Camp Beach Ammunition Transfer Point at the beach landing area at Honokanai`a. An Explosive Safety Quantity Distance of 1,250 feet has been established around each Ammunition Transfer Point and along any on-island vehicular routes during ammunition transfer.

2.1.9.6 Hazardous Materials and Hazardous Waste Storage Facilities

Current hazardous materials storage areas on Kaho`olawe are located in Base Camp and are listed in Table 9.

Table 9: Hazardous Material Storage Facilities

Hazardous Material Storage Facility ID	Description
Trailer 24	Flammables Storage Locker
Locker 24A	Pesticide Storage Locker
Trailer 15A	Custodial Cleaning Chemicals Storage Trailer
Building 15d	Reverse Osmosis Unit Chemicals Storage
Building 16	Carpenter Shop Construction Adhesives, R-12 Refrigerant
Building 17	Motor Pool Automotive Maintenance Products and Oxygen/Acetylene Cylinders
Building 30	General Storage Surplus Paints, POL and Solvents, Oxygen/Acetylene Cylinders
Trailer 30A	Storage Trailer Construction/Automotive Products

Hazardous waste is collected at initial accumulation sites and transferred to central accumulation storage. Current hazardous waste storage facilities on Kaho`olawe Island are located at the Base Camp facilities listed in Table 10.

Table 10: Hazardous Waste Storage Facilities

Hazardous Waste Storage Facility	Location	Description
17-1	Central Accumulation Site (Building 17 Awning)	Yellow Plastic Overpack containing two 55-gallon drums for waste oil accumulation
17-2	Central Accumulation Site (Building 17 Awning)	Yellow Plastic Overpack containing two 55-gallon drums for waste antifreeze accumulation
17-3	Central Accumulation Site (Building 17 Awning)	Yellow Plastic Secondary Containment Pallet for storage of used lead acid batteries
17-4 (Recommended)	Central Accumulation Site (Building 17 Awning)	55-Gallon drum for storage of used asbestos brake pads
17-5 (Recommended)	Central Accumulation Site (Building 17 Awning)	Plastic Secondary Containment Overpack for accumulation of waste solvents
17-6 (Recommended)	Central Accumulation Site (Building 17 Awning)	Plastic Secondary Containment Overpack for used oil filters
61	Diesel Fuel Storage Area	Unknown quantity of 55-gallon waste diesel fuel and waste oil drums

2.1.10 Socioeconomic Conditions

At this time, Kaho`olawe Island Reserve is uninhabited, except for nine PUXB personnel and one Navy Technical Representative who are temporarily supporting Base Camp operations.

As stated in HRS §6K-3(b), no commercial activities are allowed within the reserve during KIRC tenure. However, fishing has always been an important economic and recreational activity in Hawaii, with social and cultural implications outweighing economic impacts. As a result, current KIRC rules allow for troll fishing in Zone B waters two weekends a month (HAR §13-260-4). Early studies have shown that the fishery resources around Kaho`olawe, while not abundant, are high in species diversity (U of H Marine Options Program, 1976). More recent data on commercial fishing within the reserve indicates that the volume and value of commercial fishing rose from 6,493 pounds ($13,849 value) in 1986 to 31,045 pounds ($59,331 value) in 1990 (DLNR, 1991).

2.2 Source, Nature, and Extent of Contamination

Kaho`olawe Island has been used to train military personnel for air and sea attacks, as well as for marine landings over a period extending from 1941 to 1990. Almost every type of ordnance item used by the U.S. military during this period may have been dropped or fired on

Kaho`olawe. No records have been located which indicate that chemical, biological, or nuclear weapons were used on Kaho`olawe. In addition, there are no records that indicate that depleted uranium based ordnance was used on Kaho`olawe Island. Ordnance includes both practice (inert) and service (live) items. UXO clearance operations will include collection and segregation of materials into three primary categories: UXO and ordnance-related explosives (UXO/OE), UXO-related remnants, and target materials.

2.2.1 UXO

A preliminary UXO site characterization has been conducted by the Navy and was used extensively in the preparation of this Cleanup Plan. This assessment of the extent of UXO concentrations on Kaho`olawe Island provides the Baseline Risk Assessment consistent with the non-time critical removal action under CERCLA. This assessment included two major components: (1) a characterization of UXO concentrations and the environmental conditions affecting UXO distribution, and (2) a qualitative assessment of UXO hazards.

Archival UXO data used in the assessment was derived from previous surface sweep clearance reports, former target locations and configuration as shown on the Kaho`olawe Island Target Locations (Figure 13), previous Preliminary Hazard Assessments, a 1997 Site Investigation, and the Model Project. No area on the island is seen as free from some degree of ordnance contamination. The results of the assessment were used to produce the resultant surface hazard severity map (Figure 14) and subsurface severity map (Figure 15). Hazard severity is classified as one of five categories, as defined in Table 11.

Table 11: Hazard Severity Categories

Description	Category	Definition
Catastrophic	I	Death, system loss, or severe environmental damage
Critical	II	Severe injury, severe occupational illness, major system or environmental damage
Marginal	III	Moderate injury, moderate occupational illness, or minor system or environmental damage
Negligible	IV	Minor injury, occupational illness, or less than minor system or environmental damage
None	V	No hazards

The assessment and hazard analysis process is an iterative process that relies on similarity to previous operations and past experience with similar operations. The process starts by extracting data from prior hazard assessments. Initially, the worst case data is used; as more information becomes available during the clearance process, the hazard analysis tables will be updated to reflect new operating safety information.

Figure 13: Kaho`olawe Island Target Locations

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Figure 14: EOD Site Characterization Map (Surface Hazard Severity)

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Figure 15: EOD Site Characterization Map (Subsurface Hazard Severity)

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Specific categories of UXO/OE were developed, as follows:

- Bombs
- Projectiles
- Mortars
- Grenades
- Rockets
- Guided Missiles
- Pyrotechnics
- Small Arms
- Submunitions
- Ordnance Explosive Components

Table 12 lists the types of ordnance within each of the above categories commonly found on Kaho`olawe Island. The clearance items are predominately UXO, UXO-related remnants, and target materials. There are no reports which indicate that radioactive materials or nuclear, biological, and chemical warfare materials were used on Kaho`olawe.

Table 12: Ordnance Commonly Found on Kaho`olawe Island

Name	Exp. Weight (lbs)	Type Fuzing
Bombs		
2000 lb SAP Bomb	1,000	Impact Impact Cocked Striker Impact Delay
2000 lb LDGP Bomb/MK84	1,000	Impact Impact Cocked Striker Impact Delay VT
1000 lb LDGP Bomb/MK 83	500	Impact Impact Cocked Striker Impact Delay VT
500 lb. LDGP Bomb/MK 82	200	Impact Impact Cocked Striker Impact Delay VT
250 lb. LDGP Bomb/MK 81	100	Impact Impact Cocked Striker Impact Delay VT

Name	Exp. Weight (lbs)	Type Fuzing
FAE Bombs	75 E.O.	Mech Time Piezo Electric
40 lb Frag Bombs	23	Impact
Fire Bombs	705	All-Ways Acting Napalm (WP igniters)
Projectiles		
20mm Projectiles	.02	Impact Impact Self Destruct Impact (Cocked-Striker)
3”/50 Projectiles	1.66	Impact Mech Time VT
5”/38 Projectiles	8	Impact Impact (Cocked-Striker) (Tail and Nose)
5”/54 Projectiles	10	Impact Mech Time
106mm Projectile (HEAT)	2.79	Impact PIBD Piezo Electric
105mm Projectile	7.76	Piezo Electric Impact Mech Time
8” Projectiles	21.58	Impact Mech Time
16” Projectile	153	Impact
Mortars		
81mm Mortar	4.3	Impact Mech Time Powder Time
60mm Mortar	5	Impact
60mm Mortar	1 WP	Mech Time Powder Time
Grenades		
40mm Grenade	.17	All-Ways Acting
Rockets		
2.75” Rocket	2.3	Impact VT
66mm LAW	1.5	Impact
3.5” Bazooka	3	Impact
5” HVAR Rocket	20	Impact VT

Name	Exp. Weight (lbs)	Type Fuzing
5" Zuni Rocket	20	Impact VT
4.5" Barrage Rocket	8	Mech Time Powder Time
4.2" Rocket Thrown Depth Charge	15	All-ways acting Hydrostatic
7.2" Rocket Thrown Depth Charge	33	All-ways acting Hydrostatic
Guided Missiles		
Tow Surface Attack	10	Impact
Dragon Anti-Tank	6	Impact
AGM-12 Bullpup	250	Impact VT
AGM-45 Shrike	55	Impact VT
Pyrotechnics		
MK 24 Aircraft Illuminating Flare	17	Mech Time Powder Time
MK 45 Aircraft Illuminating Flare	17	Powder Time
5 Inch Projectile (Illuminating)	6	Powder Time Mech Time
Small Arms		
.22 Caliber .9mm .45 Caliber 5.56mm 7.62mm 12 Gauge Shotgun Shell 50 Caliber	Varied	Not Applicable
Submunitions		
Butterfly Bomblets	0.5	Impact Anti Disturbance Long Delay
Baseball Type Bomblets (Anti-Personnel)	0.25	Anti-Disturbance

2.2.1.1 Bombs

Bombs found on Kaho`olawe Island range from 2 lbs to 3,000 lbs. There are various types of bombs – from general purpose to fuel-air-explosion to fire bombs (napalm). The fuzing incorporated in these bombs also varies. Typical fuzing systems used include: impact, cocked striker, piezo electric, all ways acting, time delay, and variable time (radar) fuzes.

2.2.1.2 Projectiles

Projectiles found on Kaho`olawe range from aircraft launched 20mm to shipboard-fired 16-inch projectiles. Explosive weights range from .017 lbs in the 20mm to 150 lbs in the 16-inch. White

phosphorous projectiles have also been found on island. Fuzing systems include: impact (cocked-striker), mechanical time, powder train time, piezo electric, and all-ways acting fuzes.

2.2.1.3 Mortars

In addition, there are 81mm mortar rounds present that contain 4.3 lbs of white phosphorous for a main charge. The fuzing of mortar rounds consist principally of impact or mechanical time systems. Mortars can range from 60 mm to 81 mm.

2.2.1.4 Grenades

Grenades can range from the 40 mm to fragment and blast. The 40 mm poses a great hazard due to its all-ways acting fuze.

2.2.1.5 Rockets

The variety of rockets ranged from 2.75 inch to 7.2 inch rockets. Explosive weights range from 2.3 lbs to 33.7 lbs.

2.2.1.6 Guided Missiles

The two types of guided missiles used on Kaho`olawe were air launched with warheads up to 250 lbs and man-portable ground launched with 10 lb warheads. The dome of these missiles incorporates piezo electric type switches as impact back-up for the radar fuzing.

2.2.1.7 Pyrotechnics

Pyrotechnics found on Kaho`olawe Island include aircraft dropped illuminating charges containing 17.6 lbs of illuminating compound. The fuzing is usually powder train time or mechanical time. The 5-inch star projectile is also found on the island with the same fuzing as mentioned previously.

2.2.1.8 Small Arms

The full spectrum of small arms can be found on Kaho`olawe's range. They range from .22 caliber to 50 caliber.

2.2.1.9 Submunitions

Submunitions range from butterfly bomblets to baseball-type. These submunitions were generally used for anti-personnel purposes, and may incorporate very sensitive anti-disturbance features.

2.2.1.10 Ordnance/Explosive Components

Ordnance/Explosive components are recognizable, intact components from the various ordnance items. These items may or may not have an explosive hazard.

2.2.2 UXO-Related Remnants

UXO-related remnants, which consist of ordnance fragments and components, were generated through the functioning of ammunition and open detonation.

2.2.3 Target Materials

Target materials include those items used as military targets (i.e., tires and vehicles).

2.2.4 Other Potentially Contaminated Sites

During the Model Project, a number of on-island sites were identified which may contain non-UXO contamination. These potentially contaminated sites (including dumps, burn pits, and target vehicle storage areas) are located on Figure 16 and summarized in Table 13, which lists three categories of waste materials that may have been disposed at the identified sites. The three categories are defined as:

- **Hazardous Substance** -- CERCLA broadly defines hazardous substances as listed substances (volatile organics, semi-volatile organics, pesticides/PCB's and metals) and substances and pollutants listed under the Clean Water Act, hazardous wastes listed under the Resource Conservation and Recovery Act, hazardous air pollutants listed in the Clean Air Act, and imminently hazardous chemicals listed under the Toxic Substance Control Act.
- **Non-Hazardous Substance** – Exempt CERCLA substances, such as Petroleum Oil and Lubricants and certain mining wastes.
- **Solid Waste** – Bulk trash and other general refuse, such as scrap metal, discarded furniture, construction debris, etc.

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Figure 16: Potentially Contaminated Sites

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Table 13: Other Potentially Contaminated Sites

Site	Hazardous Substance	Non-Hazardous Substance	Solid Waste	Description
Base Camp Bulky Waste Storage Area	✔		✔	Contains, large metal items, junked vehicles, UXO debris, batteries, brake shoes (asbestos)
Current Garbage Burn Pit	✔		✔	Residue from burning Base Camp refuse
Former Base Camp Garbage Burn Pit	✔		✔	Residue from burning Base Camp refuse
Lower Nursery Area Burn Pit	✔	✔	✔	Three small areas may have been used to burn propellant powder and potentially Pentachlorophenol (PCP) treated dunage from artillery firing positions
Landing Zone 1	✔	✔	✔	Three or four areas may have been used to burn potentially Pentachlorophenol (PCP) treated dunage
Landing Zone Seagull	✔		✔	Contains various small batteries equivalent to a volume of several 55-gallon drums
Waikahalulu Refuse Storage Area (Klines Gulch)	✔		✔	Four open demolition pits used to burn and/or detonate UXO; kick-outs surround each pit.
Waikahalulu Refuse Storage Area (Klines Gulch)	✔	✔	✔	Contains automobile batteries, target vehicle components mixed with UXO debris
Bulky Metal Staging Area (Explosives Holding Area)	✔	✔	✔	Contains target vehicles
Naval Gunfire Target Area	✔	✔	✔	Contains automobile batteries, painted tires, and target vehicle components mixed with UXO debris
Former LCU Staging Area	✔	✔	✔	Contains target vehicle components mixed with UXO debris

2.3 Previous Removal Actions

Previous removal actions have been conducted on Kaho`olawe and are shown in Table 14.

Table 14: Historical Clearances

Time Period	Cleared Total	Amount of Live UXO	Amount of Practice Ordnance	Amount of UXO Debris (lbs)
1981 - 1982	3,596 acres	4,816	33,661	Not Documented
1981 – 1987	10,057 acres	38,865	Not Documented	303,412
1987 – 1993	Re-swept previous areas	96,836	43,042	1,832,986
1994	Base Camp 11.3 acres	0	0	125
1995 - 1996	240 acres	4,030 (306 subsurface)	(Included in total Live UXO count)	17,736-surface 16,977-subsurface

2.3.1 Historical Military Cleanup Operations

In response to the provisions of the 1980 Consent Decree (*Aluli v. Brown*), the Navy has conducted various surface clearance activities over portions of the island. Military Explosive Ordnance Disposal (EOD) personnel conducted these surface clearance activities under the operational control of Commander, Naval Base Pearl Harbor.

2.3.2 Base Camp

In the fall of 1994, the EOD Detachment Pearl Harbor and technical representatives from Pacific Division, Naval Facilities Engineering Command and Naval Explosive Ordnance Disposal Technical Division conducted a surface clearance of Base Camp. The objective was to clear the area of surface UXO and delineate an area for the continuance of Base Camp operations under a civilian-manned Base Operating Support contract.

During the 1995-1996 time frame, the Navy conducted a removal of scrap items located in the Former LCU Staging Area of Base Camp. The scrap items consisted of target vehicles, inoperable construction vehicles (trailers, tractors, and bulldozers), tires, and scrap metals. These items were transported off-island to Maui Scrap Metal.

2.3.3 UXO Model Clearance Project

The Navy conducted the UXO Model Clearance Project (from August 1995 through January 1996) to:

- Test the feasibility of certain UXO clearance procedures and technologies on Kaho`olawe
- Model coordination of UXO clearance activities among the interested parties
- Model procedures developed for the cleanup as related to protection of historical, cultural, and religious sites

- Model environmental protection efforts, erosion control, and revegetation strategies in areas involved in the pilot project

Visual surface and subsurface UXO clearance activities (to a depth of one foot or four feet) were conducted in designated areas, totaling approximately 240 acres.

Protective Works Demonstrations were conducted to evaluate the effects of blast and fragmentation on nearby archaeological sites and plant natural resources. The demonstrations clearly indicated that with proper protection, historic properties, archaeological sites, and environmental and natural resources may be effectively protected. The results of the demonstrations are documented in the Unexploded Ordnance (UXO) Model Clearance Project Kaho`olawe Island, Hawaii, Protective Works Demonstration Report (OHM, 1996).

2.4 Information Management

An electronic database will be used for performing daily data management activities. The electronic database will be based on tracking and documentation requirements consistent with the Contract Deliverables, as presented in Attachment JC.6 of the Clearance Contract. This interactive "real-time" network system allows users to access data and perform remote review of daily operations. A user password protection system grants authorized users access to those portions of the database applicable to their functional area.

2.4.1 Data Management System

The Data Management System will consist of nine modules, as shown in Figure 17. This system will be used to record and document all day-to-day island technical information. Tracking records for all on-island personnel will be accessible on a "real-time" basis. This system, as envisioned, will be used to assist in ensuring safety of all range operations. The main module will be the Kaho`olawe Island Database (KID). This module will contain the essential documentation of information relating to UXO clearance operations, historical properties, natural resource concerns, and the environmental condition report.

Data sheets are used to record the information, as identified in the project Standard Operating Procedures and reporting requirements.

The remaining modules will serve to record data from those operations supporting the UXO cleanup. Pre-developed reports will be available and be able to be retrieved quickly from the project data server and displayed to the user.

Data sorts/queries are configured to: (1) prepare reports consistent with the requirements of the contract and (2) input into the Kaho`olawe Island Geographic Information System ORACLE database (as discussed in Section 0).

PUXB's Quality Control (QC) managers for each functional area will verify that the information electronically entered into the Kaho`olawe Island Database reflects the information collected in the field and other relevant documentation. Upon QC approval and with appropriate password authorizations, the information can be accessed for further processing and external observation through the wide area networked Data Management System (DMS).

2.4.2 Electronic Grid Folder (Review Board)

The Review Board reviews various aspects of the clearance operations. Findings and recommendations are electronically submitted to this Board.

The Review Board is a 9-member body with Government and PUXB representatives, including:

Government:

Board Chairperson: Navy Technical Representative (NTR)

Members: UXO On-Site Navy Technical Representative
Historic Preservation On-Site Navy Technical Representative
KIRC-authorized representative

PUXB:

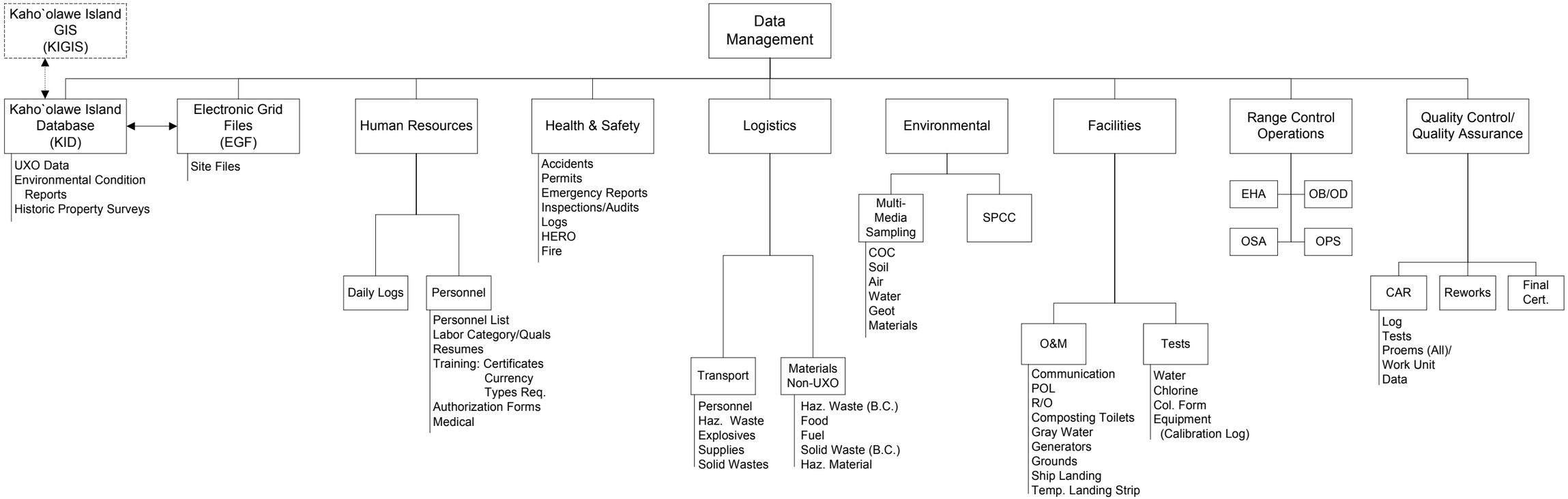
Board Chairperson: Range Control Officer

Members: UXO Quality Control Manager
UXO Safety Officer
Historic Preservation Quality Control Manager
Natural Resources Quality Control Manager

The Government Review Board is chaired by the NTR, who has final approval authority. The UXO on-site NTR recommends approval/disapproval based on a UXO perspective. The Historic Preservation on-site NTR recommends approval/disapproval based on a historic preservation perspective. The KIRC-authorized representative recommends approval/disapproval based on a land use perspective.

The Review Board electronically reviews the findings and recommendations during three phases: 1) Assessment Review, 2) Anomaly Review, and 3) Disposition Review. Each Review Board member can recommend "Approval," "Conditional Approval," or "Disapproval" of a finding and/or recommendation in their respective area. If a conditional approval is given by any of the Review Board member(s), he/she shall submit amendments to the findings and recommendations, mitigation measures, and/or monitoring of activities on the Review Board Decision. Each Review Board member then transmits their action decision via an electronic, password protected signature field within the Electronic Grid Folder. The Government Chairperson then resolves any conflicts and issues a final decision. All Review Board Decisions shall occur within seven (7) calendar days after each submittal of findings and recommendations. The approved Review Board Decision will then be transmitted for implementation during clearance operations.

Figure 17: Data Management System



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2.4.3 KIGIS

The Kaho`olawe Island Geographic Information System (KIGIS) is a computer-based decision support system with relational databases, cost analysis, and support presentations. KIGIS will allow PUXB to have on-line access to current graphic displays of data for unexploded ordnance, maps, environmental data, and infrastructure data.

The primary objective of KIGIS is to provide an information system to manage site cleanup of UXO and residue from exploded and unexploded ordnance. Secondly, KIGIS provides a model application to enable adequate cost prediction, cost trade-off analysis, cost monitoring, and informed decision making.

PUXB will use KIGIS to manage and analyze all graphical and non-graphical data associated with this UXO Clearance Project. KIGIS contains maps and photographs of Kaho`olawe, a database for ordnance and historic property data, and a model to estimate the clearance costs. PUXB will also have the capability to enter, update, and maintain the data as cleanup progresses.

The information gathered during the 1995 UXO Model Clearance Project is archived in the KIGIS system.

2.5 Site UXO Risk Assessment

The source, nature, and extent of UXO contamination on Kaho`olawe Island is described in Section 2.2. When subjected to heat, shock, friction and/or inadvertent movement, UXO may produce catastrophic or severe effects to human health and the environment. Castastrophic and/or severe effects may result from blast, fragmentation, overpressure and/or fire. UXO are an imminent hazard and immediate cause of death or disablement to the general public if disturbed. UXO are frequently encountered as an intact fuzed unit. UXO are routinely discovered in a “dud fired” condition, with fuzing safeties removed. The physical appearance of UXO does not provide an indication of the safe condition of the item. The surface and subsurface hazard severity levels for the island are shown on Figure 14 and Figure 15, respectively, and referenced in Section 2.2.

DoD 6055.9-STD, Chapter 12, requires development of UXO remediation methodologies and use restrictions considering remediation planning, remediation process, site-specific remediation depth determination, and interim planning assessment depths.

Remediation planning determines the depth to which UXO remediation is necessary dependent on the projected end-use of the land and the extent of potential human exposure. This determination requires:

- Information concerning the remediation and notification that additional cleanup is necessary before further and/or different use permitted will be included in applicable land disposal documents.
- The intended end use may be defined in law or by the end user, which can be any combination of federal, state, local, and private entities (Kaho`olawe Use Plan, December, 1995). Chapter 12 further states “Land disposal documents must include notice that there would be increased risks to operations and public safety if violations of the end use were to occur.”
- The land’s projected end use must be changed in those cases where UXO detection systems are not sensitive enough or funds are not available to remove UXO to the planned remediation depth.

- Documents about the remediation depth to which UXO was removed and the process by which that depth was determined must be included in the land disposal documents.

The remediation process includes those several steps in removing UXO from each specific land area. This process is recommended to include:

- Determination of the boundaries of each parcel of land to be remediated
- Determination of known or suspected UXO by type
- Delineation of the locations of UXO and the remediation depth
- Removal and disposition of UXO
- Documentation of the process
- Continued surveillance

Preferably, remediation depth is determined using site-specific information including:

- Types of ordnance and soil characteristics
- Estimated depth to which each type of ordnance may penetrate
- Risk associated with the proposed end use assuming differing depths of remediation
- Actual UXO depth conditions encountered during the remediation

There will always be some level of risk remaining after completion of a remediation action. Therefore, the minimization of risk/hazards may require some form of institutional control, such as:

- Posting signs warning of the danger associated with the range
- Erecting fences or other measures to control access to risk areas
- Suspending incompatible land uses
- Implementing community education and awareness programs
- Requiring “dig permits”
- Conducting additional source removals or surface sweeps for UXO, as required
- Implementing deed restriction(s)
- Implementing a monitoring program

2.5.1 Kaho`olawe Specific Clearance Levels (Tier I and Tier II)

UXO clearance requirements and default clearance depths are keyed to land uses, and include selected priority areas of the island surface and subsurface, as noted in the Kaho`olawe Use Plan. UXO clearance may include clearance of limited beach, surf zone, and/or submerged water areas. Minimum clearance criteria and clearance depths (Table 15) were developed

considering proposed land uses established in the Kaho`olawe Use Plan and interim planning depths provided in DoD 6055.9-STD, Chapter 12, Paragraph C.4.e. Additional site-specific clearance requirements may be established based on the risk associated with the end use of the site assuming differing depths of remediation, in light of the ordnance types likely to be present.

Clearance activities will be closely coordinated among the various functional areas (UXO, historic preservation, environmental, natural resources, construction, etc.) as site conditions and the existence of historic properties, and environmental, and natural resource concerns may effect construction and UXO clearance operations and methodologies.

When encountered, UXO may be relocated for disposal if safe-to-move or destroyed in place if not safe-to-move. UXO destruction in place is a risk mitigation method performed to eliminate catastrophic or severe exposure. The main considerations for UXO destruction are the level and imminent nature of the hazards present. Two factors influence a decision to destroy UXO in place. The first is the sensitivity of the item to movement. The second is the level of acceptable exposure to personnel involved with the movement. The ultimate decision to move UXO for destruction rests solely upon the results of a detailed UXO safety review.

Table 15: UXO Clearance Tier Chart

MOU Term	Use Plan Term	Clearance Requirement	Allowed Use	Remarks (Limitations)
Tier I		Surface plus 0 ft. (No Subsurface)	Limited access with EOD/UXO escort, low intensity, no intrusive activities	Surface visual areas, broadcast surface seeding, low erosion potential
Grasslands/ Revegetation	Botanical/Wildlife Preserve	Surface plus 0 ft. (No Subsurface)	Limited access mound planting with EOD/UXO escort, low intensity, no intrusive activities	Broadcast surface seeding, mound planting
Historical, Cultural, or Archaeological Sites	Cultural/Historical Preserves	Surface plus 0 ft. (No Subsurface)	Limited access with EOD/UXO escort, restricted use, no intrusive activities	No soil disturbance
Tier II				
Trails	Trails	Surface plus 1 ft.	Public access, no intrusive activities	No soil disturbance, low erosion potential
		Surface plus 4 ft.	Public access, trail maintenance activities	High erosion potential
Roads	Roads (Built-up road)	Surface plus 4 ft.	Public access, vehicular traffic, road maintenance activities	
	Roads (Excavation required to build road)	Surface plus 4 ft. below planned excavation	Public access, vehicular traffic, road maintenance activities	
Human Habitation	Overnight Campsite, Educational & Cultural Centers, Work Camps	Surface plus 4 ft.	No intrusive activities deeper than 12 inches. (Camping, Surface Recreation)	No fire pits/imus

MOU Term	Use Plan Term	Clearance Requirement	Allowed Use	Remarks (Limitations)
		Surface plus 10 ft.	Intrusive activities to 6 ft. (Limited Subsurface Construction Activity)	Fire pits/imus permitted
		Surface plus 4 ft. below planned excavation	Intrusive activities to planned excavation depths	
Grasslands/ Revegetation		Surface plus 1 ft.	Surface raking less than 3 inches deep, surface rock gathering	No digging
	Revegetation/Soil Stabilization Area, Nurseries	Surface plus 4 ft.	Intrusive activities up to 12 inches, associated with revegetation & soil stabilization activities	
		Surface plus 4 ft. below planned excavation	Excavation to planned depth	
Reservoirs	Reservoirs	Surface plus 10 ft.	Excavation to 6 ft.	
		Surface plus 4 ft. below planned excavation	Excavation to planned depth	
Helipads	LZ	Surface plus 4 ft.	Temporary MOMAT pads	
		Surface plus 4 ft. below planned excavation	Permanent concrete pads	
Historical, Cultural, or Archaeological Sites		Surface plus 1 ft.	Public access, no intrusive activities, no escort required	No soil disturbance, low erosion potential
(No MOU term)	Buoy Moorings (Submerged Lands)	Underwater point clearance during construction	Point moorings	
(No MOU term)	Tidal Area, Coastal Area (Low water to High water mark)	Sand: Surface plus 4 ft. Rock: Surface plus 1 ft.	Surface gathering Surface gathering	Requires periodic maintenance/risk assessment

Section 3 UXO Clearance Process

The UXO clearance process outlined in this section complies with all regulatory requirements. The proposed approaches and methodologies emphasize implementation efficiency and cost-effectiveness without sacrificing safety, quality, or protection of the historic properties on Kaho`olawe Island. The proposed approaches and methodologies were selected after a careful review of all available sources of information (previous contract drawings, maps and specifications, and published plans and reports), many of which were provided by federal and state government agencies.

3.1 UXO Clearance Areas/Extent

3.1.1 Priority Areas and Levels of Clearance

Title X requires the "establishment of a two-tiered standard of restoration and ordnance clearance, removal, restoration and safety, taking into account the purpose for which any geographic area will be used and the nature and purpose of human access to such area, but assuring the protection of human health and the environment." The MOU developed two UXO clearance standards – Tier I and Tier II.

The Tier I standard was defined as clearance of all UXO from the surface of the island. The MOU states that the Cleanup Plan "shall provide for the removal or clearance of all unexploded ordnance from the surface of the island in accordance with Tier I standard."

The Tier II was identified in the MOU as the "cleanup or environmental restoration to a condition which allows the reasonably safe use of the site or area" for the purposes listed in the Kaho`olawe Use Plan. The Kaho`olawe Use Plan has been prepared to identify intended use and priority areas that are to be cleared to the Tier I and Tier II standards.

The Regulatory Framework states that the …

> "State is the primary stakeholder and land owner, responsible for the long term restoration and management of Kaho`olawe for appropriate cultural, historical, archaeological, and educational purposes. In addition, the state has a statutory, regulatory, and enforcement interest in the protection of public health and the environment.
>
> Therefore, the parties acknowledge that the State has a vested interest in the Cleanup of Kaho`olawe. As such, the Navy shall diligently consult with the KIRC in all aspects of planning and executing the Cleanup. Furthermore, the Navy shall endeavor to execute the Cleanup in a manner that is supportive of the State's long term interests and responsibilities." (Regulatory Framework)

Priority areas and levels of clearance will be established in accordance with the guidance found in Title X, MOU, and RFW, and will be designed to allow reasonably safe use for the listed purpose of each area, as identified in the Kaho`olawe Use Plan.

3.2 UXO Detection and Clearance Methods

Proposed UXO clearance approaches and methodologies must be compliant within the Regulatory Framework and incorporate the applicable requirements found in the references listed in Table 16.

Table 16: Applicable Requirements for UXO Clearance Approaches and Methodologies

Regulation	Key Element(s)	Cleanup Considerations/Effects
DoD Ammunition and Explosive Standards (DoD 6055.9-STD)	DDESB is the DoD agent responsible for regulating explosive safety	Provides guidelines for designing and implementing the UXO clearance process; stipulates clearance approval requirements
DoD Range Rule	Transferring Range	Stipulates guidance for the appropriate response actions for closed, transferred, or transferring ranges and the implementation of guidance
NAVSEA OP 5	Ammunition and Explosive Ashore Safety Regulations for Handling, Storing, Production, Renovation, and Shipping	Identifies characteristics and hazards of ammunition, explosives, and other hazardous materials Specifies standardized safety regulations for research, development, production, renovation, care, handling, storage, preparation for shipment, and disposal of these items
Kaho`olawe Use Plan (December, 1995)	Kaho`olawe Island Reserve land uses and priority areas	Identifies priority of clearance areas Identifies intended land use for specific areas of the island Identifies certain planned facilities and infrastructure improvements

3.2.1 UXO Detection and Clearance Technologies

The UXO clearance process requires selection of removal approaches and methodologies that will accomplish the end objective -- reasonably safe use of each identified area of the island for the planned land use specified in the Kaho`olawe Use Plan. Development of clearance strategies for each work area will include:

- Review of land use identified in the Kaho`olawe Use Plan (December, 1995), in coordination with the KIRC
- Definitization of clearance boundaries for each proposed land use, in coordination with the KIRC

- Determination of known or suspect UXO by type
- Correlation of UXO types and required removal depths
- Detection and location of UXO
- Removal and/or neutralization of UXO located
- Documentation of process
- Continued surveillance

The selected clearance strategy or strategies must provide operational personnel the capability to safely and precisely locate UXO, regardless of whether the UXO are lying on the surface, covered with heavy overgrowth, buried deeply in the soil, or located underwater and potentially buried in the sediments. Detection and location of UXO primarily depend on the ability to distinguish their physical characteristics from those of the surrounding environment. Factors that affect UXO detection include:

- munition size
- shape
- casing material
- fuzing
- depth and orientation
- soil composition and geology
- vegetation and terrain
- background interference from metal scrap

UXO Types and Depths -- The types of UXO commonly found on Kaho`olawe are described in Section 2.2.1 and listed in Table 12. The depths to which ordnance items may penetrate on Kaho`olawe were used in development of UXO detection requirements for Tier II clearance (see Section 3.2.5, Table 20).

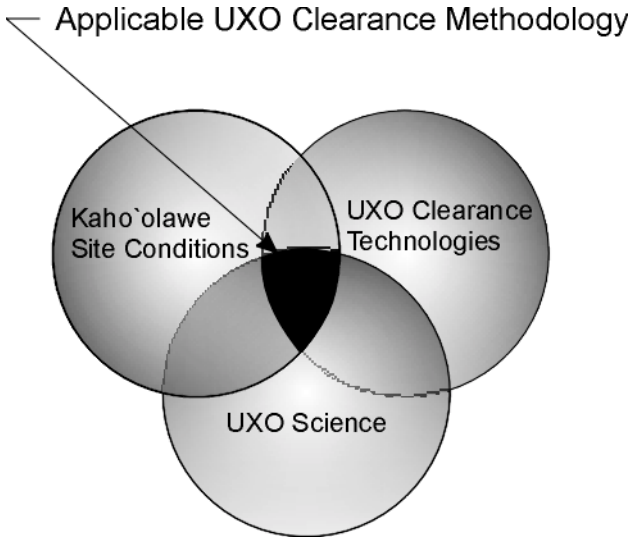
Soil Composition and Geology -- Kaho`olawe Island is a single volcanic dome composed of tholeiitic basalt base rock (containing up to 20% magnetite) covered by very diverse soil types with highly variable geophysical characteristics. Kaho`olawe's magnetite-rich soils and basalts severely limit the usefulness of all magnetometers. The quantity of magnetite in the basalt limits the functionality of conventional fluxgate and cesium vapor magnetometers, especially in hardpan areas. In addition, certain rocks were observed to produce a magnetic response that mimicked that of iron objects.

Vegetation and Terrain -- The existing topography of the island (Figure 1) ranges from steep slopes and deeply eroded gullies to the undulating hardpan with surface lava rock and rock outcrops. This results in an irregular surface which may produce a higher than normal number of geologic-related false anomalies (anomalies not related to UXO or UXO-related items). The density of vegetation on Kaho`olawe can be classified as: none, small clumps/groves, moderate, dense, and impassable. Vegetation types are described in Section 2.1.6.1.

Background Interference -- The magnetite-enriched basalt geology is the single greatest factor influencing the selection of effective subsurface geophysical detection instrumentation. Time Domain Electromagnetic (TDEM) metal detectors are less affected by magnetic background noise than magnetometers and can be used to detect ferrous and nonferrous UXO.

The combination of proven technology, an understanding of science of UXO detection and removal approaches and methodologies, and a review of the site-specific environment is required for selection of an applicable UXO clearance methodology, as illustrated in Figure 18.

Figure 18: Applicable UXO Clearance Methodology



3.2.2 Detection Systems

A single detection system that can accomplish UXO detection unambiguously within all the above variables is non-existent. The three major categories of technologies for the detection of UXO are magnetometry, infrared (IR), and ground penetrating radar (GPR). Magnetometers (fluxgate or cesium vapor) are the most commonly used form of detecting UXO on or below the surface and can be used for underwater use. Magnetometers can only detect UXO containing ferrous metal. Metal detectors can locate both ferrous and nonferrous metallic objects and can be adapted for use underwater; however, conventional metal detectors can only detect UXO located on or very near the surface. TDEM induction metal detectors have proven to be reliable in detecting ferrous and nonferrous UXO. Infrared has proven effective only in conducting gross assessments of areas containing UXO, but lacks the capability to provide point detection of UXO. GPR can collect rough images of buried metallic and nonmetallic UXO. GPR effectiveness is severely limited in certain soil conditions.

Technology performance results from advanced technology demonstrations (ATDs) have shown detection systems exhibiting UXO detection capabilities ranging from 0 to 85%. For example, if 100 UXO items are located within a work area scheduled for a Tier II removal action, a detection system with an 85% detection capability may detect 85 of the 100 UXO items. The results of the ATDs also show a marginal ability for the detection systems demonstrated to discriminate between UXO/UXO-related items and non-UXO related anomalies. This resulted in high false alarm rates translating into many empty holes and unnecessary excavations. A 70% false alarm rates results in the excavation of 100 holes to unearth 30 UXO/UXO-related items.

During the Model Project, performance results of three (3) detection system configurations showed that the ability to discriminate between UXO and/or UXO-related remnants and non-UXO related anomalies scored 25, 65, and 87%, respectively, with false alarm rates of 75, 35, and 13%, respectively.

3.2.2.1 Evaluation of Detection Systems

A series of corporate criteria were employed to evaluate various detection system options in relation to contract requirements, site-specific conditions, known ordnance types, and penetration depths, as follows:

Effectiveness –

- **Validation** – Detection system had to be proven through an accepted test/demonstration or previous DoD contract execution.
- **Achieve Removal Objectives** -- Provide a minimum probability of detection of 85% with a 90% confidence level.

Implementability –

- **Real-Time Functionality** – The detection system must be operable in real time where required for anomaly reacquisition and excavation confirmation.
- **Portability** – Field equipment had to be man-portable.

Reliability – Equipment requires high mean time between failures system history. Replacement detection equipment had to be readily available on short notice. Routine maintenance had to be on-island.

Costs – Minimize detection equipment and processing costs.

The evaluation of detection systems was divided into two segments conforming to Tier II clearance depth requirements. Table 17 shows the overall rating of each detection system considered for detection of UXO to depths up to 4 feet. Table 18 shows the overall rating of each detection system considered for detection of UXO at depths greater than 4 feet.

Table 17: UXO Detection Systems (< 4 Feet)

Sensor Technology	Representative Equipment	Overall Rating	Rationale for Rating
Time-Domain EM (TDEM) – Field Discrimination	Geonics EM61	Good	Meets detection requirements with low false positive rate
Time-Domain EM (TDEM) – Data Collection and Post Processing and Analysis	Geonics EM61	Fair	Expensive and time-consuming, no real-time detection
Hand-held TDEM	GTL TM-4 or Geonics prototype	Poor	Does not currently meet detection requirements
Induction Coils	White Spectrum, All-Metal, or Sand Monster	Fair	Depth of penetration limited to a few inches
Terrain Conductivity Meters	Geonics EM31	Poor	Response is highly dependent on instrument height and magnetic properties of soil and rock
Fluxgate Magnetometry	Schonstedt GA-52C or GA-72CD	Poor	Magnetic soil and rock obscures response from UXO
GPR	GSSI SIR-10	Poor	Low production rates, inconsistent detection ability
Infrared	FLIR Systems	Poor	Limited depth of penetration, UXO signature obscured by vegetation

Table 18: UXO Detection Systems (> 4 Feet)

Sensor Technology	Representative Equipment	Overall Rating	Rationale for Rating
Time-Domain EM (TDEM) – Field Discrimination	Geonics EM61	Good	Meets detection requirements with low false positive rate
Time-Domain EM (TDEM) – Data Collection and Post Processing and Analysis	Geonics EM61	Fair	Expensive and time-consuming, no real-time detection
Terrain Conductivity Meters	Geonics EM31	Poor	Poor resolution, adversely affected by terrain
Fluxgate Magnetometry	Foerester Mark 26	Poor	Prone to false positives due to magnetic soil and rock
Cesium-vapor Magnetometry	Geometrics G-858	Poor	Prone to positive alarms due to magnetic soil and rocks
GPR	GSSI SIR-10	Poor	Low production rates, inconsistent detection ability

The detection system comprised of a TDEM EM61 operated in the field discrimination mode achieved the highest overall rating (Good) in both categories of comparison. A summary of findings in relation to the established evaluation criteria follows:

Effectiveness –

- **Validation**-- The TDEM EM61 field discrimination detection system was proven during operational and quality management activities during the Model Project. Navy quality assurance sampling found no remaining UXO.
- **Achieve Removal Objectives** – During the last two years, the TDEM EM61 has been the detection instrument of choice utilized in achieving the highest detection capability at the Jefferson Proving Grounds (JPG) ATDs. Although various post processing and analysis systems have been utilized at JPG, the foundation detection data was acquired through deployment of the EM61 detection instrument. EM61 detection capability for JPG2 is graphically displayed in Figure 19 in terms of depth of detected UXO item versus UXO diameter. The lower detection limit (mass versus depth limits of detection capability) for the JPG ATD is shown, as well as the lower detection limit for Tier II clearance requirements listed in Table 19. The TDEM EM61 field discrimination detection system was successfully deployed during the Model Project and yielded a detection capability of 87% while maintaining a low false alarm rate of 13%.
- Figure 20 displays the lower detection limit of the EM61 detection instrument for operations on Kaho`olawe Island during the Model Project. This information is plotted in relation to the Tier II clearance requirements listed in Figure 20.

Figure 19: JPG Targets Detected

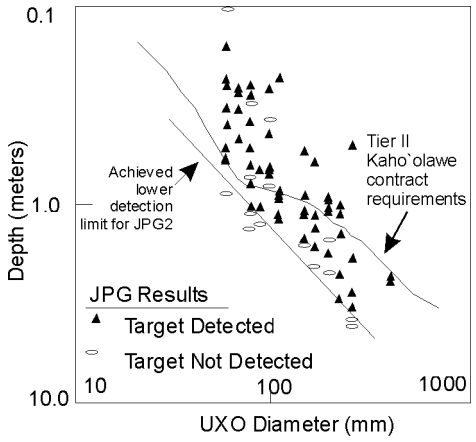
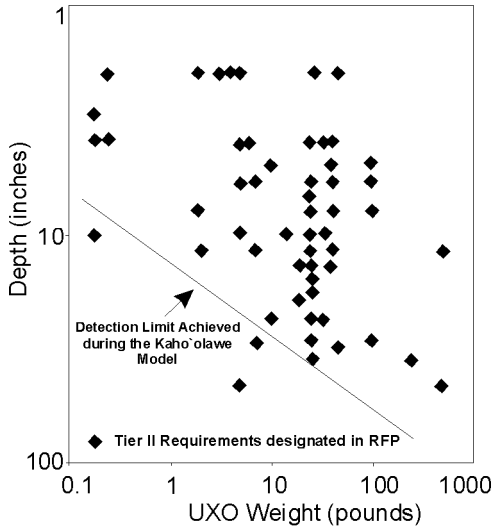


Figure 20: Model Project Targets Detected



Implementability –

- **Real Time Functionality** -- The TDEM EM61 field discrimination detection system provides a self sustaining total real time operation without the need for any post processing and analysis of data. Instrument operators can utilize audio response and/or visual displays to determine peaking detection responses associated with UXO and UXO-related items.

- **Portability** -- The TDEM EM61 field discrimination detection system may be used in three modes: wheel; skirt; and handheld. The wheel mode allows the operator to push or pull the one meter square sensing unit while carrying the battery and electronics in a backpack. A majority of the identified priority clearance areas may be covered in this manner. The skirt mode requires the operator to carry the one meter square sensing unit similar to a hula hoop. The operator or a team assistant must carry the battery and electronics in a

backpack. This mode of operation accommodates the rugged terrain and gulch areas of the island. The handheld version of the EM61 field discrimination detection system utilizes a 0.5 meter sensing unit which can be either carried like a conventional metal detector or adapted with training wheels to push along the ground surface. In either configuration, the operator must carry the battery and electronics in a backpack. The handheld detection system allows use of the detection system where wide area coverage is not required or feasible (i.e., point detection and anomaly verification during excavation, steep slopes, and narrow trails).

Reliability -- The scale and remoteness of this project demands reliable and easily maintainable UXO detection equipment and analysis technology. The Geonics EM61 is commercially-available direct from the manufacturer in Toronto, Canada and through U.S. mainland resellers. The EM61 is a simple and easily maintained piece of equipment with interchangeable components. In areas where data will be recorded and post-processed, PUXB will use nonproprietary, commercially-available software.

Costs -- The TDEM EM61 field discrimination detection system eliminates the labor, equipment, and time-delay costs associated with: data collection; processing and analysis; anomaly reacquisition; and unnecessary excavations resulting from higher false alarm rates associated with post processing. The field discrimination detection system provides an opportunity to more readily screen those anomalies associated with geologic and/or topographic conditions prior to excavation.

3.2.2.2 Limitations and Statistical Implications of UXO Subsurface Detection

During the Model Project, the EM61 achieved a weighted probability of detection of 94%, exceeding the current Clearance Contract minimum requirement of 85%. Thus, the selection of an appropriate detection system combined with properly trained personnel will greatly reduce the number of UXO not detected nor removed during UXO clearance operations.

To certify that the EM61 and its operators meet the required probability of detection criteria at the minimum confidence level, PUXB will develop QC grid(s) consistent with the geology and topography of each clearance area. These QC grid(s) will contain a statistically significant number of buried target items to provide calculation for a meaningful confidence interval for the detection capability and reliable statistical support for clearance certification.

3.2.3 Top-Down Clearance Approach

PUXB will use a top-down clearance approach during UXO clearance operations. This approach entails starting clearance operations at the top (or highest point) of a work area in order to counter the impacts that heavy rains may have in causing surface items to move into previously cleared areas.

In addition, a top-down clearance approach will permit PUXB to more-effectively address erosion-related issues, as there will be smaller amounts of water at higher elevations.

3.2.4 Tier I Surface Clearance

Minimum UXO Tier I Clearance Criteria is defined in Table 19. Minimum UXO detection requirements for Tier I clearance are an 85% probability of detection with a 90% confidence level. PUXB will provide statistical analyses of probabilities of detection to support clearance reliability levels and certification recommendations. Tier I clearance may include removal of surface debris. Specific clearance areas and requirements for Tier I clearance will be

delineated in individual Task Orders and may include only UXO or UXO remnants (e.g., those areas where the task may be specifically for reduction of UXO hazard severity level).

Table 19: Minimum Tier I Clearance Criteria

UXO	Minimum Size (English)	Minimum Size (Metric)
UXO*	All	All
UXO Remnants	1" x 2" or larger	2.54 cm x 5.08 cm or larger
Small Arms	0.22" Dia to 50 Cal	5.56 mm to 50 Cal
40mm Grenades	1.6" Dia	40 mm Dia
M26 Submunitions M38 Submunitions And Similar Items**	2.75" Dia 1.75" Dia	66 mm Dia 43 mm Dia

*UXO includes all items that contain explosives, such as: Fuzes, Bulk Explosives, Pyrotechnics, and Propellant
**Nonferrous Items

3.2.5 Tier II Subsurface Clearance

Tier II UXO clearance requirements are defined in Table 20. These requirements are based upon actual UXO penetration depths experienced on Kaho`olawe. Minimum UXO detection statistics required for Tier II clearance are an 85% probability of detection with a 90% confidence level. PUXB will certify the detection capabilities of all UXO detection equipment and provide statistical analyses of probabilities of detection to support clearance reliability levels and certification recommendations. Tier II clearance may include removal of metallic debris. Specific clearance areas and depth requirements will be specified in individual task orders.

Table 20: UXO Detection Requirements for Tier II Clearance

ITEM	DEPTH (English)	DEPTH (Metric)
20mm w/ Casing	6"	15.2 cm
60mm – 81mm Mortar	14"	35.6 cm
2.25 – 2.75" Rocket Warhead	30"	76.2 cm
3" Projectile	23"	58.4 cm
5" Projectile	36"	91.4 cm
100 lb A/N Bomb	48"	1.2 m
250 lb A/N Bomb	48"	1.2 m
250 lb MK Bomb	72"	1.8 m
500 lb A/N Bomb	48"	1.2 m
500 lb MK Bomb	96"	2.4 m
1000 lb A/N Bomb	96"	2.4 m
1000 lb MK Bomb	96"	2.4 m
2000 lb MK Bomb	120"	3.0 m

3.2.6 Beach, Surf Zone, and Submerged Water Areas

UXO clearance activities may include possible clearance of limited beach, surf zone, and/or submerged water areas. If and when PUXB is tasked to conduct such activities, the activities will be conducted in accordance with PUXB's approved Safe Practices Manual for Commercial Diving Operations. PUXB will submit a Work Plan Addendum (describing such activities) for Navy approval, and activity-specific Standard Operating Procedures for Navy concurrence.

3.2.7 Historic Properties, Environmental, and Natural Resources Protection

3.2.7.1 Historic Properties Protection

PUXB will provide historic property protection during all on-island activities. Historic property protection will be in accordance with the Regulatory Framework, the substantive requirements of the National Historic Preservation Act of 1966 (as amended), and professional archaeological standards and practices. PUXB will identify, document, evaluate, and protect all historic properties which will be potentially affected by project activities.

Historic Preservation personnel will be continually involved as an integral part of the UXO clearance process, performing historic property protection through recording, monitoring, and mitigation. Decisions concerning historic property protection will be made by the Review Board after determination of effect by applying the criteria of effect (36 CFR 800.9) to the affected historic properties. A Research Design and a Historic Preservation Implementation Plan are required under the Regulatory Framework. The Historic Preservation Implementation Plan will integrate the research design and procedures to accomplish historic preservation protection to historic properties and traditional cultural places.

3.2.7.2 Environmental and Natural Resources Protection

More than 80% of the island is characterized as hardpan, barren soil, and/or alien vegetation, and parts of the island and its surrounding waters are habitat to endangered marine life and land plants. PUXB will protect the environment and natural resources of Kaho`olawe Island during all operations. Endangered plants will be located and clearly marked to prohibit human induced harassment and damage. Interactions potentially resulting in the disturbance of monk seals and turtle nesting areas will be avoided.

We will implement environmental and natural resources protective measures in accordance with the Regulatory Framework. These protective measures will include protecting, monitoring, and documenting environmental and natural resources; preventing increased erosion; controlling storm water/sediment runoff; managing solid waste; controlling, managing, and disposing of hazardous materials; collecting, treating, and disposing of waste water; minimizing ocean discharges and air pollution; implementing pollution prevention initiatives; protecting endangered species and their habitats; and preventing the spread and introduction of alien species.

3.2.7.3 Protective Works

Protection procedures for in-situ destruction of UXO will be recommended in the context of information obtained during protective works experiments conducted during the Model Project. In these experiments, it was determined that banded rubber tires or other types of barriers around the UXO comprised effective protection of surrounding areas from damage caused by blast and fragmentation effects. These protective works are expected to be standard for protection of historic properties during future clearance operations. Decisions concerning site protection will be made by the Review Board after determination of potential adverse effects.

3.2.8 Quality Assurance/Quality Control Programs

PUXB is responsible for the quality management of all UXO clearance and environmental restoration activities for ensuring that only those products/services conforming to contractual requirements are implemented and offered to the Navy for acceptance. Therefore, PUXB has developed a Quality Assurance Project Plan that will serve as the basis for continually assessing the implementation, effectiveness, compliance, and adequacy of operations.

3.2.8.1 PUXB QA/QC Program

3.2.8.1.1 UXO

A dedicated UXO Quality Control Manager will:

- Require that Tier I clearance operations provide for an 85% probability of detection with a 90% confidence level of UXO detection and removal.
- Require that Tier II clearance activities provide for an 85% probability of detection and a 90% confidence level of UXO detection and removal to contract required depths.
- Ensure that the following activities are conducted in accordance with the applicable Standard Operating Procedures: land survey and mapping, area preparation, UXO surface clearance, geophysical detection, UXO subsurface clearance, UXO disposition, explosives management, and UXO-related remnant and target material processing.
- Ensure that a daily Search Effectiveness Probability test is conducted during UXO surface clearance. Quality Control personnel will inconspicuously place a mix of five inert UXO items and/or UXO remnants on the surface of a grid to determine the effectiveness of the surface sweep team. If the effectiveness of the sweep is less than 90%, a “stop work” will be initiated and corrective action initiated.
- Verify that Tier I and Tier II clearance statistical analyses of probabilities of detection are consistent with clearance reliability levels and certification requirements.

3.2.8.1.2 Historic Properties Quality Control Management

A dedicated Historic Preservation Quality Control Manager will monitor compliance with the Quality Assurance Project Plan, Historic Preservation Research Design, and Implementation Plan using the three phases of quality control -- preparatory, initial, and follow-up. The Historic Preservation Quality Control Manager will:

- Observe historic preservation personnel in various field conditions and document responses to queries regarding procedures
- Review historic preservation planning and decision making, and verifying consistency in practices and compliance
- Review laboratory procedures to verify consistency with approved requirements

- Monitor field mitigation actions to ensure that adverse effects are recognized by the historic preservation personnel and that appropriate actions are taken
- Monitor and assess the consultation process, planning, and implementation of protection measures
- Monitor communication lines for consistency with approved protocol
- Monitor scheduling of historic preservation activities and verify full integration of effect determination and historic preservation decision making with UXO field operations prior to initiation of task order work
- Track documentation, consultation, and preservation of effect

3.2.8.1.3 Natural Resources Quality Control Management

The Natural Resources Quality Control Manager is responsible for developing and implementing the sections of the Quality Assurance Project Plan and Standard Operating Procedures that address the natural resource aspects of the program to ensure compliance with regulatory, DoD, and Navy requirements. The Natural Resources Quality Control Manager is responsible for directing and approving correction of any surveillance findings or non-conformances that impact project natural resource operations, preparing all natural resources implementing procedures, and monitoring and approving all natural resources reports. The Natural Resources Quality Control Manager has the authority to suspend certain natural resource-related work activities after notifying the Program Manager and/or the Range Control Officer when a condition adverse to the health, safety, or the environment is identified.

3.2.8.2 Navy Quality Assurance

The Navy will provide Quality Assurance oversight to assess the quality of the work performed by PUXB on Kaho`olawe Island under their Clearance Contract. The Navy will verify that all UXO clearance and environmental restoration activities are executed in accordance with the requirements of the contract, and to ensure that the Contractor's stated results exhibit a high degree of confidence.

3.2.8.2.1 UXO Quality Assurance

The objectives of the Navy UXO Quality Assurance program are:

- Document and verify the quality of the Contractor's UXO clearance
- Examine and concur with Contractor's written UXO related work plans, Standard Operating Procedures, quality program plans, and other documents, as required in the Removal Action Scope
- Provide comments and recommendations on proposed UXO clearance methodologies
- Conduct in-process QA assessment of all PUXB's activities that could affect the quality of the UXO clearance results, and based on the information obtained as a result of these assessments, determine the confidence in the results

- Verify Contractor UXO clearance performance in relation to Tier I and Tier II clearance criteria
- Support final Navy certification of the cleared areas of Kaho`olawe as reasonably safe for the specified uses of each area

3.2.8.3 State of Hawaii Quality Assurance

The State of Hawaii is the primary stakeholder and land owner, and thus has a statutory, regulatory, and enforcement interest in the protection of public health and the environment. The KIRC, as the Navy's single point of contact with the State of Hawaii, will provide review and input into all aspects of planning and executing the cleanup of Kaho`olawe Island.

The KIRC's Quality Assurance program will provide oversight of:

- Compliance with the Regulatory Framework
- Scheduling of clearance activities by previously established priority designation
- Protection of historical, cultural, and religious sites and artifacts
- Implementation of erosion and runoff control measures in accordance with adopted standards
- Consistency and coordination of cleanup operations with restoration activities, to the maximum extent practical
- Planning and design of infrastructure improvements

3.3 UXO Clearance and Disposal Operations

3.3.1 Introduction

PUXB's management approach incorporates a teaming strategy that yields a seamless organization with fully-integrated team members. This eliminates redundant management layers and precludes the interface problems often encountered with prime-subcontract arrangements. The extent of participation by each team member will be delineated on a task-by-task basis, and the work assigned to each team member will remain with that firm for the duration of the contract.

UXO clearance on Kaho`olawe Island presents several technical challenges. Kaho`olawe's geology, soil types, topography, and environmental and historical properties are critical elements impacting the process. To ensure the protection of Kaho`olawe's historic properties, environmental and natural resources, and religious sites, all steps will be closely coordinated with professionally-recognized historic property, environmental, and natural resource experts. The seamless integration of these functional groups is a foundation of PUXB's UXO Clearance Process; and the success of each functional area is dependent upon close coordination between all functional areas.

UXO –The UXO functional area is responsible for completing UXO clearance activities identified through task orders in the priority areas outlined in the Kaho`olawe Use Plan while protecting the island's historic properties, environmental, and natural resources from the impacts of operations.

Historic Preservation – The goal of the historic preservation functional area is to protect the historic properties by avoiding or mitigating potential adverse effects from UXO operations. This will be accomplished through: pre-investigative research; consultation with the KIRC; historic property identification, location, mapping and recording; historic property significance evaluation; determination of effect on historic properties; development of recommendations; review and approval protocols; monitoring; and other mitigative measures, as presented in the Review Board Decision.

Environmental – The environmental functional area is responsible for protecting Kaho`olawe Island's land, ocean, and water resources. This will be accomplished by preventing increased erosion caused by cleanup activities; controlling storm water/sediment runoff; managing solid waste; controlling, managing, and disposing of hazardous materials; collecting, treating, and disposing of waste water; avoiding ocean discharge; controlling air pollution; managing ozone depleting substances; and implementing pollution prevention initiatives.

Natural Resources – The natural resources functional area is tasked with the protection of Kaho`olawe Island's natural resources and implementation of restoration activities required as a result of UXO cleanup and disposal operations. These resources include the island's native plant communities, marine and terrestrial wildlife, and endangered species. This functional area will also ensure appropriate procedures are implemented to prohibit alien plant species from entering the island.

Survey – The survey functional area is responsible for physically identifying and marking the boundaries of Grid Map Units, individual historic properties, and endangered natural resources.

3.3.2 Range Control and Security

The Range Control/Operations Center (RC/OC) will coordinate, monitor, and control all on-island operations. The goal of the RC/OC is that all operations will be conducted in a manner that complies with applicable regulations, promotes the safety of all on-island personnel, and protects Kaho`olawe Island Reserve's historic properties, environment, and natural resources.

The RC/OC will coordinate, monitor, and control: inter- and intra-island transportation of personnel, equipment, and materials; on-island personnel and visitor access control; UXO clearance activities; explosive operations; construction activities; protection of historic properties, and environmental and natural resources; communications; secure and safeguard property, facilities, equipment, and materials; and regulatory compliance.

The RC/OC will enforce on-island security procedures regarding:

- **Access Regulations** – Only Government-authorized personnel and visitors are permitted to access the island, and then only for approved operations. On a daily basis and prior to authorizing access to the island, the RC/OC will confirm personnel requesting access to the island are authorized by the Navy and possess current certification.

- **Restricted Areas** -- The RC/OC will also ensure on-island personnel remain within the limits of the operations, including avenues of entry and exit. Personnel will not enter restricted areas unless required to do so and authorized for such entry by the RC/OC.

- **Removal from the Island** – The RC/OC has the authority to remove any PUXB personnel or service provider from the island for criminal, safety, or policy violations.

- **Violation Notifications** – The RC/OC will provide timely reporting to the Navy of all unlawful activities, access violations, criminal violations, personnel injuries, and property loss and damage.

3.3.3 Technical Requirements

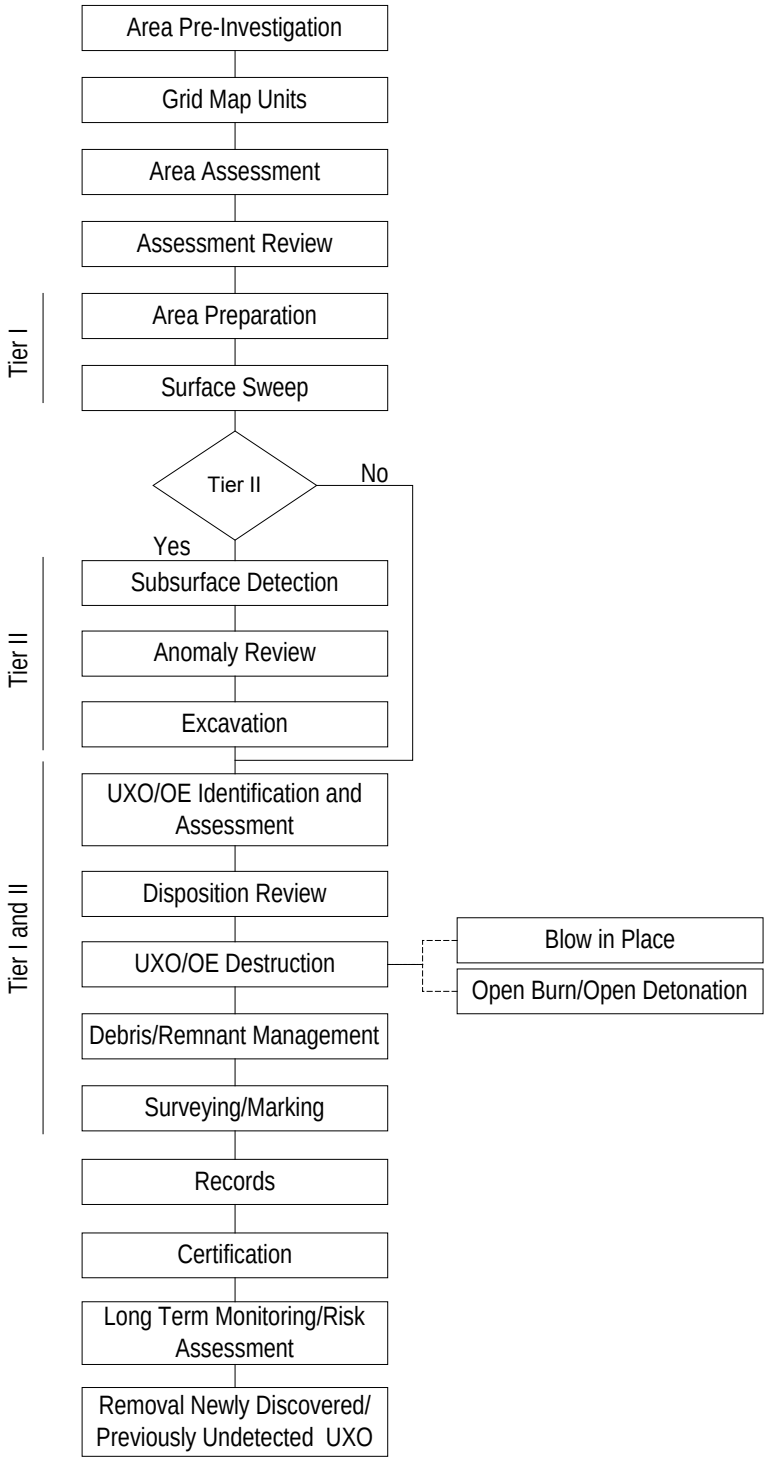
The UXO clearance process on Kaho`olawe Island requires close coordination of personnel from various professional disciplines, including UXO detection, removal, and disposition; historic preservation; natural resource protection; engineering; and land surveying.

Tier I technical requirements include pre-investigation archival searches; establishment of work area boundaries and sub-areas (Grid Map Units); completion of a UXO/OE concentration assessment; historic property survey and environmental conditions report; historic preservation, environmental, and natural resources monitoring (as required); sweep area preparation; clearance of all UXO, UXO-related remnants, target materials, and other non-UXO related materials from the surface of the designated work areas; debris/remnant management; UXO disposition; quality control; and data management.

Tier II technical requirements include subsurface detection, excavations, debris/remnant management, UXO destruction, quality control, data management, and documentation (of the detection process, remediation depth to which UXO are removed, and exceptions).

The technical steps of the UXO clearance process are identified in Figure 21. This process incorporates compliance methodologies to achieve technical, contractual, and regulatory requirements. Each step will be accomplished in strict accordance with the approved Work Plan and Standard Operating Procedures. All personnel are required to implement the Standard Operating Procedures as assigned; deviations are not permitted.

Figure 21: UXO Clearance Process



3.3.3.1 Area Pre-Investigation

The Area Pre-Investigation is a review of all existing data relating to a specific work area. UXO, historic preservation, environmental, natural resources, and survey personnel will review existing documentation as it relates to their functional areas of expertise. The Area Pre-Investigation team will review existing maps, reports, and data from previous studies in order to formulate predictions of on-site conditions. The information will be analyzed and the team will summarize its findings and ultimately develop an Area Pre-Investigation map of each work area. The map will note anticipated work area conditions (including UXO, historic properties, environmental, and natural resources), demarcate the work area boundaries and entry/exit routes, and identify the mode of transportation required to enter/exit the work area.

UXO – UXO personnel will research and analyze existing UXO-related data, including the Kaho`olawe Island Site Characterization Report, PUXB Data Management System, UXO/OE Risk Assessment Maps, Ordnance Identification Guide, previous assessments, open source UXO technical publications, and geographic-related media.

The gathered information will enable UXO personnel to identify former target locations and determine the types and concentrations of ordnance that are prevalent in a given work area, thereby documenting the nomenclature, fuze, paintings/markings, hazards, and arming/functionings that are common to those items. Concentrations of UXO in an area will be predicted as occasional, moderate, or dense.

The results of the UXO Area Pre-Investigation will be summarized and entered into PUXB's Data Management System. The information will then be superimposed onto an Area Pre-Investigation map, noting the anticipated density of UXO within a work area, and entry/exit routes to the work area.

Historic Preservation – Historic preservation personnel will review, analyze, and summarize the National Register of Historic Places forms and accompanying maps, UXO Model Clearance Project Final Report, Archaeological Report on Monitoring During the Kaho`olawe UXO Model Clearance Project, Ogden Environmental Historic Properties Location Map, aerial photographs, and additional site-specific studies. They will also consult with the KIRC regarding traditional cultural properties that are not part of the existing National Register of Historic Places records.

The accumulated information will be synthesized into a list of known historic properties within the work area. This information will also enable the historic preservation personnel to predict the types and locations of subsurface historic properties in a work area. When analyzing the clearance requirements in light of the actual and predicted historic properties and traditional cultural properties, historic preservation personnel will be able to make preliminary estimates of the potential impacts to these historic properties during UXO clearance operations.

When entered into PUXB's Data Management System, this information will be superimposed onto the Area Pre-Investigation map, illustrating the locations of known and anticipated historic properties and traditional cultural properties in the work area.

Environmental – Environmental personnel will analyze soil survey maps, site characterization maps, aerial photographs, KIGIS information, and topographic maps. They will also review environmental concerns associated with former use areas from previous reports and previously identified areas (e.g., burn pits at the nursery, and LZ1). This information will be used to create a list of environmental concerns associated with the work area; the information will ultimately be entered into PUXB's Data Management System for incorporation into a consolidated Area Pre-Investigation map.

Natural Resources -- Natural resources personnel will review, analyze, and summarize previous botanical and faunal surveys, endangered species locations, site characterization maps, KIGIS, aerial photographs, potential erosion hazards, and areas of potential wetlands.

A listing of endangered species will be compiled, including photographs of each species. When entered into the Data Management System, this information will be incorporated into the Area Pre-Investigation map and graphically note the reported locations of flora and fauna (endangered species), potential wetlands, and monk seal and turtle sightings.

Survey -- The surveyor will review previously documented survey activities, clearance boundary data, and control monument positions provided by the Navy. The surveyor will then identify the existing National Geodetic Survey control monuments to be used for the work areas and identify the locations of secondary control monuments to be established for work areas or clearance boundaries. After reviewing the work area boundaries and their relationship to the Grid Map Unit, the surveyor may suggest realignment of the work area boundaries to coincide with the Grid Map Unit (where feasible).

An ASCII file will be created to list the "x" and "y" coordinates of the clearance boundary corners, clearance boundary intersect with the Grid Map Unit, and Grid Map Unit corners. The surveyor will then utilize this file to establish and mark the respective points with iron pipes/pins at clearance boundary corners and wooden stakes at Grid Map Unit corners. A map will then be prepared (using KIGIS as a base) and include the work area, Grid Map Unit, and clearance boundaries (based on the Kaho`olawe Use Plan).

3.3.3.1.1 Cultural Considerations

In areas where traditional cultural properties are known or anticipated, UXO, historic preservation, and survey personnel will accompany a KIRC representative to locate and mark the boundaries of areas identified as traditional cultural properties.

Once a traditional cultural property is identified in a work area, the KIRC representative may conduct an appropriate cultural protocol. The KIRC will be consulted to determine appropriate treatment during clearance activities. The data gathered during these activities will be entered into PUXB's Data Management System and used for determining the scope of future operations in the work area. Subsequent clearance activities, including excavations and/or detonations, may require additional ceremonies, as determined by the KIRC.

If there are no potential traditional cultural properties in a work area, PUXB will bypass this activity and move directly into Grid Map Unit operations.

UXO – UXO personnel will escort this team, assist in avoiding UXO hazards that may be encountered, and maintain communications with Range Control.

Historic Preservation – Historic preservation personnel will record descriptions of traditional cultural properties and assist in marking and location their position.

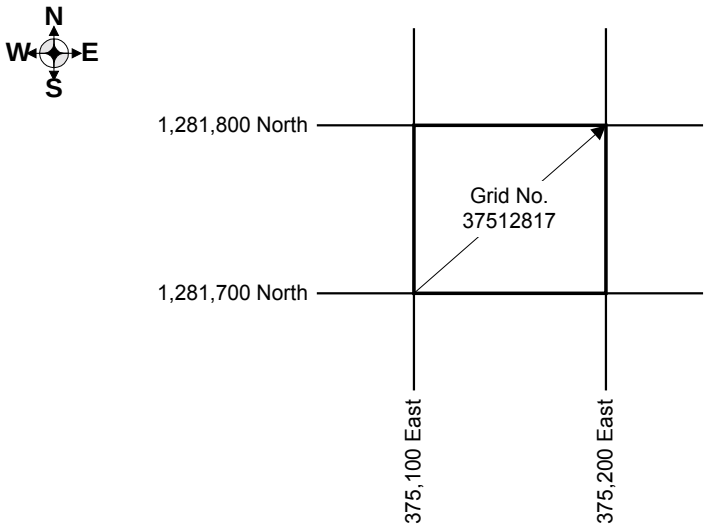
Survey -- Survey personnel will visibly mark and record the boundaries of traditional cultural properties.

3.3.3.2 Grid Map Units

Work areas will be subdivided into Grid Map Units that measure one hectare (100 meters x 100 meters). The Grid Map Units will enhance command and control of the work area and enable Range Control to more closely monitor the location of personnel and types of operations within a given work area. Clearance boundaries and boundaries between various levels of UXO clearance levels will also be monumented.

The Grid Map Unit is identified by an eight-digit number, based on the east/west and north/south coordinate values of the southwest corner of the Grid Map Unit. The first four digits represent the east/west coordinate and the next four digits represent the north/south coordinate. As illustrated in Figure 22, coordinates of the southwest corner of the example grid are 375,100 East and 1,281,700 North; therefore, the grid is identified as Grid Map Unit 37512817 -- the first four digits of the east coordinate 375,100 and the first four digits of the north coordinates, (disregarding the digit representing the millions) 1,281,700.

Figure 22: Grid Map Unit



Once located with a real-time Global Positioning System or total station, work area and clearance boundary intersects will be established and marked with permanent iron pipes/pins. The corners of the Grid Map Unit will be surveyed and marked with wooden stakes.

UXO – A UXO Specialist will guide the Grid Map Unit team, identifying, marking, and avoiding encountered UXO. The UXO Specialist will maintain consistent communications with Range Control.

The UXO Specialist will also confirm that the desired location for setting the survey marker is free of any surface and subsurface anomalies by checking the area with a point detection instrument. If the location is not clear, the UXO Specialist will check an alternate offset point, as directed by the surveyor.

Historic Preservation –Historic Preservation personnel will accompany the Grid Map Unit team to ensure that placement of survey markers do not adversely impact historic properties. If necessary, the Historic Preservation personnel will instruct the Surveyor to select an alternative offset point that will not adversely impact the historic property.

Survey - A Hawaii Registered Professional Land Surveyor will coordinate and be responsible for the technical competency of all land survey and mapping activities, including establishment of the Grid Map Units and clearance boundary delineations. The position of existing clearance boundary markers will be verified prior to establishment of additional boundaries and Grid Map Units within a work area.

3.3.3.3 Area Assessment

The Area Assessment is a multi-disciplinary approach to assess actual field conditions in relation to UXO, historic properties, environment, and natural resources. This team will verify and refine the Area Pre-Investigation data, map the existing conditions in the Grid Map Unit, and document their findings.

The Area Assessment team will make recommendations to the Review Board for proceeding with UXO clearance activities. When formulating their recommendation, the team will recommend land clearing strategies (i.e., manual vegetation removal, burnoff, and defoliation) that enhance UXO clearance operations while minimizing erosion and negative impacts to native plant communities and historic properties.

The acquired data will be electronically maintained in PUXB's Data Management System and uploaded to Electronic Grid Folders and KIGIS for future review and reporting purposes.

UXO – UXO personnel will guide the Area Assessment team through the Grid Map Unit. From a UXO perspective, they will:

- Visually scan the terrain to identify surface UXO/OE, craters, comouflets (mounds of soil that may contain subsurface gases), and other potential explosive hazards
- Verify and record the types and density of UXO, UXO-related remnants, target materials, and non-UXO related materials in the Grid Map Unit
- Identify and mark UXO to avoid UXO hazards
- Identify anomaly-free areas for the placement of markers

The findings will be documented on a UXO Area Assessment form and incorporated into PUXB's Data Management System. This information will be used to schedule and sequence future UXO clearance operations.

Historic Preservation – Historic preservation personnel will provide all of the necessary documentation for historic property physical evaluations, significance assessments, determination of effects, and choice of mitigation through Tier I clearance activities. Therefore, they will recover previously-recorded historic properties, compare the existing records to the current field conditions, and record supplemental data (such as newly discovered sites). This information will serve as the basis for significance assessments for historic properties and be used to determine impacts and mitigation actions.

Area Assessment of historic properties will be accomplished in two phases.

Phase I involves historic property discovery. Historic preservation personnel will traverse the Grid Map Unit, locate historic properties, assign field numbers, and establish two reference points for each site/feature discovered.

If it is verified that there are no historic properties in a Grid Map Unit, this information will be recorded on an Historic Properties Area Assessment form.

Phase II involves the recording of historic properties discovered within each Grid Map Unit. The Historic Preservation personnel will assign permanent site numbers, supplement existing site descriptions and maps (if applicable), document all newly-located historic properties, and prepare records for each historic property. Findings and recommendations will be composed for each historic property and for the entire Grid Map Unit.

Environmental and Natural Resources – The environmental and natural resources Area Assessment includes the visual assessment and documentation of the existing vegetation (community type, density, and dominant species); the discovery (if any) of endangered species; slope, terrain, and soil conditions; and drainage patterns for each Grid Map Unit.

Environmental and natural resources personnel will submit these findings, along with the appropriate pre- and post-clearance digital photo documentation, as part of an Environmental Conditions Report. The Environmental Conditions Report documents each Grid Map Unit before and after UXO clearance activities.

As required, environmental personnel will participate on the Area Assessment team to document specific environmental conditions (such as petroleum, oils, and lubricants; hazardous materials; waste management; air quality; and water quality). Environmental personnel will recommend whether or not to proceed with further investigation of suspected environmental contaminants. Further investigation may require the development of a Grid Map Unit site-specific sampling and analysis plan.

The environmental and natural resource findings will be entered into the Data Management System and KIGIS, as well as used in preparing electronic grid folders. Findings will be summarized and make recommendations for land clearing and erosion control strategies prepared and submitted to the Review Board.

Survey -- The surveyor will utilize Global Positioning System instrumentation to verify the position of Grid Map Unit corners, historic properties and environmental natural resource significant areas; and topography and planimetric features. A Total Station survey instrument will be used when the vegetation cover prevents the use of the Global Positioning System. The surveyor will:

- Record the position of all grid corners, compare the field positions to the proposed, and report any differences noted
- Record the position of all clearance boundary points
- Record the position of marked surface UXO
- Record the topography and planimetric features of the grid
- Record the reference points for historic properties and map the perimeter of historic properties sites and features (as identified by historic preservation personnel)
- Record the locations and limits of flora and fauna (as identified by natural resource personnel)
- Record the outlines of eroded areas (as identified by natural resource personnel)
- Record the outline of potentially contaminated areas (as identified by environmental personnel)
- Record the outline of potential wetlands (as identified by natural resources personnel)

The recorded field data will be reduced and downloaded into the KIGIS, which will produce a plot on the Grid Map Unit. A Grid Map Unit map, with one-meter contours, will be produced and utilized to implement all future clearance activities.

3.3.3.4 Assessment Review

The findings and recommendations of the Area Assessment functional areas (UXO, historic preservation, natural resource, environmental, and survey) will be evaluated and compared to predicted (or available) information bases. After this information is reviewed by PUXB's members of the Review Board (UXO Quality Control Manager, Historic Preservation Quality Control Manager, Natural Resources Quality Control Manager, UXO Safety Officer, and Range Control Officer), the findings and recommendations will be forwarded to the Government members of the Review Board via the Data Management System's electronic grid folder database. If the assessment data is quite different from the expected, a new risk assessment vs. Kaho`olawe Use Plan for that area may be generated, considering the type(s) of ordnance found, extent of human exposure, and the cost vs. benefit evaluation for minor adjustments to the Kaho`olawe Use Plan. Any possible change to the Kaho`olawe Use Plan or clearance criteria must be resolved and agreed upon between the Navy and the KIRC before any further UXO clearance activities within the Grid Map Unit. Each Government Review Board member then recommends "Approval," "Conditional Approval," or "Disapproval" of the finding and/or recommendations in their respective area. If a conditional approval is given by any of the Review Board member(s), he/she shall submit amendments to the findings and recommendations, mitigation measures, and/or monitoring of activities on the Review Board Decision. The Government Chairperson then resolves any conflicts and issues a final decision. The approved Review Board Decision will then be transmitted for implementation during clearance operations.

3.3.3.5 UXO Clearance Operations (Tier I)

3.3.3.5.1 Area Preparation

Area Preparation activities include reduction of vegetation that limits the effectiveness of surface and subsurface clearance personnel and/or equipment and allows for safer, more effective UXO clearance operations. These activities (manual removal, controlled burn, or defoliation) are dictated by a Grid Map Unit's terrain and concentration of vegetation, historic properties, and environmental and natural resources. Area preparation activities will follow UXO avoidance procedures.

UXO – Land clearing strategies include:

Manual Removal -- Surface vegetation that is below the height of tree limbs will be removed by initially cutting grass, followed by pruning of tree limbs, and subsequently cutting of trees (if warranted). Tree canopies will be elevated through selective pruning to enable instrument detection near tree trunks. When required, tree trunks will be cut at above-grade levels to maintain the tree root systems and maintain the soil profiles.

Controlled Burning – Reduction of ground cover and low rising tree canopy within a grouping of Grid Map Units. Portable burners will only be used to ignite the controlled burn, and not to subsequently monitor a burn. Grass and near ground covers are burned away from the surface without producing adverse effects to subsurface root networks. Follow-on manual removal of remaining vegetation may be required.

Controlled Burning may also reduce the explosive hazard of certain surface UXO/OE present in the area.

Major considerations associated with the selection of this option include the presence of natural firebreaks, potential for development of manmade firebreaks, and existence of favorable weather conditions.

Defoliation – A land clearing methodology that may be utilized which involves the application of approved herbicides to defoliate grasses, shrubs, and the leaves of trees. The herbicides interrupt the transfer of nutrients to plant life, accelerating biodegradation. Only chemical approved by the United States government for agriculture purposes will be permitted for use on Kaho`olawe. Manual removal of remaining vegetation may also be required.

Historic Preservation –- Historic preservation personnel will monitor Area Preparation activities in certain Grid Map Units to ensure protective measures are implemented for those historic properties that could potentially be impacted. While in the field, historic preservation personnel will brief the entire team on the location, boundaries, and significance of known historic properties in the Grid Map Unit, their condition and sensitivities, and the identification of artifacts and other archaeological materials. Historic properties uncovered during Area Preparation will be recorded as part of the Historic Property Survey, findings and recommendations for the Grid Map Unit revised as necessary, and a re-submittal to the Review Board initiated.

Environmental – Environmental personnel will provide guidance on compliance with regulatory framework, as applicable to the Area Preparation process that is being implemented. As necessary and based on existing information, environmental personnel will initiate the development of a site-specific sampling and analysis program for the subject Grid Map Unit.

Natural Resources – Based on specific Grid Map Unit conditions, natural resources personnel may monitor Area Preparation operations to ensure mitigation recommendations of the Review Board are implemented.

3.3.3.5.2 Surface Sweep (Tier I)

Surface Sweep (Tier I) clearance requirements are defined as “removal or clearance of all unexploded ordnance from the surface of the island.”

UXO – Surface Sweeps are conducted by visual and/or detector-aided operations, with zero (0) foot subsurface investigation. Detector-aided operations will be used when visibility is restricted. The UXO team members will:

- Inspect surface materials and segregate them as UXO-related remnants, target materials, or non-UXO related materials.
- Flag, make a preliminary identification, and record previously unidentified UXO by Grid Map Unit. Each item will be given a unique identifier number for monitoring purposes, and chain-of-custody for each item will commence at this time.

Historic Preservation – Historic Preservation personnel will ensure that historic properties are protected during Tier I clearance activities by monitoring the Surface Sweep activities when needed, as determined during Area Assessment and Assessment Review. Prior to operations, historic preservation personnel will brief the team, addressing the location and boundaries of known historic properties, significance and sensitivities of the historic properties, and identification and characteristics of artifacts and other archaeological materials.

Environmental – Environmental personnel will implement the sampling and analysis plan for surface soils and other non-UXO related potentially contaminated areas.

Natural Resources – The natural resources personnel will monitor Surface Sweep operations in areas of endangered species. Monitoring can include a pre-operational briefing to all on-site personal regarding the recognition and avoidance of endangered species.

3.3.3.6 UXO Clearance Operations (Tier II)

3.3.3.6.1 Subsurface Detection

Subsurface detection to Tier II detection requirements is a non-intrusive operation. During these operations, subsurface anomalies that resemble UXO/OE will be identified, and the location of the subsurface anomalies will be marked with a flag. These operations include the identification of areas that may contain subsurface historic properties that could be impacted by subsurface clearance activities; in these cases, PUXB will develop a plan for minimizing those impacts.

The findings and recommendations of the UXO, historic preservation, environmental, and natural resource functional areas will be consolidated, entered into PUXB's Data Management System, and submitted to the Review Board. The team's consolidated recommendations will include the follow-on excavation of subsurface UXO in respect to historic property, environmental, and natural resources in the area.

UXO – UXO personnel will locate and mark subsurface target anomalies resembling UXO. This systematic process will be conducted with a geophysical detection instrument that provides visual and audible signals to the operator. The operator will mark all anomalies with a flag and record the visual readings and approximate position coordinates within the Grid Map Unit.

The recorded information will be entered into PUXB's Data Management System. Once a Review Board Decision is formulated by the Review Board, this information will be used to re-acquire the anomalies for subsequent operations.

Historic Preservation – Historic preservation personnel will evaluate all Tier II clearance work areas to determine the probability of buried archaeological remains. The evaluation will be based on available information, including the presence of associated surface sites, presence of buried archaeological materials exposed in soil cuts, or extent of the subsurface cultural deposits. The extent of subsurface deposits may be determined with the aid of geophysical mapping and/or implementation of archaeological test excavation. All identified subsurface deposits will be recorded and evaluated for significance and potential adverse effect during clearance operations. These findings and specific treatment will be recommended in accordance to the procedures of the historic property survey.

Environmental – Environment personnel will recommend erosion control procedures and monitoring requirements for areas that are highly-prone to erosion. If the team encounters areas resembling subsurface burn pits or trenches, environmental personnel will map the area; record and analyze the data; review the results; and recommend additional subsurface sampling (if required) to the Review Board.

Natural Resources – Natural resources personnel will monitor Subsurface Detection operations in areas that contain endangered species. Monitoring can include a pre-operational briefing to all team personnel in the recognition and avoidance of endangered species.

3.3.3.6.2 Anomaly Review

Once consolidated, the findings and recommendations that result from Subsurface Detection operations will be submitted to the Anomaly Review Board.

In areas which do not have any previously defined historic property, environmental, or natural resource limitations and/or Area Assessment Review Board limitations, PUXB's Review Board representatives (UXO Quality Control Manager, Natural Resources QC Manager, UXO Safety Office, and Range Control Officer) will review the submitted findings; approve, conditionally-

approve, or disapprove the recommendations; and formulate a Review Board Decision for subsequent excavation operations in the Grid Map Unit.

If an area was previously noted as containing historic property, environmental, or natural resource sensitivities during the Area Assessment review, or if potential historic preservation, environmental, or natural resources limitations are subsequently discovered, the findings and recommendations for subsequent operations in that area will be submitted to all appropriate PUXB and then Government members of the Review Board. The Review Board will review the findings and anomaly data; approve, conditionally approve, or disapprove the recommendations; and formulate a Review Board Decision for subsequent operations.

Information developed or discovered significantly different from that expected from historic review may result in changes to the Kaho`olawe Use Plan or clearance requirements, as agreed to by the Navy and KIRC.

If anomalies are detected at depths greater than those specified in the UXO Clearance Tier Chart (Table 15) or if anomalies fall within culturally and/or archaeologically-sensitive areas where excavation cannot be accomplished, the Review Board will also review these anomalies again and formulate a Review Board Decision for further actions related to these specific anomalies.

3.3.3.6.3 Excavation

Excavation operations are conducted to investigate and identify subsurface target anomalies to the depth requirement.

UXO – UXO personnel will manually excavate target anomalies to a depth of one foot (i.e., with a pick and shovel). If an anomaly is deeper than one foot, it will be either mechanically excavated (i.e., backhoe), or manually excavated if site constraints and accessibility do not permit mechanical excavation. Prior to excavation, erosion control measures will be instituted in accordance with previous findings and recommendations and Review Board Records of Decision.

If an anomaly is deeper than the contractual depth requirement, it will be marked, recorded, and resubmitted to the Anomaly Review Board for further consideration and guidance, as discussed in Section 3.3.3.6.2.

Excavation holes will be backfilled and seeded for natural germination.

Historic Preservation – Historic preservation personnel will monitor compliance with Review Board recommendations for anomaly excavation when the excavations are conducted in areas of known sites and/or features, or areas that have a high probability for unrecorded subsurface deposits.

The excavation of each anomaly will be monitored for archaeological deposits and serve as archaeological testing in these areas. If archaeological deposits are encountered, they will be evaluated for significance and potential adverse effect from the remaining clearance operations; the findings and specific treatment will be recommended according to procedures of the historic property survey.

Data recovery, as a form of site protection, will take place only when all other alternatives have been eliminated. If a site cannot be adequately protected, then data recovery will be considered to mitigate unavoidable damage to the historic property. If data recovery does occur, it will be undertaken with a view to addressing the research problems.

Environmental – Environmental personnel will conduct subsurface soil sampling, as recommended by the Review Board and in accordance with previously prepared site-specific sampling and analysis plan.

If environmental contaminants are suspected or solid waste items are encountered, environmental personnel will provide guidance regarding additional sampling and characterization (as required), management of investigation derived waste, stockpiling of excavated material, and procedures for protection of the surrounding environment and area. Pending identification and evaluation of the encountered anomaly, a detailed, site-specific sampling and analysis plan will be prepared for additional subsurface investigation.

Environmental personnel will also ensure that erosion is not increased during excavation activities through implementation of erosion control procedures, construction of erosion control structures, and monitoring of areas highly prone to erosion.

Natural Resources – The natural resources personnel will provide monitoring oversight during excavation in areas of endangered species, as approved by the Anomaly Review Board. Monitoring can include a pre-excavation briefing to all personnel in procedures to avoid subsurface harm to endangered plant species.

3.3.3.7 UXO Clearance Operations (Tier I and/or Tier II)

3.3.3.7.1 UXO/OE Identification and Assessment

All UXO/OE will be appropriately identified and assessed prior to disposition. After each UXO/OE item is positively identified, an appropriate destruction action will be determined. Representatives of the UXO, historic preservation, environmental, and natural resource functional areas will determine the hazards associated with the item and the potential adverse impacts a demolition will have on the surrounding area, including identification and location of all historic properties, environmental, and natural resources within the effective fragmentation distance or 100 meters (whichever is less). This team will recommend one of the following means of disposition to the Review Board:

- Blow-In-Place
- Consolidate to a Centralized Facility
- No Action

UXO – Initially, UXO personnel will make a preliminary identification of all encountered UXO. At this level of identification, items will be categorized as:

- Bombs
- Projectiles
- Mortars
- Grenades
- Rockets
- Guided Missiles
- Pyrotechnics
- Small Arms
- Submunitions
- Ordnance/Explosives Components

Once the UXO personnel gain complete access to the UXO/OE item, they can analyze the physical evidence of the item (paint markings, other markings, measurements, etc.) and research technical publications to positively identify the item and its fuzing. Identification and assessment data will include:

- Item
- Item location
- Fuzing
- Net explosive weight, type of filler
- Depth
- Existing site conditions
- Quantity/distance calculations
- Mode of transportation (if safe-to-move)
    - Packaging of items for transport
    - Blocking and bracing requirements
- Schedule

In certain cases, an encountered UXO/OE item will be unsafe-to-move. Assessment of a UXO/OE and determination of whether it is safe-to-move depends upon many factors. The following questions will be used to assist in that determination.

- What is the type of fuzing?
- Has the fuzing functioned?
- Is the fuzing damaged beyond the possibility of functioning?
- Can the fuzing be physically inhibited to prevent functioning?
- Can safety features be reinstalled?
- Is the fuzing device that is required to initiate the UXO present?
- Are the key components present?
- Do publications provide procedures for safe movement?
- Will controlled movement and specific procedures for packing prohibit the fuze from functioning?

UXO/OE items that are unsafe-to-move must be detonated in place (blow-in-place or BIP). UXO personnel will determine the best approach to the demolition and calculate the resultant fragmentation distance. If historic properties and/or endangered species are located within the fragmentation distance of the item, protective works (physical barriers) may be required to limit, control, or reduce adverse effects of the blast and fragmentation that will be generated during the high order detonation of the UXO/OE. UXO personnel will work closely with historic preservation and natural resource personnel to determine the appropriate mitigation methodologies for each detonation. The following factors will be considered when designing appropriate mitigation measures (e.g., protective works) – net explosive weight of the UXO, the distance between the UXO and the historic properties and/or environmental and natural resources to be protected, and the various types and combinations of materials available.

Safe-to-move items will be relocated and consolidated at the Open Storage Area (OSA) for disposition at a centralized facility (OB/OD or thermal treatment).

UXO personnel will determine the best method of transporting UXO that is safe-to-move via air or land. In either mode, the UXO will be secured (i.e., blocked and/or braced) and packaged, as required for safe transport. UXO is classified as "forbidden explosives" for air transport. However, NAVSUP PUB 505 allows for the authorization of a deviation based on a specific mission or operation when the deviation is: (1) requested by the shipper and fully justified as operational necessity, and (2) validated by the shipper's major command. Accordingly, if the most cost-effective UXO transport option is by air, then a deviation request will be submitted to the Review Board for transmittal to the Naval Ordnance Center via PACNAVFACENGCOM and NAVEODTECHDIV.

If the item is unsafe-to-move and the implementation of protective works cannot reduce, limit, or eliminate adverse impacts to historic properties, environmental, or natural resources in close proximity to the UXO item, no destructive action will be taken. In this event, institutional controls will be required, as discussed in Section 2.5.

Historic Preservation – Historic preservation personnel will confer with the UXO personnel to determine the adverse impacts a demolition may have on historic properties and traditional cultural places previously identified and located within the effective fragmentation distance or 100 meters for each item. Historic preservation personnel will then recommend mitigation levels.

Natural Resources – Natural resources personnel will confer with the UXO personnel to determine the adverse impacts a demolition may have on endangered species located within the effective fragmentation distance of each item. Natural resources personnel will then recommend mitigation levels.

3.3.3.7.2 Disposition Review

The Review Board will review disposition findings and proposed mitigation data (in the case of an in-situ disposition action) or air transport waiver (in the case of safe-to-move items by air) and approve, conditionally-approve, or disapprove the submitted recommendations, in accordance with the procedures outlined in Section 2.4.2.

3.3.3.7.3 UXO/OE Destruction

UXO/OE destruction is conducted to eliminate the explosive hazard from UXO items. The Demolition Manager will ensure UXO/OE destruction operations and the protection of historic properties and natural resources are implemented in accordance with the Disposition Review Board's Decision.

UXO – UXO personnel will conduct all UXO/OE destruction activities. There are two options for UXO/OE Destruction: Blow in Place (in-situ disposition) or Consolidated Disposition. The destruction approach will be determined by the UXO/OE type, fuzing, and filler; orientation; soil conditions; and historic property, environmental, and natural resource considerations. All disposition actions will be tracked in PUXB's Data Management System. Tracking will include the status of UXO and UXO-related items; documentation of chain of custody and Review Board Review Board Decision; inventory of demolition materials; and completion of a DoD Single Line Item Release/Receipt Document (DD Form1348-1, Jul 91).

> **Blow in Place (BIP) –** The Demolition Manager will BIP those UXO items that are unsafe-to-move; install and implement mitigation measures to protect historic properties

or natural resources within the effective fragmentation distance of the item; and re-grade the resulting crater with existing materials and re-seed the area for natural germination.

Consolidated Disposition – UXO/OE that is safe-to-move will be transported to the Open Storage Area Inspection Point where it will be consolidated by type, accounted for, and stored in the OSA while awaiting future destruction via Open Burn/Open Detonation or Thermal Treatment.

Open Burn/Open Detonation -- Site approval has been granted for an Open Burn and Open Detonation facilities. Consolidated UXO will be destroyed using open detonation; low order UXO will be demilitarized using open burn procedures.

Thermal Treatment -- OE (20mm or smaller) will be thermally treated. The residue will be inspected to ensure the fillers have been totally destroyed. If the filler has not been destroyed, the item will be thermally treated again and the casing manually destroyed so that it cannot be retrofitted into ordnance (per DoD Defense Reutilization and Marketing Manual 4160.21-M). The residue scrap will be transported to the thermal treatment for processing and, once treated, to the Defense Reutilization Management Office (DRMO) Interim Storage Facility located in Base Camp (Section 5.1.5.1) for transport off-island.

Historic Preservation – Historic preservation personnel will verify that necessary protective works are in place prior to the detonations. Post-destruction cleanup documentation will include a description of any historic properties exposed to the detonation and/or any adverse effects of the detonation on the same.

Environmental – Environmental personnel will take soil samples, as required, before and after BIP procedures and analyze the results to ascertain any negative environmental impacts. Sampling will only be required for those in-situ destruction of UXO containing fillers which have not been previously sampled. All appropriate data will be recorded as part of the post clearance Environmental Conditions Report.

Natural Resource – Natural Resource personnel will oversee the implementation of mitigation measures in areas of endangered species. Monitoring can include a pre-operational briefing to all personal regarding avoidance of endangered plant species. When UXO has been designated for BIP, the Natural Resource personnel will monitor installation of mitigation actions (including protective works) to protect endangered plants and animals within the fragmentation zone of the UXO/OE. After a BIP, natural resources personnel will determine if the operation resulted in any adverse impact on the natural resources.

3.3.3.7.3.1 Explosives Management

PUXB will manage demolition materials in accordance with applicable following federal, state, and local laws and regulations, including, but not limited to:

- Bureau of Alcohol, Tobacco, and Firearms Publication (ATFP) 5400.7 (ATF - Explosives Law and Regulations)
- Department of Defense (DoD) 6055.9-STD (DoD Ammunition and Explosives Safety Standards)
- NAVSEA OP5, Volume 1, March 1997. Ammunition and Explosives Ashore Safety Regulations for Handling, Storing, Production, Renovation, and Shipping
- Department of Transportation (DOT) 27 CFR and 49 CFR

- State of Hawaii Department of Labor and Industrial Relations Division of Occupational Safety and Health
- NAVSEA OP 3347 – United States Navy Ordnance Safety Precautions

UXB International, Inc., under the authority of its Alcohol, Tobacco, and Firearms (ATF) license, will purchase explosives for PUXB. UXB's license is:

- Bureau of Alcohol, Tobacco, and Firearms User of High Explosives License: License Number 1-VA-054-33-8K-11586 (expiration date: October 1, 1998).

An authorized UXB officer will provide written authorization designating the individuals who can purchase, store, or utilize explosives. This letter will specify the name, home address, date and place of birth, and the social security number of the designated individual(s), and will be amended as personnel changes occur. A copy of the letter will be maintained at the Maui Technical Office.

Only designated personnel who have a Certificate of Fitness and Hawaii-state Blasters License will be permitted to purchase explosives. Explosives will be purchased from a commercial distributor. PUXB will provide to the licensed distributor a current, certified-signed statement of the intended use of the explosive material.

The explosives and initiators will be stored separately in the EHA, which consists of two fenced temporary storage, portable, explosive magazines rated with a maximum storage capacity of 4,000 net explosive weight. PUXB will adhere to the explosive limits for these magazines.

At a minimum, a weekly physical inventory of the stored explosives will be conducted to reconcile the actual quantities with the quantities annotated on the corresponding Magazine Data Cards. Any discrepancies will be immediately reported and an audit will be initiated to determine the source of the discrepancy.

Unexpended explosives will be returned to the EHA at the end of the workday.

PUXB will maintain permanent records pertaining to explosive materials for a period of five years from the date of transaction. These records will be secured in the Maui Technical Office to ensure their security and regulatory compliance.

3.3.3.7.4 Debris/Remnant Management

The management of the debris/remnants collected from the field involves the inspection, segregation, and accounting of the materials.

UXO – UXO personnel will collect debris/remnants by Grid Map Unit and categorized them as UXO-related remnants, target materials, or non-UXO related materials. During material inspection, processing, and segregation, the category and disposition stream for each item will be determined. Designated UXO personnel will then inspect, track, and document the chain-of-custody items.

UXO-Related Remnants -- UXO-related remnants include all exploded remnants recovered during surface and subsurface clearance operations. UXO-related remnants will be visually inspected and segregated into three types: brass, aluminum, and other metals. These remnants will be boxed by type and stored adjacent to the OSA fence. All of the UXO-related remnants will be subjected to a 5X thermal treatment. Upon 5X processing and, if required demilitarization in accordance with Section 3.3.3.7.4.1, UXO-related remnants will be consolidated in the DRMO Interim Storage Facility and staged for subsequent off-island transport and transfer to DRMO-Hawaii at Barber's Point,

Oahu. Any residual hazardous waste will be disposed of by the appropriate methodology identified in Table 34 in Section 4.2.9.

Target Materials – Target Materials include those items used as military targets (i.e., tires, vehicles, wood, and empty drums). The location of all target materials will be recorded for reference purposes. All target materials will then be visually inspected in the field for explosives and other fire hazards and transported (by air or land) to the target materials consolidation point in Base Camp. These materials will be steam cleaned, and the water analyzed for explosive contaminants. Materials will be processed through the steam cleaning process until they satisfactorily pass the analysis test. Once certified as containing no explosive residue, and, if required, demilitarized in accordance with Section 3.3.3.7.4.1, target materials will be consolidated in the DRMO Interim Storage Facility and staged for subsequent off-island transport and transfer to DRMO-Hawaii at Barber's Point, Oahu.

Non-UXO Related Materials -- Non-UXO related materials include all manmade trash (i.e., plastic and wood). These materials will be transported from the field directly to the Base Camp and containerized in lockable collection bins for off-island transport to an appropriate disposition facility.

3.3.3.7.4.1 Demilitarization

Demilitarization is the process of manually destroying an item so that it cannot once again be retrofitted into ordnance, per DoD Defense Reutilization and Marketing Manual 4160.21-M (March 1990).

UXO – UXO personnel will conduct all demilitarization operations and assure that demilitarized property is inspected and not commingled with any other property. They will re-inspect all scrap materials during outloading to prevent dangerous materials from being delivered.

The designated UXO personnel (UXO Demolition Manager) will inspect, process, and document the following statement on each DD 1348-1 form:

"I, ___(*Name)*___, certify that the property listed hereon has been inspected by me, and to the best of my knowledge and belief, contains no items of a dangerous nature."

3.3.3.7.4.2 Documentation

Complete documentation of all activities is required to be maintained and included as part of the Administrative Record for this removal action.

UXO – UXO personnel will maintain a DD 1348-1 form for each UXO/OE item, and each UXO/OE item will be tracked within PUXB's Data Management System. UXO/OE, UXO-related remnants, target materials will be tracked using a tog or bar code system to maintain a chain of custody for discovery of final disposition.

Historic Preservation – An historic property record form will be used to record and evaluate existing historic property data, recording additional data for known properties, and new data for newly-discovered sites/features. This will be maintained in our Data Management System. An archaeological monitoring activity log will also be completed to record any site damage or no effect.

Historic Preservation services performed and findings of the field work during the UXO Clearance Project will be documented in interim, task order, and close out reports written in accordance with the Secretary of the Interior's Standards and Guidelines for Archaeological documentation (48 CFR 44716).

Environmental – Environmental personnel will photo document the work area prior to and after clearance activities have taken place and aid in the production of the Environmental Conditions Report. Sampling and analysis and manifest documentation will be maintained and submitted with the Close-Out Report of each work area.

Natural Resources – Natural Resources personnel will ensure that natural resources are accurately recorded as part of the Environmental Conditions Report. The data may include, but is not limited to: endangered species locations, vegetation cover, and plants used for erosion control.

3.3.3.7.5 Surveying and Marking

Survey personnel will placard the boundaries of cleared and exception areas with permanent signs that provide transiting personnel with appropriate warnings regarding potential hazards. Carsonite or metallic reference markers, will be installed adjacent to all clearance boundary corners. Final Clearance Maps for each work area and a Final Island Map will be prepared for recording with the State of Hawaii Bureau of Conveyance.

Historic Preservation – Historic preservation personnel will accompany all survey teams. The monitoring archaeologist will ensure that locations selected for the Carsonite markers and permanent signs do not adversely impact historic properties.

3.3.3.8 Records

3.3.3.8.1 UXO Clearance Documentation/Final Report

The complexity (many and various activities occurring at the same time), size (estimated at $280 million), and duration (1997 through 2004) of this project, contract, and task orders require that processes and procedures be developed to manage the closure activities. These closure activities will occur throughout the project's life cycle and will include activities for the closure of geographical work areas, task orders, and the contract.

3.3.3.8.1.1 Work Area Closure

A work area is a grouping of contiguous area Grid Map Units on Kaho`olawe Island. This area must be of a size or character so that closing out this area is economically justified. In order to close out a work area, there must be no reasonable possibility that PUXB will have to re-enter that work area to perform additional work. Therefore, all work area tasks must be complete and the work area must be far enough away from an adjacent on-going work area or future work area so that this work area will not be within the fragmentation or exclusion zone of another on-going or future work area.

3.3.3.8.1.2 Task Order Closure

A task order is closed out when all of the work identified in the Statement of Work of the specific Task Order has been completed and accepted by the Navy and all costs have been accumulated.

3.3.3.8.1.3 Contract Closure

After all task orders under this contract are closed out (except for the task order whose Statement of Work specifies closing out the contract), the contract may be closed out. Therefore, the last or "close out" Task Order and the contract will be closed out simultaneously.

3.3.3.8.2 Demobilization

Demobilization will be coordinated in a minimum of three phases – Kaho`olawe Island, Maui Technical Office, and PMO - Honolulu. The current schedule anticipates completion of demobilization of all Kaho`olawe-based activities at the conclusion of UXO clearance operations or November 11, 2003, whichever occurs first, subject to extension by mutual agreement of the State of Hawaii and Navy. The Maui Technical Office will remain functional through all project close out activities, except final contract closure. The PMO - Honolulu will demobilize concurrent with final contract closure.

3.3.3.9 Certification

A final UXO clearance report will describe all activities performed for UXO clearance and related activities. This report will include appropriate recommendations for UXO clearance certification.

3.3.3.9.1 UXO Clearance Certification

PUXB will prepare a final UXO clearance report describing all UXO clearance and related activities. This report will include appropriate UXO clearance certification recommendations for the Navy's use in preparing the "certification that ordnance clearance or removal or environmental restoration performed pursuant to this Memorandum of Understanding and Title X has been completed with respect to each particular area or site". (MOU, Section VI.K) This report will include:

- A report of area pre-investigation records from the Data Management System showing UXO, cultural, geographic, environmental, historic property, and natural resource characteristics of the area before UXO clearance activities were performed.
- A report of UXO clearance activities from the Data Management System, particularly the Kaho`olawe Island Database and the Kaho`olawe Island Geographical Information System. This report will include UXO clearance performed with exceptions and variations, UXO disposition, non-UXO debris and remnants and its disposition, recommendations for future land use, etc.
- Appropriate end land uses for each area or site.
- Risk assessment and recommendation for risk management.
- Summary of the cleanup of hazardous and other wastes.
- All survey and mapping data from the Kaho`olawe Island Geographical Information System and the appropriate survey and mapping data from the Kaho`olawe Island Database at the precision specified in the contract or the appropriate task order.
- A report showing the chain of custody and/or final disposition of all UXO, UXO-related remnants, target material, and non-UXO materials.
- A final copy of all relevant and important Parsons-UXB quality control reports and associated data.

Probabilities of detection for each work area/Grid Map Unit.

- Final survey maps in a form that can be recorded with the State Bureau of Conveyance.

- A lessons learned report describing problems encountered, solutions, and recommendations for the future.

3.3.3.9.2 Department of Defense Explosive Safety Board

Per Section VI. B. of the Memorandum of Understanding, the Navy will provide certification to the State that the ordnance clearance or removal or environmental restoration performed pursuant to the MOU and Title X has been completed with respect to each particular area or site. This certification may be provided in one or more documents and will be submitted to the Department of Defense Explosive Safety Board (DDESB) for concurrence. The certification(s) shall describe the actions taken to implement the Cleanup Plan; the particular action performed in each area; and the uses which are considered reasonably safe to be conducted in those areas as a result of the UXO clearance actions taken by the Navy. The State shall record the certification documents with the State Bureau of Conveyances and transmit and notice such certifications to any successors or assigns of the State, including any lessees.

3.3.3.9.3 Transfer Access Control

Access control of Kaho`olawe Island will be transferred from the Navy to the State of Hawaii upon completion of all on-island UXO clearance operations or November 11, 2003, whichever comes first, in accordance with Title X and the Memorandum of Understanding. This transfer of access control is subject to extension by mutual agreement by the State of Hawaii and Navy.

3.3.3.10 Long Term Monitoring and Risk Assessment

Title X Section 1002. (a) (1) (vi) requires development within the MOU of "the means for regular interval clean-ups and removal of newly discovered previously undetected ordnance by the Navy." Section XI of the MOU requires that "the Navy and the KIRC, on behalf of the State, shall develop an agreement by May 9, 1998 regarding procedures by which the Navy may conduct regular interval clearance and removal of newly discovered, previously undetected ordnance." This plan for long term monitoring and risk assessment recurring review will be developed consistent with Section 178.11 of 32 CFR Part 178. In addition, the State of Hawaii will develop a long-term risk management plan, with Navy assistance, to protect public safety while providing for meaningful safe use after 2003. This plan will include recommendations for administrative and engineering controls, as well as limitations on use.

The recurring review will evaluate the changes in physical conditions on Kaho`olawe (i.e., erosion), changes in public accessibility, and effectiveness of the UXO clearance activities. The initial review (visual or detector aided visual dependent on the vegetation, topography, and geology) will be conducted within one year after closeout of a work area. Recurring reviews for each work area will be conducted in the several years following completions of the initial review with subsequent reviews occurring with the following time intervals after the initial review: second review, 1 to 3 years; third review, 3 to 5 years; fourth review, 5 to 7 years; fifth review, 7 to 10 years; and final review, 10+ years.

At each recurring review, the review procedures and the evaluation criteria used to assess the effectiveness of the UXO clearance will be documented in a recurring review report. The recurring review report will provide a discussion of the findings, stating whether or not the UXO clearance continues to effectively address the risk on Kaho`olawe Island, and if any new problems have been discovered in the period since the last review, such as changes in public accessibility (due, for example, to changes in the adjacent land uses).

If the response failed to remain effective, or a new problem is discovered, then the responsible party will document the action(s) which will be taken to address that problem and the schedule

for the action. Any clearance activities within a work area (either as a result of newly discovered UXO or independent actions) will require re-initialization of the recurring review schedule.

3.3.3.10.1 Removal of Newly Discovered but Previously Undetected UXO

The Department of Defense is never fully relieved of its obligation to address environmental damages caused by military munitions under the Defense Environmental Restoration Program (DERP). The Department of Defense has also been designated as the lead removal response authority with respect to military munitions in the National Contingency Plan (40 CFR 300.120 (d). If at some future date a problem is discovered at a range where the Department of Defense completed a removal action, the Department of Defense will conduct an appropriate response to address that problem. This response is typically handled as an explosives or military munition emergency response; however, if the circumstances indicate a need for a more detailed response, the Department of Defense can reopen the range removal action and conduct any appropriate actions.

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Section 4 Engineering Trade-Off Analysis

A key component of this project is the identification and analysis of UXO and non-UXO treatment and disposition alternatives. This Engineering Trade-Off Analysis (ETA) was completed to perform a comparative analysis of various UXO and non-UXO treatment and disposition alternatives.

The ETA follows the U.S. Environmental Protection Agency guidance document entitled Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA, Chapter 2, August 1993, (USEPA Guidance Document) and addresses the treatment and disposal of UXO: UXO/OE that is safe-to-move, UXO-related remnants, and target materials; and the removal and disposition of Other Materials: other potentially contaminated non-UXO related materials. The goal of the ETA is to recommend treatment or disposition alternatives based on the evaluation of effectiveness, implementability, and cost criteria for UXO and Other Materials.

4.1 Engineering Trade-Off Analysis (UXO)

This section summarizes the treatment and/or disposition alternatives for contaminated UXO/OE items, UXO-related remnants, and target materials. Final recommendations of treatment and/or disposition for each item are presented. For purposes of this section, "UXO" is used as a broad term to include all elements addressed in this component of the Engineering Trade-Off Analysis (ETA), including the Target Materials element, and does not include unexploded ordnance.

4.1.1 Streamlined Risk Evaluation

Justification of treatment or removal of UXO is based on the identified risks associated with the UXO. The following discussion indicates why UXO presents risks to human health and the environment and why it must be treated prior to a final disposition.

UXO is defined as military munitions that have been primed, fuzed, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remain unexploded either by malfunction, design, or any other cause. When subjected to heat, shock, friction, and/or inadvertent movement, UXO may produce catastrophic or severe effects to human health and the environment. Catastrophic and/or severe effects may result from blast, fragmentation, overpressure and/or fire. UXO are an imminent hazard and immediate cause of death or disablement if disturbed. UXO are frequently encountered as an intact fuzed unit. UXO are routinely discovered in a "dud fired" condition, with fuzing safeties removed. The physical appearance of UXO does not provide an indication of the safe condition of the item.

When encountered, UXO is relocated for disposal if safe-to-move or disposed of in place if unsafe-to-move. The decision to move UXO for centralized destruction is reviewed by competent safety personnel and ultimately rests solely with the individual exposed to the imminent hazard. UXO destruction in place is a risk mitigation method performed to eliminate catastrophic or severe exposure. The main considerations for UXO destruction in place are the severity and imminent nature of the existing hazards. Two factors influence a decision to destroy UXO in place: (1) the sensitivity of the item to movement, and (2) the level of acceptable exposure to personnel involved with the movement. Items that are safe-to-move are transported to the Open Storage Area for future destruction at the approved Open Burn/Open Detonation area.

4.1.2 Identification of UXO Engineering Trade-Off Analysis Scope, Goals, and Objectives

The scope of the UXO Engineering Trade-Off Analysis is evaluation of treatment alternatives for UXO expected to be found on the island, and evaluation of treatment and/or disposition alternatives for UXO-related remnants and target materials.

The goal of the UXO ETA is to recommend specific treatment and/or disposition actions for UXO and explosives contaminated items, based on an evaluation of effectiveness, implementability, and cost criteria. The primary objectives to achieve the stated project goal, include: elimination of the explosion hazards through treatment of UXO/OE and UXO-related remnants, and disposal of potentially contaminated target material waste streams.

Treatment and disposition schedule considerations include:

- All UXO treatment activities are anticipated to be complete prior to November 11, 2003
- Construction of UXO treatment systems must be in consistent with the overall UXO clearance schedule
- UXO treatment systems methodologies must be approved prior to start of any UXO clearance operations
- UXO treatment systems must be established and operational prior to the Open Storage Area reaching 90% of total capacity

4.1.3 Identification and Description of UXO Treatment and Disposition Alternatives

The UXO component of the ETA was divided into three elements: UXO and UXO-related explosives (UXO/OE), UXO-related remnants, and target materials. Where necessary for organizational purposes, these elements were further divided into sub-elements so that the actual item or material to be treated or disposed could be isolated.

The UXO/OE element was considered for various treatment technologies without being further divided into sub-elements.

The UXO-related remnants element was maintained as a separate element and included a Potentially Contaminated Soil sub-element.

The Target Materials element includes those items used as military targets (i.e., tires and vehicles). Target Materials sub-elements were considered after the target has undergone a visible inspection for the presence of UXO/OE and has been disassembled. The Target Materials element was divided into five sub-elements: Vehicle Batteries and Asbestos Brakes; POLs and anti-freeze removed from target vehicles; Stripped Target Vehicles, or Chassis; Tires from the vehicles; and Potentially Contaminated Soil.

4.1.3.1 UXO/OE and UXO-Related Remnants Treatment Technologies

Conventional waste munitions contain Propellant Explosive Pyrotechnic (PEP) materials, which pose potential safety hazards because of their typically highly flammable and/or explosive nature. These potential hazards can easily be heightened by a lack of proper precautions; for example, PEP materials may become much more hazardous in cases where deterioration, contamination, and/or mixing of these materials have taken place. Because of the numerous potential hazards associated with these materials, it is DoD's policy that safety shall be of paramount importance in any operation in which PEP materials are involved. In keeping with this policy, DoD has instituted a multitude of safety regulations and instructions to govern the

production, handling, transportation, storage, rework, treatment, and disposal of PEP materials. For example, Army Material Command Regulation No. 755-8 requires visual inspection, segregation, flashing, certification, and quality assurance of all metallic scrap from open detonation destined for DRMO. Thus, it is apparent that the importance of the safety aspects of any waste munitions treatment or disposal operation cannot be overemphasized.

There are a number of technologies presently available for treating or disposing of munitions and munitions-related items. DoD is currently seeking to sell, recycle, reuse, and salvage as much of this material as is practical and safe to do so.

The treatment technologies considered for addressing the UXO/OE and UXO-related remnants elements include thermal and non-thermal methodologies.

4.1.3.1.1 Thermal Treatments

Eight thermal treatment methodologies were considered and/or investigated for the disposal of ordnance and/or PEP. These include the approaches listed below:

- Open Burn
- Ammunition Peculiar Equipment, 1236 Deactivation Furnace (APE 1236 Unit)
- Air Curtain
- Rotary Furnace/Kiln
- Fluidized Bed
- Wet Air Oxidation
- Hot Gas Decontamination
- Molten Salts

4.1.3.1.2 Non-Thermal Treatments

Seven non-thermal-related treatment technologies considered include:

- Biodegradation
- Central Disposal Sites
- Chemical Decomposition
- Deep Land Burial
- Deep Well Slurry Injection
- Landfill
- Long-Term Storage/Retention

4.1.3.2 Target Materials Disposition Options

The disposition options considered for the Target Materials sub-elements include the following (not every disposition option applies to every sub-element). For purposes of this study, “Off-Island”

means off Kaho`olawe Island but within the State of Hawaii, unless otherwise specified as a disposition option, requiring transport to the continental United States.

- No Further Action
- Institutional Controls
- Stage as Non-Contaminated Solid Waste
- On-island Landfilling
- Off-island Landfilling
- Off-island Recycling

4.1.3.3 UXO Treatment and Disposition Alternatives

The treatment technologies for UXO/OE and UXO-related remnants and the disposition options for Target Materials were evaluated to develop a matrix of treatment technologies and disposition options for each sub-element.

4.1.3.3.1 UXO/OE

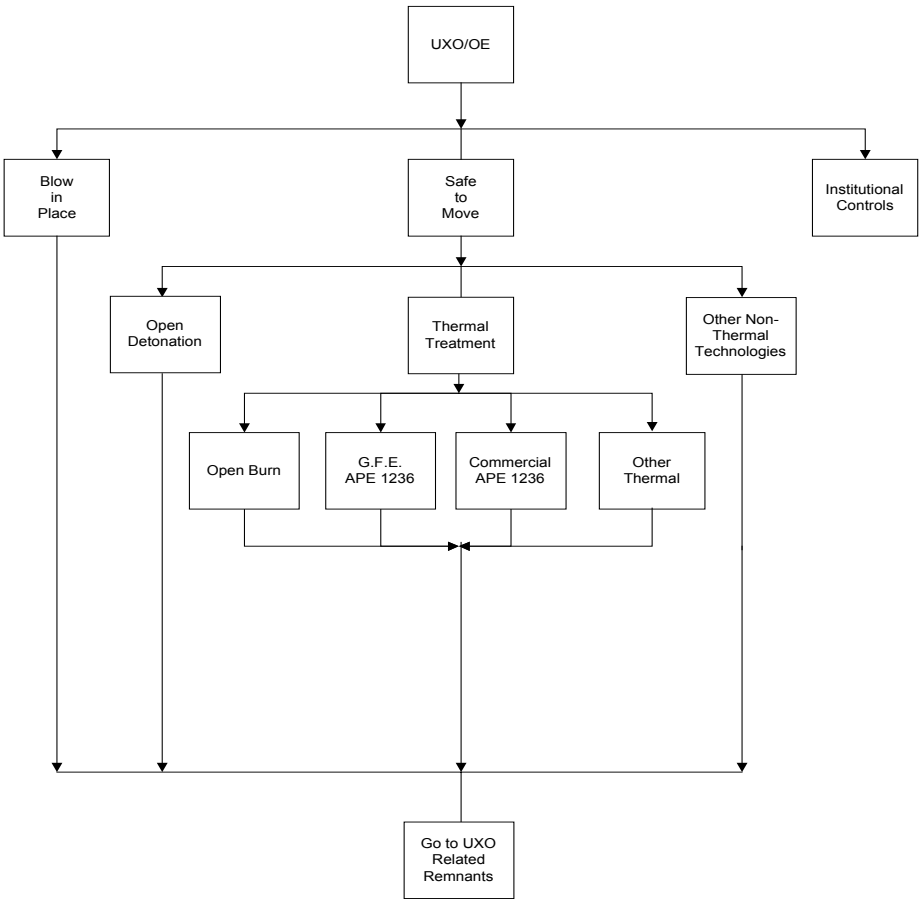
The UXO element was analyzed following three pathways, as shown in Figure 23. UXO/OE will be either blown in place, deemed safe-to-move and consolidated, or left as found.

UXO/OE blown in place will become part of the UXO-related remnants element.

UXO/OE deemed safe-to-move, as described in Section 3.3.3.7.1, will be processed and treated by either open detonation, thermal treatment, or one of the other non-thermal technologies. The open detonation pathway was reserved for larger items (the only safe disposition option available based on a hazard analysis review), while the smaller items underwent the comparative analysis of the remaining treatments. Following this processing and treatment, resulting UXO/OE remnants will become part of the UXO-related remnants element and decision pathways.

UXO/OE left as found would require the use of institutional controls (as described in Section 2.5) to mitigate any explosion hazards.

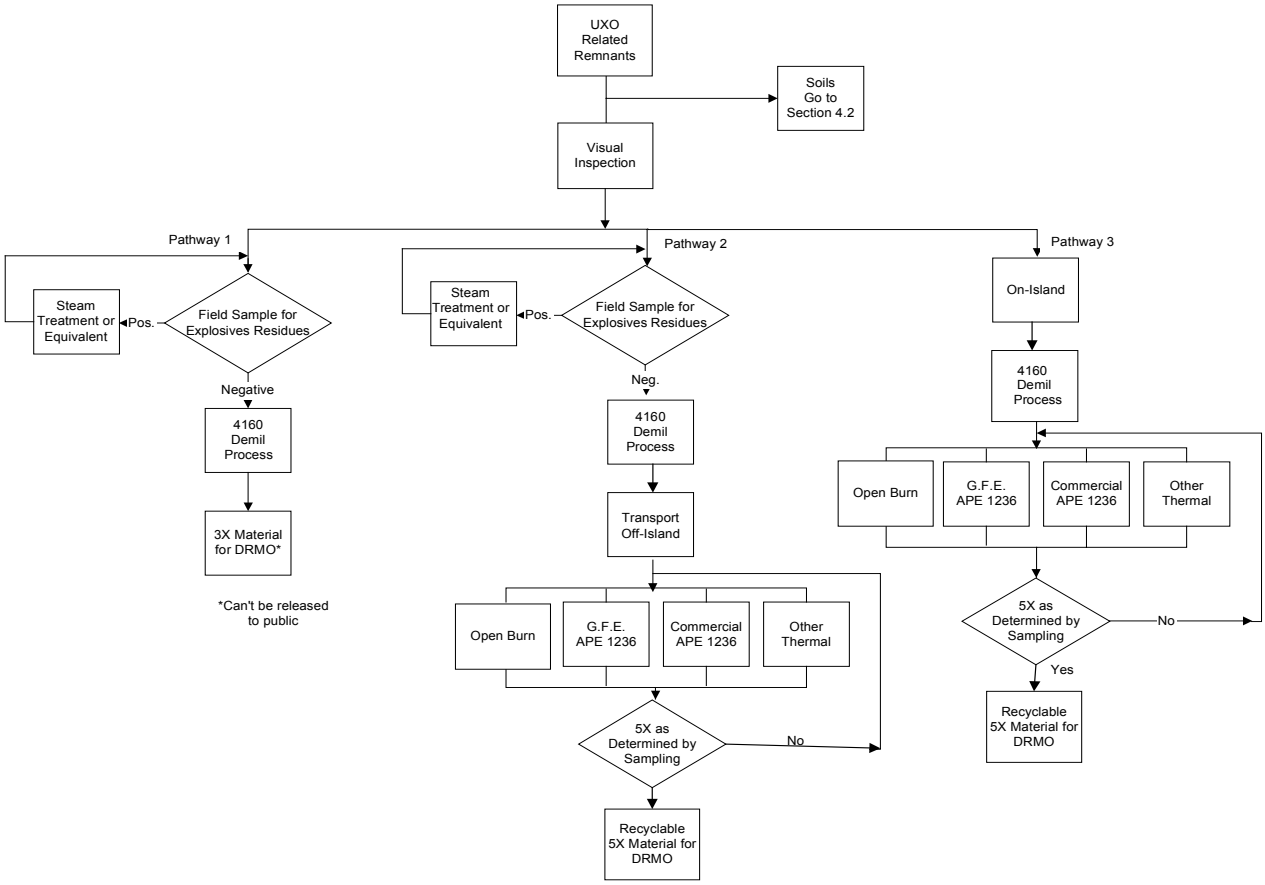
Figure 23: UXO/OE Treatment Decision Flow Chart



4.1.3.3.2 UXO-Related Remnants

UXO-related remnants, after visual inspection, were evaluated along three treatment/disposition pathways, as shown in Figure 24 and then follow three pathways to treatment or disposition. Pathway No. 1 renders the UXO-related remnants 3X material, pathway No. 2 treats the UXO-related remnants off-island and renders them recyclable 5X material, and pathway No. 3 treats the UXO-related remnants on-island and renders them recyclable 5X material. Additionally the sub-element, Potentially Contaminated Soil, requires an evaluation of treatment or disposition alternatives. This evaluation is discussed in Section 4.2.

Figure 24: UXO-Related Remnants Treatment Decision Flow Chart



The pathways are discussed below:

1. UXO-related remnants will be field sampled for explosives residues. If tested positive for residues, the material will be treated for explosive residues (i.e., steam wash or equivalent methodology) until no more residues are detected. At that point, the material will undergo the DoD 4160 demilitarization process (disconfigured to prevent future use as an ordnance component) and will be staged as 3X material for DRMO. In this condition, the material cannot be released to the public. This pathway was not considered any further after notification that the DRMO office at Barber's Point would not accept 3X material.

2. UXO-related remnants will also be considered as a pathway. After sampling and treatment for explosives residues (as in No. 1 above) and processing to achieve demilitarization in accordance with the Defense Reutilization and Marketing Manual (DoD 4160.21-M and M-1), off-island transport of the remnants will commence and processing through one of the following

treatment alternatives will take place to render it recyclable 5X material: Open Burn; G.F.E. APE 1236 unit; Commercial APE 1236 unit; and other thermal treatments. After treatment, the material will be sampled to confirm that it is 5X material. If it is not 5X, the material will go through the treatment again. The former remnants will then be transported to DRMO as recyclable 5X material. It will be staged for DRMO.

3. UXO-related remnants will consider those treatments listed in No. 2 above as on-island operations. However, the initial field sampling and treatment for explosive residues steps are not required since the material does not have to be transported off-island. The pathway will result in the same end product: recyclable 5X material staged for DRMO.

4. Potentially contaminated soil associated with UXO-related remnants is addressed as an element of the Other Component of the ETA (Section 4.2).

Table 21 presents the matrix of all identified UXO/OE and UXO-related remnant elements and the treatment alternatives considered for each.

Table 21: Matrix of UXO/OE and UXO-Related Remnants Treatment Alternatives

Elements or Sub-Elements	Treatment Alternatives																				
					Other Thermal																
	Open Detonation	G.F.E. APE 1236 Unit	Commercial APE 1236 Unit	Open Burn	Air Curtain	Rotary Furnace/Kiln	Fluidized Bed	Wet Air Oxidation	Hot Gas	Molten Salts	Biodegradation	Central Disposal Sites	Chemical Decomposition	Deep Land Burial	Deep Well Slurry Injection	Landfill	Long Term Storage	Off-Island Open Burn	Off-Island G.F.E. APE 1236 Unit	Off-Island Commercial APE 1236 Unit	Off-Island Other Thermal
UXO/OE																					
UXO Related Remnants																					

4.1.3.3.3 Target Materials

Target Materials will undergo a UXO inspection and segregation, and five sub-elements will require evaluation of disposition alternatives: Vehicle Batteries and Asbestos Brakes; POLs and Anti-freeze removed from target vehicles; Stripped Target Vehicles, or Chassis; Tires from the vehicles; and Potentially Contaminated Soil.

The pathways are discussed below.

1) The Vehicle Batteries and Asbestos Brakes sub-element will consider the following disposition alternatives: No Further Action, Institutional Controls, On-Island Landfilling, Off-Island Recycling, and Off-Island Landfilling (in Hawaii).

2) The POLs and Anti-freeze sub-element considered the following disposition alternatives: No Further Action, Institutional Controls, and Off-Island Recycling.

3) Stripped chassis will undergo treatment for removal of explosive residue, if necessary, based on a positive explosives residues field sampling results, and will then be considered non-contaminated recyclable material and will be staged on-island for disposition.

4) Tires stripped from the vehicles are addressed as an element of the Other component of the ETA (Section 4.2) and are not further considered within this UXO component.

5) Potentially contaminated soil associated with target materials is addressed as an element of the Other component of the ETA (Section 4.2) and is not further considered within this UXO component.

Table 22 presents the matrix of all identified Target Materials sub-elements and the disposition alternatives considered for addressing each.

Table 22: Matrix of Target Materials Sub-Elements and Disposition Alternatives

	Disposition Alternatives					
TARGET MATERIALS SUB-ELEMENTS	**No Further Action**	**Institutional Controls**	**On-Island Landfill**	**Off-Island Recycle**	**Off-Island Landfill (in Hawaii)**	**Stage As Non-Contaminated Recyclable Material**
Vehicle Batteries and Asbestos Brakes						
POLs/Anti Freeze						
Chassis						

4.1.4 Evaluation Criteria

In general accordance with Chapter 2 of the CERCLA Non-Time-Critical Removal Actions Guidance Document, this section discusses the evaluation criteria in terms of removal actions. Each of the removal action alternatives identified must be evaluated for effectiveness, implementability, and cost as part of the comparative analysis.

The effectiveness of an alternative refers to its ability to meet the clean-up objectives within the scope of the removal action. The effectiveness category is divided into the following evaluation criteria:

- Overall Protection of Human Health and the Environment
- Compliance with ARARs
- Long-Term Effectiveness
- Reduction of Toxicity, Mobility, or Volume Through Treatment
- Short-Term Effectiveness

The implementability category includes the technical and administrative feasibility of implementing an alternative, and the availability of the various services and materials required

for implementation. The implementability category is divided into the following evaluation criteria:

- Technical Feasibility
- Administrative Feasibility
- Availability of Services and Materials
- Regulatory/Community Acceptance

Each alternative is also evaluated by its projected overall cost. The projected cost is an order of magnitude estimate that includes the planning, implementation, transportation, disposal, site restoration, and post-removal activities, or other tasks, as necessary, to complete the treatment or disposition action alternative. The costs consider capital costs, post removal site control costs (operation and maintenance activities), and present worth costs (where the removal action does not begin immediately or requires longer than one year to complete).

4.1.5 Evaluation of UXO Treatment or Disposition Alternatives By Criteria

4.1.5.1 Introduction

The treatment and disposition alternatives underwent a decision screening process whereby some of the alternatives were eliminated from further consideration and were not retained for the detailed comparative analysis presented in the next section. This decision screening process was necessary to allow a focused analysis of treatment or disposition alternatives which might realistically be implemented. The retained treatment or disposition alternatives were assessed by the evaluation criteria to demonstrate that they were appropriate options for the comparative analysis.

4.1.5.2 UXO/OE

The larger UXO/OE items were reserved for treatment by the open detonation method. Therefore, the decision screening process and subsequent comparative analysis of treatment alternatives was completed for the smaller UXO/OE items as discussed below.

4.1.5.2.1 UXO/OE Decision Screening Process

The following treatment technologies were not retained for the detailed comparative analysis:

Non-Thermal Technologies

- biodegradation
- central disposal sites
- chemical decomposition
- deep land burial
- deep well slurry injection
- landfilling
- long term storage

Thermal Technologies

- air curtain
- rotary furnace
- rotary kiln
- fluidized bed
- wet air oxidation
- hot gas decontamination
- molten salts

The non-thermal technology alternatives were eliminated from the detailed comparative analysis because the individual treatments failed either the effectiveness or implementability criteria, or both. The technical feasibility sub-criterion for many of these treatment methods, particularly biodegradation and chemical decomposition, was not satisfied since the technology must be proven and reliable. Some of the technologies, such as deep land burial, deep well slurry injection, landfilling, or long term storage, fail the effectiveness criteria requirements of long term effectiveness or reduction of toxicity. Additionally, these technologies are non-compliant with NAVSEA OP5, Vol. 1, Chapter 13, paragraph 13-1.3.1 which states "Burying of ammunition or explosives, as well as ocean dumping, or dumping in wells, marshes, streams, inland waterways, waste places, or pits is prohibited."

The other thermal technologies were eliminated from the detailed comparative analysis because, for the most part, they failed the implementability criteria. The technical feasibility sub-criterion was not satisfied since the technology must be proven and reliable. Contract stipulations require that only proven technologies be considered for the overall Clearance Project. Additionally, those incinerator processes which are proven, still failed the technical feasibility sub-criterion because of the prohibitive operating costs resulting from the power and fuel supply requirements, as well as the need to handle potentially significant amounts of cooling water which would be generated.

The alternatives to treat UXO/OE retained for the comparative analysis are: Open Burn, the G.F.E. APE 1236 Unit, and a commercial incinerator equivalent to the APE 1236 Unit. The general treatment approach for each is:

- **Open Burn (OB)** – The burning of materials, in the open air or in a receptacle, without significant control of the combustion and in such a manner that the products of combustion are emitted directly into the ambient air without passing through a device intended to control gaseous or particulate emissions.
- **Ammunition Peculiar Equipment, 1236 Deactivation Furnace (APE 1236 Unit)** – This is a deactivation furnace used for small explosive items (less than 8 inches in diameter and with a net explosive weight of no more than five pounds). All particulate matter is collected in DOT-approved 55-gallon drums from an environmental control system.

4.1.5.2.2 UXO/OE Treatment Alternatives Evaluation by Criteria

When assessed by the nine evaluation criteria, the remaining treatment alternatives (Open Burn, the G.F.E. APE 1236 Unit, and a commercial incinerator equivalent to the APE 1236 Unit) were acceptable and were retained for the detailed comparative analysis presented in the next section.

4.1.5.2.3 UXO-Related Remnants

The UXO-related remnants element considered three possible pathways for the UXO-related remnants and also considered a Potentially Contaminated Soil sub-element.

4.1.5.2.4 Pathway No. 1 Decision Screening Process

This pathway considered staging UXO-related remnants as 3X material for DRMO following steam water treatment for explosives residues, as necessary, followed by the DoD 4160 demilitarization process. Since only one alternative was considered, no comparative analysis of other alternatives could be performed on this pathway.

As discussed in Section 4.1.3.3.2, the DRMO – Hawaii at Barber's Point will not accept 3X material. Therefore, this pathway was eliminated from further analysis.

4.1.5.2.5 Pathway No. 2 Decision Screening Process

This pathway considered open burn, the G.F.E. APE 1236 unit, the commercial equivalent to the APE 1236 unit, and the six remaining thermal treatment technologies listed as Other Thermal on Table 21 as off-island processes to render UXO-related remnants into recyclable 5X material.

Off-island treatment of UXO-related remnants was eliminated because this approach failed the effectiveness and implementability criteria. The short term effectiveness sub-criterion is not achieved because the potential impact of the transport of the UXO-related remnants (prior to the thermal treatment) makes this approach insufficiently protective of workers or environment. Additional considerations, which would prevent the administrative feasibility sub-criterion from being satisfied, include: special approvals and permitting required to transport the UXO-related remnants off Kaho`olawe Island, special permitting required to build and operate the treatment technologies off Kaho`olawe Island, and the need to locate a DoD controlled facility to implement the treatment technologies. The costs involved in transporting the material off-island, and establishing and implementing the treatment alternatives off-island, would be prohibitive relative to on-island implementation of these treatment alternatives. As a result, Pathway 2 was not retained for comparative analysis.

4.1.5.2.6 Pathway No. 3 Decision Screening Process

Of the treatment technologies described to render UXO-related remnants into recyclable 5X material, on-island, the six thermal treatment technologies listed as Other Thermal on Table 21 were not retained for the detailed comparative analysis.

These thermal technologies were eliminated from the detailed comparative analysis because, for the most part, they failed the implementability criteria. The technical feasibility sub-criterion was not satisfied since the technology must be proven and reliable. Contract stipulations require that only proven technologies be considered for the overall Clearance Project. Additionally, those incinerator processes which are proven, still failed the technical feasibility sub-criterion because of the prohibitive operating costs resulting from the power and fuel supply requirements, as well as the need to handle potentially significant amounts of cooling water which would be generated.

The on-island alternatives to render UXO-related remnants into recyclable 5X material which were retained for the comparative analysis are: (1) Open Burn, (2) the G.F.E. APE 1236 Unit, and (3) a commercial equivalent to the APE 1236 Unit.

4.1.5.2.7 Pathway No. 3 Treatment Alternatives Evaluation by Criteria

When assessed by the nine evaluation criteria listed in Section 4.1.4, the remaining on-island treatment alternatives were acceptable and were retained for the detailed comparative analysis presented in Section 4.1.6.3.

4.1.5.2.8 Potentially Contaminated Soil Decision Screening Process

The decision screening process for potentially contaminated soils is addressed in the Soils element of the ETA and summarized in Section 4.2.

4.1.5.3 Target Materials

The Target Materials element considered five sub-elements requiring evaluation of disposition alternatives: Vehicle Batteries and Asbestos Brakes; POLs and Anti-freeze removed from target vehicles; Stripped Target Vehicles, or Chassis; Tires from the vehicles; and Potentially Contaminated Soil.

4.1.5.3.1 Vehicle Batteries and Asbestos Brakes Decision Screening Process

Two of the five disposition alternatives were not retained for the detailed comparative analysis: no further action and institutional controls.

The no further action alternative was eliminated from the detailed comparative analysis because this alternative fails the effectiveness and implementability criteria. The effectiveness criteria requires stricter protection of human health provisions than is attained by allowing future users of the island to encounter vehicle batteries or asbestos brakes which could present a human health hazard. This alternative does not reduce risk. The implementability criteria was not satisfied since this alternative would not meet with community acceptance, as the existence of these materials left as is would affect the historical, cultural, or religious activities of future users of Kaho`olawe

The institutional controls alternative was eliminated from the detailed comparative analysis because this alternative fails the implementability criteria. The implementability criteria was not satisfied since this alternative would not meet with community acceptance, as fenced off areas of vehicle batteries or asbestos brakes, or the restriction of access to areas where these materials could be encountered, would impede the historical, cultural, or religious activities of future users of Kaho`olawe.

In addition, two additional disposition alternatives, on-island landfilling and off-island landfilling, were not retained for vehicle batteries. Chapter 342-J, HRS, prohibits disposal of lead acid batteries at solid waste facilities, and mandates that they be recycled at a U.S. Environmental Protection Agency permitted facility within the continental United States.

The disposition alternatives retained for the comparative analysis for the asbestos brakes sub-element are: On-Island Landfilling, Off-Island Recycling, and Off-Island Landfilling (in Hawaii).

4.1.5.3.2 Asbestos Brakes Disposition Alternatives Evaluation by Criteria

When assessed by the nine evaluation criteria, the remaining disposition alternatives (on-island landfilling, off-island recycling in Hawaii, and off-island landfilling in Hawaii) were acceptable and were retained for the detailed comparative analysis presented in Section 4.1.6.4.

4.1.5.3.3 POLs and Anti-Freeze Decision Screening Process

The only alternative retained for POLs and anti-freeze was Off-Island Recycling. The no further action and institutional controls alternatives were not retained for the same reasons as stated in Section 4.1.5.3.1 above. Since only one alternative was considered, no comparative analysis was performed on this sub-element.

4.1.5.3.4 Chassis Decision Screening Process

The only alternative considered for Chassis was staging as non-contaminated solid waste, following treatment for explosives residues and/or DRMO demilitarization, if required. Since only one alternative was considered, no comparative analysis was performed on this sub-element.

4.1.5.3.5 Tires Decision Screening Process

The decision screening process for Tires is addressed in the Tires element of the ETA and summarized in Section 4.2.

4.1.5.3.6 Potentially Contaminated Soil Decision Screening Process

The decision screening process for potentially contaminated soils is addressed in the Soils element of the ETA and summarized in Section 4.2.

4.1.6 Comparative Analysis of the UXO Treatment and Disposition Alternatives

4.1.6.1 Introduction

The retained UXO treatment and disposition alternatives were ranked relative to one another in terms of their effectiveness, implementability, and cost using the evaluation criteria listed in Section 4.1.4.

4.1.6.2 Comparative Analysis of UXO/OE Element Treatment Alternatives By Criteria

4.1.6.2.1 UXO/OE

Table 23 presents the selection rankings of the treatment alternatives for the UXO/OE element in respect to effectiveness, implementability, and costs.

Table 23: UXO/OE Selection Criteria Application

Alternatives	Effectiveness	Implementability	Cost	Total	Rank
Open Burn	2	1	1	4	1
G.F.E APE 1236	1	2	2	5	2
Commercial APE 1236	1	2	3	6	3
Note: Ranking from best to worst; best = 1, worst = 3					

The APE 1236 treatment unit(s) were ranked as the most effective alternatives for treating UXO/OE. The Open Burn treatment method was ranked as the most implementable alternative. The construction and operation of the Open Burn area was considerably less costly than the APE 1236

units. Based on the rankings within the three categories, the set up and operation of the Open Burn area is the preferred alternative to address the smaller UXO/OE found on Kaho`olawe Island. Larger UXO will treated by Open Detonation, as described in Section 4.1.5.2.

4.1.6.3 Comparative Analysis of UXO-Related Remnants Element Treatment Alternatives By Criteria

4.1.6.3.1 UXO-Related Remnants

Table 24 presents the selection rankings of the treatment alternatives for the UXO-related remnants element in respect to effectiveness, implementability, and costs.

Table 24: UXO-Related Remnants Selection Criteria Application

Alternatives	Effectiveness	Implementability	Cost	Total	Rank
Open Burn	2	1	1	4	1
G.F.E APE 1236	1	2	2	5	2
Commercial APE 1236	1	2	3	6	3
Note: Ranking from best to worst; best = 1, worst = 3					

The APE 1236 treatment unit(s) were ranked as the most effective alternatives for treating UXO-related remnants. The Open Burn treatment method was ranked as the most implementable alternative. The construction and operation of the Open Burn area was considerably less costly than the APE 1236 units. Based on the rankings within the three categories, the set up and operation of the Open Burn area is the preferred alternative to address the UXO-related remnants found on Kaho`olawe Island.

4.1.6.4 Comparative Analysis of Target Materials Sub-Elements Treatment Alternatives By Criteria

4.1.6.4.1 Asbestos Brakes

Table 25 presents the selection rankings of the treatment alternatives for the asbestos brakes element in respect to effectiveness, implementability, and costs.

Table 25: Batteries/Asbestos Selection Criteria Application

Alternative	Effectiveness	Implementability	Cost	Total	Rank
On-Island Landfill	2	3	3	8	3
Off-Island Recycle (in Hawaii)	1	2	2	5	2
Off-Island Landfill (in Hawaii)	2	1	1	4	1
Note: Ranking from best to worst; best = 1, worst = 3					

The off-island recycling alternative ranked as the most effective disposition alternative for this sub-element. The off-island landfilling alternative was the most implementable alternative. The off-island landfilling (in Hawaii) alternative was slightly less costly than the off-island recycling alternative (to be conservative, this alternative assumes that no costs are recouped through recycling). Based on the rankings within the three categories, off-island landfilling (in Hawaii) is the preferred alternative to address vehicle batteries and asbestos brakes found on Kaho`olawe Island.

4.1.6.4.2 POLs and Anti-Freeze

Since only one disposition alternative (off-island recycling) was considered for this sub-element, no comparative analysis was performed. It is recommended that POLs and anti-freeze be staged for off-island recycling in Hawaii.

4.1.6.4.3 Chassis

Since only one disposition alternative (on-island staging as non-contaminated recyclable material) was considered for this sub-element, no comparative analysis was performed. Target vehicle chassis are recommended to be staged for disposition as a non-contaminated recyclable material.

4.1.6.4.4 Tires

The Tires sub-element of Target Materials is addressed in the Tires element of the ETA, as summarized in Section 4.2. Tires will be utilized during the UXO removal process as Protective Works. The final disposition alternative recommended for tires is on-island use in erosion control measures.

4.1.6.4.5 Potentially Contaminated Soil

The comparative analysis of the Potentially Contaminated Soil sub-element is addressed in the Soils element of the ETA and summarized in Section 4.2. The recommended disposition alternative for the soils contamination with Other than POL constituents is off-island landfilling in Hawaii. The recommended disposition alternative for Soils contaminated with POL constituents only is on-island landfarming with use as clean fill.

4.1.7 Recommended UXO Treatment or Disposition Alternatives

The recommended UXO treatment or disposition alternatives are summarized in Table 26.

Table 26: Recommended UXO Treatment or Disposition Alternatives

Element	Recommended Treatment/Disposition
UXO/OE	Open Burn
UXO-Related Remnants	Open Burn
Vehicle Batteries	Off-Island Recycling
Asbestos Brakes	Off-Island Landfilling (in Hawaii)
POLs and Anti-Freeze	Off-Island Recycling (in Hawaii)
Chassis	On-Island Staging as Non-Contaminated Solid Waste
Tires	On-Island Use in Erosion Control Measures
Soils Contaminated with Other Than POL Constituents	Off-Island Landfilling (in Hawaii)
Soils Contaminated with POL Constituents	On-Island Landfarming With Use as Clean Fill

4.2 Engineering Trade-Off Analysis (Other Materials)

This section addresses the potentially contaminated non-UXO related materials that could be encountered during this UXO Clearance Project.

4.2.1 Previous Other Removal Actions/Investigations

Previous removal actions or investigations mainly focused on the UXO aspects of Kaho'olawe Island. During the Model Project, several areas were encountered that had the potential to contain Other Contaminants -- four burn pits at the Lower Nursery, Waikahalulu Gulch Refuse Site, and potential burn pits at LZ1.

4.2.2 Source, Nature, and Extent of Other Contamination

The exact source, nature, and extent of any Other Contamination has not been defined. Basic assumptions (based on available data) were made to estimate types and quantities of Other Contaminated materials. A listing of other potentially contaminated sites is provided in Table 13. These locations were used to represent all types of areas having the potential to contain Other Contaminants which could be encountered during the project. These three locations were identified as areas to investigate and develop a process by which to dispose of possible Other contaminants encountered: Burn Pits, Bulky Waste Storage Area, and Waikahalulu Gulch Refuse Site. Additionally, two separate waste streams were identified as having the potential to be encountered at various locations across the island: tires, and potentially contaminated soils.

4.2.3 Analytical Data

No significant sampling was performed to define the nature and extent of Other Contamination. However, during the 1995 Model Project, soil sampling was performed to: provide baseline readings in the soil within detonation locations for residual chemicals associated with ordnance and explosives for comparison to determine detonation by-products; determine if blow-in-place operations resulted in residual explosive chemicals in the soil; and, establish baseline conditions for possible explosive ordnance chemicals for surface soils in the Open Storage Area. The results of the investigation indicated that explosive compounds were not detected at the method detection limit in any soil samples.

4.2.4 Streamlined Risk Evaluation

A streamlined risk evaluation was not developed for Other Contamination on the island. As sampling is completed during the UXO Clearance Project, action levels and cleanup goals will be evaluated using the risk-based corrective action policy of the Hawaii Department of Health.

4.2.5 Identification of Other Component Scope, Goals, and Objectives

The scope of the Other Component Engineering Trade-Off Analysis report is to address a reasonable number of disposition alternatives for those wastestreams expected to be found on the island, while being flexible enough to provide guidance for addressing similar sites which could be encountered during the UXO Clearance Project.

The goal of the ETA report is to recommend treatment or disposition actions for each waste stream based on the evaluation of effectiveness, implementability, feasibility, and cost criteria.

The primary objective of the Other Contaminant ETA is the elimination of hazards caused by the presence of Other Contaminants and the disposal of Other waste streams to achieve the

cleanup standards contained in the Hawaii Department of Health risk-based guidance document.

The Engineering Trade-Off Analysis schedule for the Other Contaminant disposition activities will be concurrent with the UXO clearance and treatment activities.

4.2.6 Identification and Description of Other Contaminant Removal Action Alternatives

The Other Component of the Engineering Trade-Off Analysis was divided into five categories or elements corresponding to the identified locations or waste streams expected to be encountered on the island: Burn Pits, Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site, Tires, and Soils. Each of these elements was further divided into sub-elements to distinguish the actual item or material to be treated and/or disposed.

The Burn Pits element was divided into two sub-elements: Soil/Ash or Burn Residue and Metallic Debris. The Soil/Ash or Burn Residue sub-element includes the intermixed soil and ash from the burn pit operations as well as the charred or partially burned combustibles (wooden pallets, etc.) which may have been included. The Metallic Debris sub-element includes those materials that would not have burned completely during the operations.

The Bulky Waste Storage Area element was divided into four sub-elements: Potentially Contaminated Components, Soil/Ash or Burn Residue, Batteries and Asbestos, and Metallic Debris. The Potentially Contaminated Components sub-element includes metallic drums, paint cans, or similar materials which could contain hazardous residues or which could be intermixed with soils which have been contaminated by spilled or leaked contents of materials stored there. The Soil/Ash or Burn Residue sub-element has already been defined. The Batteries, Asbestos sub-element includes those materials which are, or which contain, hazardous substances that may be able to be recycled. The Metallic Debris sub-element has already been defined.

The Waikahalulu Gulch Refuse Site element was divided into four sub-elements: Potentially Contaminated Components, Soils, Batteries and Asbestos, and Metallic Debris. The Potentially Contaminated Components sub-element has already been defined. The Soils sub-element includes those soils associated with the Waikahalulu Gulch Refuse Site which could have been contaminated by the materials stored there. This sub-element becomes part of the Soils element which addresses all soils contamination associated with the Other component of the ETA. The Batteries and Asbestos sub-element has already been defined. The Metallic Debris sub-element has already been defined.

The Tires element was not further divided into sub-elements. The Tires element includes tires used as Target Materials and tires from non-operational, non-target vehicles.

The Soils element includes associated soils from various UXO and Other Component elements. The Soils element was divided into two sub-elements: Soils Contaminated with Other Than Petroleum, Oils, and Lubricant Constituents (POL), and Soils Contaminated with POL Constituents Only. The Soils Contaminated with Other Than POL Constituents sub-element includes soils determined to contain non-RCRA hazardous concentrations (and therefore not a hazardous waste) as determined by sampling. Although not broken out as a separate sub-element, soils that exceed RCRA hazardous waste characterization levels (as determined by sampling) and that can only be disposed in a RCRA hazardous waste landfill are also addressed within this sub-element, as well as soils with less than 10% TNT (by volume). Soils containing equal to or greater than 10% TNT (by volume) are defined as an explosive (OE). Treatment and disposition of UXO/OE is described in Section 4 . The Soils Contaminated with

POL Constituents Only sub-element includes soils that contain only POL contamination, as determined by sampling.

4.2.6.1 Other Treatment Technologies

Numerous treatment technologies to address some of the sub-elements expected to be encountered were considered for the analysis. Some sub-elements did not require treatment prior to disposition. Treatments were considered mainly for the soils expected to be encountered. The following five treatments were considered for contaminated soils expected to be encountered: natural attenuation, bioventing, on-island landfarming with on-island use as clean fill, on-island thermal treatment with on-island use as clean fill, and off-island thermal treatment with off-island use as clean fill.

4.2.6.2 Other Disposition Options

Following any necessary treatment, the waste streams considered the following disposition options (not every disposition option applies to every sub-element): no further action, institutional controls, stage as non-contaminated solid waste, on-island recycling, on-island landfilling, off-island landfilling, off-island recycling, and off-island hazardous waste landfilling.

4.2.6.3 Other Treatment and Disposition Alternatives

A matrix of treatment technologies and disposition options for each Other sub-element was developed. Decision process flow charts showing the pathway from element to sub-element to disposition alternative were developed. A matrix table summarizing the sub-elements and their associated treatment and disposition alternatives, was developed (Table 27).

Table 27: Matrix of Other Sub-Elements and Disposition Alternatives

		ALTERNATIVES												
SUB-ELEMENTS	ELEMENT FROM WHICH DERIVED	No Further Action	Institutional Controls	On-Island Landfill	Off-Island Hazwaste Landfill (on Mainland)	Off-Island Landfill (in Hawaii)	On-Island Recycle	Off-Island Recycle (in Hawaii)	Natural Attenuation	Bioventing	On-Island Landfarm, Use as Clean Fill	On-Island Thermal Treatment, Use as Clean Fill	Off-Island Thermal Treatment, Off-Island Use as Clean Fill (in Hawaii)	Non-Contaminated Solid Waste
Soil/Ash or Burn Residue	Burn Pits, Bulky Waste Storage Area													
Metallic Debris	Burn Pits, Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site													
Potentially Contaminated Components (Drums,etc.)	Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site													
Batteries/Asbestos	Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site													
Soils (Go to Soils Element)	Waikahalulu Gulch Refuse Site, Soils													
Tires	Tires													
Soils Contaminated with Non-POL constituents	Soils													
Soils Contaminated with POL Constituents Only	Soils													

4.2.6.3.1 Burn Pits

The Burn Pit materials will undergo a UXO clearance and segregation, and two sub-elements will require evaluation of disposition alternatives: Soil/Ash or Burn Residue, and Metallic Debris.

- Soil/Ash or Burn Residue will consider four disposition alternatives: No Further Action, Institutional Controls, On-Island Landfill, and Off-Island Landfill (in Hawaii)
- Metallic Debris, following steam treatment for removal of any explosives residues and verification sampling, will be considered non-contaminated solid waste and will be staged on island

4.2.6.3.2 Bulky Waste Storage Area

The Bulky Waste Storage Area materials will undergo a UXO clearance and segregation, and four sub-elements will require evaluation of disposition alternatives: Potentially Contaminated Components, Soil/Ash or Burn Residue, Batteries and Asbestos, and Metallic Debris.

- Potentially Contaminated Components will consider four disposition alternatives: No Further Action, Institutional Controls, On-Island Landfill, and Off-Island Landfill (in Hawaii).
- Soil/Ash or Burn Residue will consider four disposition alternatives: No Further Action, Institutional Controls, On-Island Landfill, and Off-Island Landfill (in Hawaii).
- The Batteries, Asbestos sub-element considered five disposition alternatives: No Further Action, Institutional Controls, On-Island Landfill, Off-Island Recycle (in Hawaii), and Off-Island Landfill (in Hawaii).
- Metallic Debris, following steam treatment for explosives residues, will be considered non-contaminated solid waste and will be staged on island.

4.2.6.3.3 Waikahalulu Gulch Refuse Site

The Waikahalulu Gulch Refuse Site materials will undergo a UXO clearance and segregation, and four sub-elements will require evaluation of disposition alternatives: Potentially Contaminated Components, Soils, Batteries and Asbestos, and Metallic Debris.

- Potentially Contaminated Components will consider four disposition alternatives: No Further Action, Institutional Controls, On-Island Landfill, and Off-Island Landfill (in Hawaii)
- Soils will be addressed within the Soils element
- The Batteries, Asbestos sub-element considered five disposition alternatives: No Further Action, Institutional Controls, On-Island Landfill, Off-Island Recycle (in Hawaii), and Off-Island Landfill (in Hawaii)
- Metallic Debris, following steam treatment for explosives residues, will be considered non-contaminated solid waste and will be staged on island

4.2.6.3.4 Tires

The Tires will undergo a UXO inspection and segregation. This element was not further divided into sub-elements.

- Tires will be sampled for explosives residues. Following steam cleaning treatment for removal of any explosives residues and verification sampling, the material will be considered non-contaminated solid waste for use on island for erosion control purposes. Tires used for erosion control purposes will also be modified by drilling or punching holes in each during the treatment process to prevent the collection of water.

4.2.6.3.5 Soils

The Soils will be sampled and based on the results, two sub-elements will require evaluation of disposition alternatives: (1) Soils Contaminated with Other Than POL Constituents, and (2) Soils Contaminated with POL Constituents Only. Soils which are not contaminated, as determined by the sampling, were not considered further for the study.

- For Soils Contaminated with Other Than POL Constituents, will consider four disposition alternatives: No Further Action, Institutional Controls On-Island Landfill, and Off-Island Landfill (in Hawaii). Should sampling indicate contaminants at RCRA hazardous levels, the only alternative would be disposal in a hazardous waste landfill.
- For Soils Contaminated with POL Constituents Only, four in situ disposition alternatives were considered: No Further Action, Institutional Controls, Natural Attenuation, and Bioventing. Four post-excavation disposition alternatives were considered: On-Island Landfarming with On-Island use as Clean Fill, On-Island Thermal Treatment with On-Island use as Clean Fill, Off-Island Landfill, and Off-Island Thermal Treatment with Off-Island use as Clean Fill.

4.2.7 Evaluation of Disposition Alternatives By Criteria

4.2.7.1 Introduction

Each of the disposition alternatives developed were assessed by nine evaluation criteria listed in Section 4.1.4. The disposition alternatives underwent a decision screening process whereby some of the alternatives were eliminated from further consideration and were not retained for the detailed comparative analysis presented in the next section. The retained disposition alternatives were assessed by the evaluation criteria to demonstrate that they were appropriate options for the comparative analysis.

4.2.7.2 Burn Pits Sub-Elements

4.2.7.2.1 Decision Screening Process for Soil/Ash or Burn Residue

Two of the four disposition alternatives originally considered were not retained for the detailed comparative analysis: no further action and institutional controls.

The no further action alternative was eliminated from the detailed comparative analysis because this alternative fails the effectiveness and implementability criteria. The effectiveness criteria requires stricter protection of human health provisions than is attained by allowing future users of the island to encounter contaminated soil/ash or burn residue or other items found in the pits which could present a human health hazard. This alternative does not reduce risk. The implementability criteria was not satisfied since this alternative would not meet with community acceptance, as the existence of soil/ash or burn residue left as is would affect the historical, cultural, or religious activities of future users of Kaho`olawe.

The institutional controls alternative was eliminated from the detailed comparative analysis because this alternative fails the implementability criteria. The implementability criteria was not satisfied since this alternative would not meet with community acceptance, as fenced off burn pits, or the restriction of access to areas where the burn pits are located, would impede the historical, cultural, or religious activities of future users of Kaho`olawe.

The disposition alternatives retained for the comparative analysis for this sub-element are: On-Island Landfilling, and Off-Island Landfilling (in Hawaii).

4.2.7.2.2 Residue Disposition Alternatives Evaluation by Criteria Soil/Ash or Burn

When assessed by the following nine evaluation criteria, the remaining disposition alternatives (on-island landfilling and off-island landfilling, in Hawaii) were acceptable and were retained for the detailed comparative analysis presented in the next section.

- Protection of Human Health and the Environment
- Compliance with ARARS
- Long Term Effectiveness
- Reduction of Toxicity
- Short Term Effectiveness
- Technical Feasibility
- Administrative Feasibility
- Availability of Services and Materials
- Community Acceptance

4.2.7.2.3 Decision Screening Process for Metallic Debris

The only disposition alternative for metallic debris is steam treatment and staging as non-contaminated solid waste. Therefore, no comparative analysis was performed.

4.2.7.3 Bulky Waste Storage Area Sub-Elements

4.2.7.3.1 Decision Screening Process for Potentially Contaminated Components

Two of the four disposition alternatives were not retained for the detailed comparative analysis: no further action and institutional controls.

The no further action alternative was eliminated from the detailed comparative analysis because this alternative fails the effectiveness and implementability criteria. The effectiveness criteria requires stricter protection of human health provisions than is attained by allowing future users of the island to encounter potentially contaminated components, such as drums or paint cans which could present a human health hazard. This alternative does not reduce risk. The implementability criteria was not satisfied since this alternative would not meet with community acceptance, as the existence of these potentially contaminated components left as is would affect the historical, cultural, or religious activities of future users of Kaho`olawe.

The institutional controls alternative was eliminated from the detailed comparative analysis because this alternative fails the implementability criteria. The implementability criteria was not satisfied since this alternative would not meet with community acceptance, as fenced off areas

of staged contaminated components, or the restriction of access to the bulky waste storage area, would impede the historical, cultural, or religious activities of future users of Kaho`olawe.

The disposition alternatives retained for the comparative analysis for this sub-element are: On-Island Landfilling and Off-Island Landfilling (in Hawaii).

4.2.7.3.2 Disposition Alternatives Evaluation by Criteria for Potentially Contaminated Components

When assessed by the nine evaluation criteria, the remaining disposition alternatives (on-island landfilling and off-island landfilling in Hawaii) were acceptable and were retained for the detailed comparative analysis presented in the next section.

4.2.7.3.3 Decision Screening Process for Batteries/Asbestos

Two of the five disposition alternatives were not retained for the detailed comparative analysis: no further action and institutional controls.

The no further action alternative was eliminated from the detailed comparative analysis because this alternative fails the effectiveness and implementability criteria. The effectiveness criteria requires stricter protection of human health provisions than is attained by allowing future users of the island to encounter batteries, asbestos, or similar materials which could present a human health hazard. This alternative does not reduce risk. The implementability criteria was not satisfied since this alternative would not meet with community acceptance, as the existence of these materials left as is would affect the historical, cultural, or religious activities of future users of Kaho`olawe.

The institutional controls alternative was eliminated from the detailed comparative analysis because this alternative fails the implementability criteria. The implementability criteria was not satisfied since this alternative would not meet with community acceptance, as fenced off areas of staged batteries or asbestos materials, or the restriction of access to the bulky waste storage area, would impede the historical, cultural, or religious activities of future users of Kaho`olawe.

In addition, two additional disposition alternatives, on-island landfilling and off-island landfilling, were not retained for vehicle batteries. Chapter 342-J, HRS, prohibits disposal of lead acid batteries at solid waste facilities, and mandates that they be recycled at a U.S. Environmental Protection Agency permitted facility within the continental United States.

The disposition alternatives retained for the comparative analysis for the asbestos sub-element are: On-Island Landfilling, Off-Island Recycling, and Off-Island Landfilling (in Hawaii).

Other sub-elements from the Bulky Waste Storage Area are the same as previously discussed for the Burn Pits.

4.2.7.3.4 Alternatives Evaluation by Criteria for Asbestos Disposition

When assessed by the nine evaluation criteria, the remaining disposition alternatives (on-island landfilling, off-island recycling in Hawaii, and off-island landfilling in Hawaii) were acceptable and were retained for the detailed comparative analysis presented in the next section.

4.2.7.4 Waikahalulu Gulch Refuse Site Sub-Elements

The decision screening process for soils from the Waikahalulu Gulch Refuse Site is addressed in the Soils element.

The screening process and disposition alternatives evaluation for the rest of the sub-elements for the Waikahalulu Gulch Refuse Site, which are the same as sub-elements from other areas, have been previously described.

4.2.7.5 Tires

The only disposition alternative for the Tires element is treatment for explosive residues (if present) and ultimately use on-island for erosion control measures. Therefore, no comparative analysis was performed.

4.2.7.6 Soils

4.2.7.6.1 Decision Screening Process for Soils Contaminated with Other Than POL Constituents

Two of the four disposition alternatives were not retained for the detailed comparative analysis: no further action and institutional controls.

The no further action alternative was eliminated from the detailed comparative analysis because this alternative fails the effectiveness and implementability criteria. The effectiveness criteria requires stricter protection of human health provisions than is attained by allowing future users of the island to encounter contaminated soils. This alternative does not reduce risk. The implementability criteria was not satisfied since this alternative would not meet with community acceptance, as the presence of contaminated soils would affect the historical, cultural, or religious activities of future users of Kaho`olawe.

The institutional controls alternative was eliminated from the detailed comparative analysis because this alternative fails the implementability criteria. The implementability criteria was not satisfied since this alternative would not meet with community acceptance, as fenced off contaminated soils, or the restriction of access to areas where contaminated soils are located, would impede the historical, cultural, or religious activities of future users of Kaho`olawe.

The disposition alternatives retained for the comparative analysis for this sub-element are: On-Island Landfilling and Off-Island Landfilling (in Hawaii).

4.2.7.6.2 Disposition Alternatives Evaluation by Criteria for Soils Contaminated with Other Than POL Constituents

When assessed by the nine evaluation criteria, the remaining disposition alternatives (on-island landfilling and off-island landfilling in Hawaii) were acceptable and were retained for the detailed comparative analysis presented in the next section.

4.2.7.6.3 Decision Screening Process for Soils Contaminated with POL Constituents Only

Four of the eight disposition alternatives were not retained for the detailed comparative analysis: no further action, institutional controls, natural attenuation, and bioventing.

The no further action alternative was eliminated from the detailed comparative analysis because this alternative fails the effectiveness and implementability criteria. The effectiveness criteria requires stricter protection of human health provisions than is attained by allowing future users of the island to encounter POL contaminated soils. This alternative does not reduce risk. The implementability criteria was not satisfied since this alternative would not meet with community

acceptance, as the presence of contaminated soils would affect the historical, cultural, or religious activities of future users of Kaho`olawe.

The institutional controls alternative was eliminated from the detailed comparative analysis because this alternative fails the implementability criteria. The implementability criteria was not satisfied since this alternative would not meet with community acceptance, as fenced off POL contaminated soils, or the restriction of access to areas where POL contaminated soils are located, would impede the historical, cultural, or religious activities of future users of Kaho`olawe.

The natural attenuation alternative was eliminated from the detailed comparative analysis because this alternative fails the implementability criteria. The technical feasibility of this alternative requires that, for an *in situ* application, soil microbes must be present to biodegrade the POL contaminants. However, the hardpan soils lack the nutrients and soil microbes (Kaho`olawe Environmental Restoration Plan, 1997, p.7) necessary for this alternative to be considered a realistic way to reduce contamination.

The bioventing alternative was eliminated from the detailed comparative analysis because this alternative fails the implementability criteria. The technical feasibility criterion of this *in situ* alternative must consider that a remediation system must be designed and constructed for each identified area of POL contaminated soils. Although such systems could be constructed, the costs involved in building and maintaining several different remediation systems would be prohibitive relative to the other alternatives.

The disposition alternatives retained for the comparative analysis for this sub-element are: On-Island Landfarming with Use as Clean Fill, On-Island Thermal Treatment with Use as Clean Fill, Off-Island Landfilling (in Hawaii), and Off-Island Thermal Treatment with Off-Island Use as Clean Fill (in Hawaii).

4.2.7.6.4 Only Disposition Alternatives Evaluation by Criteria for Soils Contaminated with POL Constituents

When assessed by the nine evaluation criteria, the remaining disposition alternatives (on-island landfarming with use as clean fill, on-island thermal treatment with use as clean fill, off-island landfilling (in Hawaii), and off-island thermal treatment with off-island use as clean fill (in Hawaii) were acceptable and were retained for the detailed comparative analysis presented in the next section.

4.2.8 Comparative Analysis of the Other Disposition Alternatives

4.2.8.1 Introduction

The Other sub-elements which retained only one disposition alternative metallic debris and tires are not discussed in this section, since no comparative analysis was necessary. Table 28 presents a matrix of Other sub-elements and disposition alternatives retained for comparative analysis.

Table 28: Matrix of Other Sub Elements and Disposition Alternatives Retained for Comparative Analysis

		ALTERNATIVES											
SUB-ELEMENTS	ELEMENT FROM WHICH DERIVED	On-Island Landfill	Off-Island Recycle	Off-Island Landfill (in Hawaii)	Off-Island Hazwaste Landfill (on Mainland)	Carbon Treatment with On-Island Discharge	Off-Island Disposal (in Hawaii)	On-Island Evaporation Pan	On-Island Landfarm, Use as Clean Fill	On-Island Thermal Treatment, Use as Clean Fill	Off-Island Thermal Treatment, Off-Island Use as Clean Fill (in Hawaii)	Non-Contaminated Solid Waste
Soil/Ash or Burn Residue	Burn Pits, Bulky Waste Storage Area											
Metallic Debris	Burn Pits, Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site											
Steam Treatment Water	Burn Pits, Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site, Tires											
Potentially Contaminated Components (Drums, etc.)	Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site											
Batteries	Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site											
Asbestos	Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site											
Soils (Go to Soils Element)	Waikahalulu Gulch Refuse Site, Soils											
Tires	Tires											
Soils Contaminated with Non-POL constituents	Soils											

4.2.8.2 Comparative Analysis of Burn Pits Sub-Elements Disposition Alternatives By Criteria

4.2.8.2.1 Soil/Ash or Burn Residue

Table 29 permits the selective ranking of the disposition alternatives for the Soil/Ash or Burn Residue element in respect to effectiveness, implementability, and costs.

Table 29: Soil/Ash or Burn Residue Implementability Criteria Application

	Implementability Criteria				
Alternative	**Effectiveness**	**Implementability**	**Cost**	**Total**	**Rank**
On-Island Landfill	2	2	2	2	2
Off-Island Landfill (in Hawaii)	1	1	1	1	1
Note: Ranking from best to worst; best = 1, worst = 2					

The off-island landfilling (in Hawaii) alternative ranked as the most effective based on removal of the materials from the island. The off-island landfilling alternative was the most implementable

alternative. The off-island landfilling (in Hawaii) alternative was also the least costly. Based on the rankings within the three categories, off-island landfilling (in Hawaii) is the preferred alternative to address soil/ash or burn residue found on Kaho`olawe Island.

4.2.8.3 Comparative Analysis of Bulky Waste Storage Area Potentially Contaminated Components Sub-Elements Disposition Alternatives By Criteria

Table 30 permits the selective ranking of the disposition alternatives for the Bulky Waste Storage Area Potentially Contaminated Components in respect to effectiveness, implementability, and costs.

Table 30: Potentially Contaminated Components Selection Criteria Application

Alternatives	Effectiveness	Implementability	Cost	Total	Rank
On-Island Landfill	2	2	2	6	2
Off-Island Landfill (in Hawaii)	1	1	1	3	1
Note: Ranking from best to worst: best = 1, worst =2					

The off-island landfilling (in Hawaii) alternative ranked as the most effective based on removal of the materials from the island. The off-island landfilling alternative was also the most implementable alternative. The off-island landfilling (in Hawaii) alternative was the least costly. Based on the rankings within the three categories, off-island landfilling (in Hawaii) is the preferred alternative to address potentially contaminated components found on Kaho`olawe Island.

4.2.8.3.1 Soil/Ash or Burn Residue

The comparative analysis is the same as presented for the Burn Pits.

4.2.8.3.2 Asbestos

Table 31 permits the selective ranking of the disposition alternatives for Asbestos residue elements in respect to effectiveness, implementability, and costs.

Table 31: Batteries/Asbestos Selection Criteria Application

Alternatives	Effectiveness	Implementability	Cost	Total	Rank
On-Island Landfill	2	3	3	8	3
Off-Island Recycle (in Hawaii)	1	2	2	5	2
Off-Island Landfill (in Hawaii)	2	1	1	4	1
Note: Ranking from best to worst; best = 1, worst = 3					

The off-island recycling alternative ranked as the most effective. The off-island landfilling alternative was the most implementable alternative. The off-island landfilling (in Hawaii) alternative was slightly less costly than the off-island recycling alternative. Based on the

rankings within the three categories, off-island landfilling (in Hawaii) is the preferred alternative to address batteries/asbestos found on Kaho`olawe Island.

4.2.8.4 Comparative Analysis of Waikahalulu Gulch Refuse Site Sub-Elements Disposition Alternatives By Criteria

4.2.8.4.1 Potentially Contaminated Components

The analysis of this sub-element, and the other sub-elements for Waikahalulu Gulch Refuse Site which are the same sub-elements shown for other areas, has been previously described.

4.2.8.4.2 Soils

The comparative analysis for the Soils sub-element of the Waikahalulu Gulch Refuse Site is presented in the Soils element comparative analysis.

4.2.8.5 Comparative Analysis of Tires Sub-elements Disposition Alternatives By Criteria

No comparative analysis was performed on this element since only one disposition alternative was considered.

4.2.8.6 Comparative Analysis of Soils Sub-Elements Disposition Alternatives By Criteria

4.2.8.6.1 Soils Contaminated with Other Than POL Constituents

Table 32 permits the selective ranking of the disposition alternatives for the Soils Contaminated with Other Than POL Constituents in respect to effectiveness, implementability, and costs.

Table 32: Soils Contaminated with Other Than POL Constituents Selection Criteria Application

Alternatives	Effectiveness	Implementability	Cost	Total	Rank
On-Island Landfill	2	2	2	6	2
Off-Island Landfill (in Hawaii)	1	1	1	3	1
Note: Ranking from best to worst; best = 1, worst = 2					

The off-island landfilling (in Hawaii) alternative ranked as the most effective based on removal of the materials from the island. The off-island landfilling alternative was also the most implementable alternative. The off-island landfilling (in Hawaii) alternative was the least costly. Based on the rankings within the three categories, off-island landfilling (in Hawaii) is the preferred alternative to address soils contaminated with other than POL constituents found on Kaho`olawe Island.

4.2.8.6.2 Soils Contaminated with POL Constituents Only

Table 33 permits the selective ranking of the disposition alternatives for the Soils Contaminated with POL Constituents Only in respect to effectiveness, implementability, and costs.

Table 33: POL Only Contaminated Soils Selection Criteria Application

Alternatives	Effectiveness	Implementability	Cost	Total	Rank
On-Island Landfarm, Use as Clean Fill	1	1	1	3	1
On-Island Thermal Treatment, Use as Clean Fill	1	1	2	4	2
Off-Island Landfill (in Hawaii)	4	3	3	10	3
Off-Island Thermal Treatment, Use as Clean Fill (in Hawaii)	3	4	4	11	4
Note: Ranking from best to worst; best = 1, worst = 4					

The on-island alternatives, landfarming and thermal treatment, were equally ranked as the most effective. The on-island soil treatment alternatives were equally ranked as the most implementable alternatives. The on-island landfarming alternative was the least costly. Based on the rankings within the three categories, on-island landfarming with on-island use of the soil as clean fill is the preferred alternative to address POL contaminated soils encountered on Kaho`olawe Island.

4.2.9 Recommended Disposition Alternatives for Other Contaminants Sub-Elements

Table 34 presents a table of Other sub-elements recommended disposition alternatives.

Table 34: Other Sub-Elements Recommended Disposition Alternatives

		ALTERNATIVES			
SUB-ELEMENTS	ELEMENT FROM WHICH DERIVED	Off-Island Recycle	Off-Island Landfill (in Hawaii)	On-Island Landfarm, Use as Clean Fill	Non-Contaminated Solid Waste
Soil/Ash or Burn Residue	Burn Pits, Bulky Waste Storage Area				
Metallic Debris*	Burn Pits, Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site				
Potentially Contaminated Components (Drums, etc.)	Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site				
Batteries	Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site				
Asbestos	Bulky Waste Storage Area, Waikahalulu Gulch Refuse Site				
Tires*	Tires				
Soils Contaminated with Non-POL Constituents	Soils				
Soils Contaminated with POL Constituents Only	Soils				

* Only one disposition alternative considered. Sub-element is shown for completion.

Section 5 Logistical Support Improvements

5.1 Infrastructure

Infrastructure construction and improvement activities (as identified in this section) will be performed according to the construction process summarized in Figure 25. This process coincides with certain phases of the UXO Clearance Process described in Section 3.3.3.

Figure 25: Construction Process

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5.1.1 Base Camp

Camp must be upgraded and improved to provide appropriate accommodations, subsistence, and work areas for a civilian work force for a six-year term. These upgrades or improvements must conform to Occupational Health and Safety Administration temporary labor camp requirements, and all renovations and new construction must comply with Maui County building codes. This section discusses the required modifications or upgrades to the berthing areas, galley, work shops, water and electrical utilities, and waste disposal.

5.1.1.1 Berthing Areas

The functionality and compliance of the existing berthing areas were evaluated, and an analysis was completed comparing renovation of the existing facilities with new facilities. The finding was that the existing Base Camp facilities do not currently meet the requirements of 29 CFR 1910.142 (Temporary Labor Camps), and renovation would be more costly than mobilizing and installing new modular, 4-person sleeping units. Therefore, Base Camp will be renovated to include seven new modular units. The existing shower trailer will be relocated to the proposed Range Control/Operations Center (Section 5.1.2), since there will be shared showers within each new 4-person modular unit. The reconfiguration of Base Camp is shown in Figure 26.

5.1.1.2 Galley

GKO & Associates conducted a study and prepared final design documents and plans for PACNAVFACENGCOM for the renovation of Buildings 12 and 13 (Galley). PUXB evaluated the conditions of the existing galley and mess hall and concurs with the findings of the GKO study. We will implement these upgrades and/or renovations accordingly.

5.1.1.3 Shops

PUXB evaluated the conditions of the various shops, and determined that no upgrades are necessary at this time.

5.1.1.4 Utilities – Water

The Kaho`olawe Water Supply Study, completed by GKO & Associates (1997), reviewed existing literature and evaluated the possible water supply resources to meet the needs of the UXO Clearance Project. The GKO study found that the most viable water source to support this project's requirements depended on the irrigation needs for the revegetation of the island. The recommended alternative to provide potable water requirements of 11,000 gallons per day (including water for three proposed nurseries) and a maximum of 3,000 gallons per day of irrigation water is the development of a brackish groundwater desalinization system.

This system will consist of three supply wells with submersible well pumps. Wellhead elevation is proposed at approximately 55 feet above sea level with the wells extending to 30 feet below sea level. Based upon the 1992 study conducted by Mink & Yuen, the wells could be located at any convenient site within the Base Camp area at an appropriate well head elevation.

Well construction and pump installation will be in accordance with the substantive requirements of State of Hawaii well construction standards. These standards, and the associated well construction permit, require that the wells be drilled by a State of Hawaii licensed driller and that testing be done to develop and document the source of water. Although pumping tests are not required by the State of Hawaii for a 20 gallon per minute pump installation, PUXB will perform step-drawdown and long term (8 hrs) continuous pump tests in order to determine the storativity, yield, and drawdown of the pumping wells. Based on the results of these tests, a

determination will be made as to the continuing feasibility of this alternative. If the test wells' output is consistent with design parameters, the system will be installed as proposed. Two of the three wells would be operated at or below 20 gallons per minute and the remaining well will be used (as necessary) to allow for uninterrupted service during pump maintenance operations. A 4-inch supply pipeline would convey raw brackish water to a flow equalization tank allowing for start/stop control of the well pumps. This will result in a delivery of 57,600 gallons per day to the 9,000 gallon per day reverse osmosis unit.

The existing single-stage 9,000 gallons per day reverse osmosis water purification system will be used to produce potable water. The reverse osmosis system will utilize multiple membrane wells to allow for maintenance without service interruption. Purified water will flow from the reverse osmosis unit through a disinfecting facility to a new temporary water storage tank. This storage tank will be located at an approximate elevation of +100-ft. above or north of the Base Camp landing zones.

The new potable water system will replace the existing Base Camp water distribution system and include two stand pipes. One stand pipe will be located adjacent to the berthing areas, and one stand pipe will be located in the maintenance area.

This system, operating at an efficiency of 10%, will produce approximately 5,760 gallons of potable water per day. The OSHA requirement for potable water at temporary labor camps is 35 gallons per day per person; therefore, the proposed system could eventually support a Base Camp population of 164 people. However, operation of the water treatment system at this level would classify the Kaho`olawe system as a public water system, requiring state certification. HAR 11-20-2 defines a public water system as a "system for the provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least sixty days out of the year." A system classified as a public water system may be privately or publicly owned or operated. In accordance with HAR 11-25-11, if the proposed RO system is considered to be a public water system, the RO unit would be classified as a Class 4 water treatment plant and require a Grade IV state certified water treatment plant operator on-site at all times.

Additionally, HAR 11-20-29 and 11-20-30 require submittal of supporting water quality data, completion of a sanitary survey, site characterization information, plan review and approval, and certification of the system by the State of Hawaii, Department of Health, Safe Drinking Water Branch, prior to use.

The resident population of Base Camp will be limited to no more than an average of 24 individuals, providing operational support services and quality assurance oversight. The proposed water system will be an exempt, non-public water system that will be operated (according to manufacturer's instructions) by experienced Base Camp personnel under the direct supervision of contract personnel who are state certified in the operation and maintenance of water treatment plants. Excess potable water manufactured in the RO unit will be utilized for irrigation and dust control, as well as in other industrial water applications. Bottled drinking water will be utilized for all operational personnel commuting daily and working on UXO clearance and environmental restoration related range activities.

Disposal of brine water will be accomplished using a brine storage tank and a leach field. The existing leach field (at its current location) will be expanded to meet an expected percolation requirement of 51,840 gallons per day. The expanded leach field will be positioned to prevent brine from percolating through the sides of the leach field trenches and flow overland into the ocean.

5.1.1.5 Utilities – Electrical

Toft Wolff Farrow, Inc. has completed a design to address electrical system life safety and code violations in Base Camp. This design considered the anticipated upgrades to Base Camp, particularly the berthing areas. These electrical system upgrades or improvements will:

- Replace the existing 175-kilowatt prime power diesel generator with a larger diesel generator capable of providing power to the new and future anticipated electrical loads within Base Camp. The existing 175-kilowatt generator will be rebuilt and used as a standby unit.
- Correct deficiencies in the overhead distribution system and the drops to the buildings.
- Update the existing building service equipment and provide new grounding electrode systems to accommodate the new load requirements and comply with the National Electrical Code.
- Divide the existing distribution system into two feeders for better load distribution and system reliability.

5.1.1.6 Gray Water

Gray water is currently collected from the shower trailer discharge and pumped to three 10,000-gallon bladders for storage and re-use. The effluent line between the sump pump near the shower trailer and the bladders along the southwest edge of the former LCU Staging Area is approximately 770-ft long and in varying stages of wear. The effluent line consists of a combination of 2-inch PVC pipe, 2-inch collapsible flex hose, and 4-inch solid flex hose. The gray water must then be pumped from the 10,000 gallon bladders to vehicle-mounted tankers for usage elsewhere.

When feasible, the collection system for gray water will be expanded to capture residual water from sinks and basins around Base Camp. The current effluent line and bladders in the boneyard are ineffective for use over the life of the project and will be replaced with a new collection system. The new system will be constructed to collect all gray water and pipe it into a sump at a low point in Base Camp for pumping into a 6,000 gallon storage tank for later reuse. Possible uses for gray water include dust control and nursery and revegetation irrigation. The three bladders will be relocated and reused for temporary storage of industrial water.

5.1.1.7 Industrial (Irrigation) Water

Rainfall runoff will be collected from the rooftops of the new Base Camp sleeper units and piped into the new gray water sump. Although the average rainfall in Base Camp is less than 10 inches per year, some water should be available from this procedure. Since water demands during construction may exceed supply (gray water, industrial water, and potable water), we will use sea water for dust control in areas where there will be no negative impacts to revegetation efforts or other negative environmental or natural resource impacts.

5.1.1.8 Sanitation

PUXB has evaluated the usage of the current composting toilets in Base Camp and determined that they meet the regulatory requirements for the proposed Base Camp population. However, two of these composting toilets must be relocated so that they are at least 100 feet, but no greater than 200 feet, from the berthing areas (as required by the OSHA temporary labor camp standards). In addition, two of the existing composting toilets will be relocated to the RC/OC. The waste material from these toilets will be collected, as necessary, and placed in compost piles for later use as fertilizer for plants and grasses.

Figure 26: Base Camp Improvements

<<<<<Insert Figure 7 from Logistics Study>>>>>>>

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5.1.2 Range Control/Operations Center

A centralized Range Control/Operations Center is required to effectively manage all range operations. The current operations center at Base Camp is too removed from the major activities on the island to adequately control all range activities. A location at LZ Seagull (near Lua Kealialalo) has been identified as the best location for this facility. The proposed location is along an upland ridge of the Honokoa `ili, which provides a good view of the land and ocean below. The Range Control/Operations Center complex (Figure 27) will be designed (in collaboration with the Navy and KIRC) to be easily converted for future use as a portion of one of the five proposed kahua kauhale (educational and cultural centers), as designated in the Kaho`olawe Use Plan. The building exterior will be of appropriate architecture, while the interiors will be designed for project specific functionality. This centralized location provides a more cost-effective entry and exit point for all personnel movements and will be the "eyes of the island," with periodic assistance from Base Camp.

To be effective, the proposed Range Control/Operations Center requires:

- One building for a central Range Control/Operations Center consisting of six to eight modular offices for range control consoles, communications, marine and air traffic control, and a temporary historic preservation curation facility. All rooms will be environmentally-controlled to accommodate the Data Management System and historic preservation curation.
- One building for additional management offices and a Mobile Intensive Care Technician staffed first aid station.
- One building for lodging of up to three contractor personnel, with a minimum of two at any one time for safety.
- An air traffic control trailer west of the fixed wing parking apron at the temporary landing strip for management of morning and evening inter-island personnel movements
- Relocation of the existing shower trailer from Base Camp and connection to an independent water storage facility, either one of the three existing 10,000 gallon bladders or a relocated 6,000 gallon water storage tank (Tank 3).

Solar and generator power sources, communications equipment, fuel supply, potable water, fire protection utilizing a hydro-pneumatic fire suppression pressure tank, and composting toilets (relocated from Base Camp) will be provided within the complex. Gray water, rainfall runoff, and residual liquids from composting toilets will be collected and used for nursery irrigation and fertilization.

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Figure 27: Range Control/Operations Center

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5.1.3 Inter-Island Transportation

5.1.3.1 Personnel

Effective inter-island transportation of Government and PUXB personnel requires upgrading and expanding the existing facilities on Kaho`olawe. Five primary personnel transportation and lodging alternatives (Figure 28) were considered and evaluated for the inter-island transportation of up to approximately 219 personnel during the project. The alternatives were:

Option 1: Fixed-wing + Base Camp. This option uses fixed-wing aircraft for daily transportation and allows for a daily average of 24 personnel to reside in Base Camp and up to three personnel overnight in the Range Control/Operations Center during the workweek.

Option 2: Helicopter + Base Camp. This option uses helicopters for daily transportation and allows for a daily average of 24 personnel to reside in Base Camp and up to three personnel overnight in the Range Control/Operations Center during the workweek.

Option 3: Expand Base Camp. This option expands Base Camp to accommodate the entire work force during the workweek and uses helicopters for weekly transportation.

Option 4: Ferry to Honokanai`a + Base Camp. This option uses a ferry for daily transportation from Maui to Honokanai`a Bay and allows for a daily average of 24 personnel to reside in Base Camp and up to three personnel overnight in the Range Control/Operations Center during the workweek.

Option 5: Ferry to Kuheia Bay + Base Camp. This option uses a ferry for daily transportation from Maui to Kuheia Bay and allows for a daily average of 24 personnel to reside in Base Camp and up to three personnel overnight in the Range Control/Operations Center during the workweek.

An analysis was performed for each of the above options, as summarized in Table 35. The most cost-effective inter-island transportation alternative (Figure 29) is Option 1 -- to construct a temporary landing strip on Kaho`olawe Island and transport personnel via fixed-wing aircraft with an average of 24 personnel residing in Base Camp daily. The Range Control/Operations Center will provide lodging for three additional personnel overnight during the workweek.

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Figure 28: Personnel Transportation and Lodging Alternatives

<<<Insert Figure 10 from Logistics Study>>>>>>>.

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Table 35: Inter-Island Transportation Alternative Evaluation

Option	Cost Evaluation	Advantages	Disadvantages
1	$23,206,657	• No disturbance to the existing marine mammal population • No known environmental and/or natural resource impacts • No known historic property impacts • Majority of the workforce commutes daily to the work site • Shorter travel times between the two islands • Full utilization of existing facilities • Temporary landing strip area can be readily returned to near existing conditions and topography • Limited weather related no-work days • Provides options for transport of personnel between Kaho`olawe and other islands (e.g., Maui, Lanai, and Molokai)	• Construction of a temporary landing strip on Kaho`olawe was not considered during development of the Kaho`olawe Use Plan
2	$30,226,734	• No known environmental and/or natural resource impacts • No known historic properties impact • Majority of the workforce commutes daily to the work site • Full utilization of existing facilities • Minimizes impacts to the island • No delays waiting for major infrastructure improvements • Fewer weather related no-work days than other options	• Longer travel time between Maui and Kaho`olawe than fixed-wing
3	$29,706,105	• Workforce can be from any island since everyone will live on Kaho`olawe during the workweek	• Any expansion of existing Base Camp will possibly endanger existing historic properties that surround Base Camp • Over 200 personnel living on-island for the life of this project will have a major environmental impact; this impact includes increased potable water production and increased liquid and solid wastes • The Kaho`olawe Use and Environmental Restoration Plans do not anticipate the impacts of a multi-year population of over 200 people or this expansion to Base Camp • Emergency evacuation from the island would require large numbers of rotary wing aircraft • More support personnel in Base Camp would be required to service the increased population
4	$29,394,876	• Provides facilities for support of inter-island transportation after the cleanup, consistent with native practices	• Possible adverse impact to the marine and terrestrial environment and associated natural resources; daily sea transports dramatically increases the probability of disturbance to endangered and protected species and habitats including the monk seal, the green sea turtle, and the humpback whale • Increased impacts to the marine waters of the bay (classed as Class AA waters by the State of Hawaii, Department of Health) -- Class AA waters are to remain in their natural pristine state with an absolute minimum of pollution or alteration of water quality from any human-caused source or action • More people are prone to seasickness than airsickness • Over 180 people must embark and disembark from Ma`alaea Harbor every workday and park their vehicles at the harbor's limited parking facility • Significant areas of the beach are prone to erosion during storms with Kona winds • Workers will spend approximately 90 minutes each day in transit to and from Kaho`olawe; this increases their time away from home (Maui) to 12.25 hours per day during the 10-hour day, 4-day week schedule and 10.25 hours per day during the 8-hour, 5-day work week • The single point of departure/arrival at Ma`alaea Harbor prevents departures or arrivals from other islands and staggered departure/arrival times
5	$24,819,872	• Provides facilities for support of inter-island transportation after the cleanup, consistent with native practices	• Possible extreme impacts to the environment and natural resources; daily sea transports dramatically increases the probability of disturbance to endangered and protected species, such as the green sea turtle and the humpback whale • More people are prone to seasickness than airsickness • Over 180 people must embark and disembark from Ma`alaea Harbor every workday and park their vehicles at the harbor's limited parking facilities • Workers will spend approximately 60 minutes each day in transit to and from Kaho`olawe; this increases their time away from home (Maui) to 11.75 hours per day during the 10-hour, 4-day week schedule and 9.75 hours per day during the 8-hour, 5-day week schedule • Increased impacts to the waters of the bay (classed as Class AA waters by the State of Hawaii, Department of Health). Class AA waters are to remain in their natural pristine state with an absolute minimum of pollution or alteration of water quality from any human caused source or action • Existing road from Kuheia to Lua Makika is an historic property (Feature B-10 of Site 175) and will require assessment and mitigation prior to construction of the new proposed road • The area between the end of the existing road and the beach contains the main ranch headquarters complex (Feature B-3), a cistern (Feature B-5), and a water catchment/dam feature (Feature B-6). Prior examination of this area in 1984 (Tomonari-Tuggle and Carter) indicates that subsurface cultural deposits are present in the area. Surface features date to the 19th and early 20th centuries. Subsurface deposits are most likely Pre-contact and could potentially be quite old, given the location at a protected natural landing area. Additional assessment and possible mitigation prior to construction may be required • The Site Protection Agreement emphasizes the protection and preservation of historic properties to the extent possible. In complying with this Agreement, the road design may have to be altered, including realignment of the roadway and/or limited road use (i.e., personnel only versus personnel and equipment • Kuheia Bay is a possible wetlands area because it lies at the mouth of a drainage area • The single point of departure/arrival at Ma`alaea Harbor prevents departures or arrivals from other islands and staggered departure/arrival times

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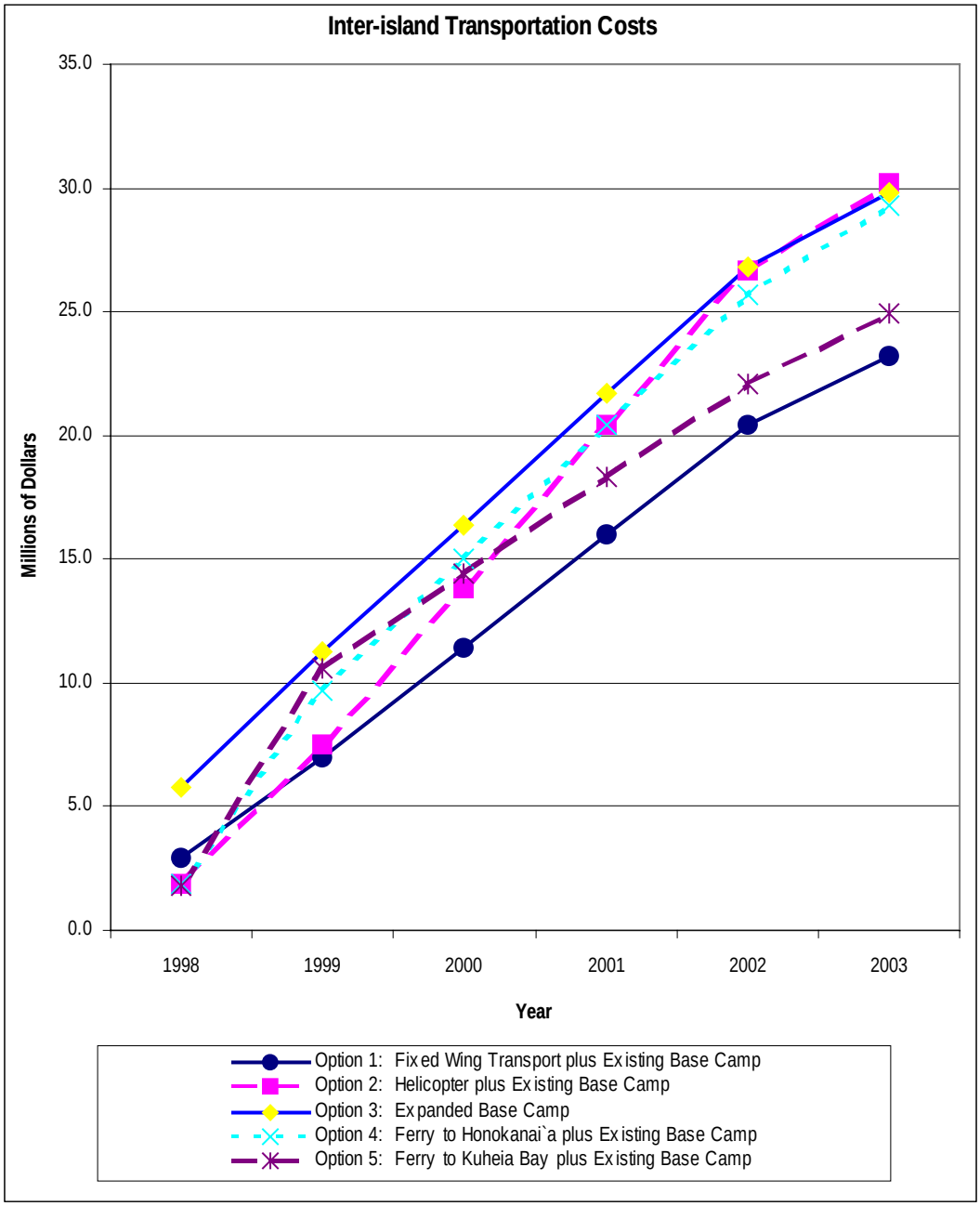
Figure 29: Inter-Island Transportation Cost Summary



5.1.3.1.1 Temporary Landing Strip

The most effective transportation alternative for PUXB and Government personnel is fixed-wing aircraft operating between the Kahului Airport General Aviation Facility on Maui (and possibly other islands) and a temporary landing strip to be constructed on Kaho`olawe. The aircraft will be based on Maui or Oahu at night and on Kaho`olawe during the workday.

A 50-ft. wide by 3,800-ft. long temporary landing strip for fixed-wing aircraft will be constructed near the previously described proposed Range Control/Operations Center (Figure 27) at LZ Seagull and near Lua Kealialalo. A loading/unloading apron, air traffic control trailer, and MEDEVAC helicopter pad will be constructed adjacent to the proposed temporary landing strip. Construction and operational criteria were based on the following:

- Chartered flight operations
- Twin Otter or equivalent 18-20 passenger aircraft
- Visual Flight Rules operations
- Federal Aviation Regulation Part 139 exemption
- Temporary landing strip with an adjacent loading/unloading apron
- Tier II clearance of the landing surface to a depth of 4 feet below the deepest excavation
- Temporary fiberglass landing mat material installed over a soil-cement stabilized base
- Runway alignment will be 90° - 270° to align with the predominant prevailing winds

The temporary landing strip is exempt from the requirements of Federal Aviation Regulations, Part 139 because it will service aircraft that will carry less than 30 passengers each. The temporary landing strip is also exempt from Hawaii Administrative Rules, Title §19-11-12 because it is a private-use, Government facility.

The location of the temporary landing strip at the Range Control/Operations Center was selected based on the following factors:

- Minimal environmental, natural resource, and historic property impacts
- Limited site grading required because of the existing relatively flat topography
- Low visual impact from a K-1 Road perspective (Makahiki route); the temporary landing strip is screened from K-1 Road by Pu`u Kahua (Figure 30)

The temporary landing strip can be constructed in late 1998 and ready for flight operations by January 1999. The construction will include UXO clearance, grading, preparation of the soil-cement base, installation of the temporary fiberglass landing mat, and emergency lighting. At the conclusion of the project, the landing strip and aprons will be removed, the natural grade restored, and revegetation performed.

Figure 30: Proposed Temporary Landing Strip

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5.1.3.2 Supplies, Materials, and Equipment

There are three modes of inter-island transportation for equipment and materials. They are:

- A ramp barge with beaching capability to deliver equipment and supply loads of up to 750 tons. A temporary, three-point mooring system (two moorings on-shore and one mooring off-shore), located at Honokanai`a, will be used for loading and unloading during the project. This system has four advantages over a permanent pier:
  - Cost-effective
  - Permits the transportation of cargo and equipment via sea without impacting the natural surroundings of the Honokanai`a beach area
  - Deliveries can be scheduled to avoid interference with the beach habitat of the monk seal
  - Underwater UXO clearance is only required at the one off-shore mooring buoy site
- An all-purpose utility ship that is capable of delivering fuel and fresh water via pump and hose discharge, and up to 75 tons of equipment and supplies which must be unloaded to smaller beaching capable craft. The temporary three-point mooring system (described above) can be used for this ship.
- Helicopters and fixed-wing aircraft which can lift or transport up to 5,000 pound loads.

5.1.4 Intra-Island Transportation

Based on Model Project experience, a one-mile corridor along each side of all existing roadways and a one-mile radius around each helicopter landing zone is the effective productivity limit for foot travel. However, there still remains a large portion of the priority clearance areas (as established in the Kaho`olawe Use Plan) beyond the limits of foot access. (Figure 31) Therefore, additional landing zones and improvements to certain trails for vehicular traffic are required to support operations.

5.1.4.1 Roadways/Trails

Upgrades to certain of the existing roadways and trails must be constructed in order to afford more cost-effective personnel transportation. We will design and construct the road/trail upgrades within the existing corridors, except where limited by existing width or geometrics. Designs will be consistent with the geometric guidelines shown in Table 36 and be of sufficient detail and documentation to meet Navy and KIRC review requirements. All design and construction will include measures to mitigate impacts to Kaho`olawe's existing historic properties and natural resources.

Proposed roadways to be upgraded are shown on Figure 31 and further defined as follows:

- K-1 Road from Base Camp to Lua Makika
- Seagull Road from K-1 Road to the Range Control/Operations Center
- K-2 Road from K-1 Road to LZ3

- Road from K-1 Road to the Explosive Holding Area
- Road from K-1 Road to the Open Storage Area
- Road to the new Open Burn/Open Detonation (OB/OD) area

In addition, certain existing trails (as shown on Figure 31) require improvements to support limited vehicular traffic.

In general, we do not anticipate increases in drainage runoff while upgrading the existing road/trail systems. Conversely, road/trail improvements could provide mitigation of some current drainage runoff problems. Existing ground surface runoff and flow paths will be improved with no adverse impact on the times of concentration and runoff quantities.

Rocks from the quarry site, identified during the Model Project, will be required for construction of erosion control and storm water management improvements. The limits of the previously identified quarry site may require expansion and/or an alternate quarry site designated. Prior to any quarry operations, an area assessment will be conducted and presented for Navy and KIRC approval through the Review Board process described in Section 2.4.2.

We forecast that the designated quarry site(s) contains insufficient rock to process for use as an aggregate base for all anticipated road/trail improvements. Transporting additional aggregate base material from off-island involves costly triple handling of great volumes of material (off-island quarry to barge, barge to on-island storage site, and storage site to construction sites). Therefore, a cost-effective alternative is the utilization of cement (6% by volume of roadway prism) and native soil to create a cement-treated soil stabilized roadway base.

The design for improvement to existing roads and trails for vehicular traffic in support of the UXO clearance activities will consider:

- Reducing susceptibility to storm water runoff and erosion
- Improving vehicular travel speed
- Reducing the likelihood of injury
- Avoidance of any archaeological sites adjacent to the existing road bed

Figure 31: Effective Transportation Network

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Table 36: Roadway Design Elements

Design Control Elements	Roadways	Vehicular Trails
Roadway Classification	Class F	Temporary
Design Speed	20 mph	15 mph
Roadway Cross Section		
Lane Width (ft.)	16 – 18 feet	12 feet
Cross Slope (in./ft.)	1/2 – 1/4 inch/feet	1/4 inch/feet
Shoulder (ft.)	4 feet	2 feet
Cross Slope (in./ft.)	3/4 – 1 inch/feet	3/4 inch/feet
Minimum Stopping Sight Distance (ft.)	200 feet	150 feet
Minimum Horizontal Curve Radius (ft.)	98.7 feet	60 feet
Vertical Alignment		
Grade Maximum (%)	12%	14%
Vertical Curve (K Value)		
Crest Vertical	15	15
Sag Vertical	18	18
Minimum Length	60 feet	60 feet

5.1.4.2 Helicopter Landing Zones

The existing helicopter landing zones require repair and/or upgrading to support the project through 2003. All existing landing zone pads must be removed, the ground cleared of unexploded ordnance to Tier II standards, and reconstructed. The two landing zones in Base Camp will be replaced with three 6-meter by 8-meter landing zone pads (Figure 26). The Marston Mats in the Base Camp landing zones can be salvaged and used to upgrade other existing landing zones or to construct new landing zones. At least two new landing zones (Kuheia and Ahupu, shown on Figure 31) are needed to increase productivity and provide controlled areas for unloading supplies and equipment. All landing zones will be constructed of pierced steel panels, Marston Mats, or concrete depending on their anticipated usage and longevity. All landing zones will be classified as “temporary use” per Federal Aviation Administration definitions.

5.1.5 Materials Staging, Shipment, and Storage

5.1.5.1 DRMO Interim Storage Facility

A DRMO Interim Storage Facility (Figure 32) will be established for storage of materials collected during the cleanup until transfer to DRMO – Hawaii or other designated DRMO facility. This facility will consist of a fenced enclosure with cross-fenced interior partitions. These interior partitions will allow for the segregation of materials (UXO-related remnants, target materials, and UXO-related materials) by type and origin (explosive versus non-explosive).

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Figure 32: Proposed DRMO Interim Storage Facility

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5.1.5.2 Solid Waste Facilities

Solid waste handling will be expanded to include a recycling program to separate recyclable paper, aluminum, glass, plastic, and cardboard from the trash generated in Base Camp. Each Base Camp building will be equipped with recyclable collection containers which will be periodically emptied into dumpsters dedicated for each type of recyclable material.

5.1.5.3 Fuel Storage Tanks

The safest and most effective method to store and manage fuels is in a centralized location in Base Camp. A centralized storage of fuels — an 8,000-gallon diesel storage tank, an 8,000-gallon gasoline storage tank, and an 8,000 gallon aviation fuel storage tank — will be the most cost-effective for the life of the project. These new tanks will be situated next to the proposed DRMO Interim Storage Facility. An additional 2,000-gallon diesel storage tank is planned for the Range Control/Operations Center near Lua Keālialalo to supply its diesel generator. The existing 1,100-gallon diesel tank will continue to serve the Base Camp generator units.

5.1.5.4 UXO and Explosives Storage Facilities

5.1.5.4.1 Explosive Holding Area

Explosives will be stored in the Explosive Holding Area (EHA). Sign boards will be placed on each magazine, according to Department of Transportation and National Fire Protection Association regulations. If repairs are necessary within the EHA, all explosive materials will be removed, placed a safe distance from the EHA, and guarded until the repairs are completed. Battery-activated safety lights or lanterns may be used in the EHA.

5.1.5.4.2 Ammunition Transfer Points (ATP)

Ammunition Transfer Points (ATPs) will be used to transfer incoming ammunition to the explosive handling vehicle for transport to the Explosive Holding Area. The Department of Defense Explosives Safety Board has approved three ATPs for use. The ATP at LZ Seagull will be the location primarily used in UXO operations. The ATPs at Base Camp will only be used in emergencies.

5.1.6 Open Burn/Open Detonation Area

5.1.6.1 Open Burn

The Department of Army Technical Bulletin 700-4 requires suspect materials to be certified to be absolutely free of any possible explosive residues prior to being excessed as scrap metal or solid waste refuse. Thermal treatment is judged and accepted as being an extremely reliable means to assure public safety with regards to these types of potential hazards.

The Open Burn area will consist of two interlocking dirt pads and have the capability for 12 burn pans, a primer pit, and two incendiary cages with burn boxes. Operationally, the Open Burn area will only burn in every other burn pan.

The primer pit operation involves treatment of small explosive components, such as cartridge primers and small arms. This operation consists of a heavy steel pan with graded cover. The pan will be constructed of a 1 ¼ inch carbon steel. The top of the pan is 7 feet by 5.5 feet and is tapered to 2.4 feet by 3.5 feet at the bottom. The pan stands approximately 2.5 feet by 3 feet tall. The lid will be constructed of the same material with half inch slots which allow oxygen to enter and hot gases to vent. An inspection pan is located near the primer pit for inspection of

thermally treated materials. No thermal treatment occurs in this inspection pan. Components which have been treated at the primer pit are placed in this pan and visually inspected to insure all have functioned and are certifiable as 5X.

The incendiary cage and burn box are provided for flashing or thermal treatment of explosive contaminated and suspect explosive contaminated materials. The burn box is a steel wire cage with a steel bottom that smaller items can be put in and then placed in the incendiary cage and thermally treated. An example of smaller items treated in this manner are UXO remnants and smaller target debris. Larger items (e.g., target jeeps and trucks) may be placed in the incendiary cage and thermally treated.

The burn pans are suspended off of the ground by means of concrete parking blocks. The area under and immediately around these pans will be covered with a bed of sand to aid in the routine cleanup of kick-out material. Solid bulk propellant and explosives are open burned (thermally treated) in clay-lined steel pans. This insulates the steel pan from the direct heat, which keeps the pan from warping and losing tensile strength. The pans have aluminum lids to be used when the pans are not in operation. The maximum net bulk propellant weight for each pan is 1,500 pounds, while the maximum net bulk explosive is 500 pounds. Prior to placing the bulk propellant or explosive in the burn pan, the propellant/explosive container is electrically bonded to the pan by a ground strap to prevent stray static electricity discharge. After bonding is complete, the operator is then allowed to pour and spread the propellant/explosive out evenly/uniformly across the width of the pan. Remote initiation for each pan is accomplished. The average time taken for 1,500 pounds of bulk propellant to burn is 15-30 seconds, while 500 pounds of bulk explosive can take 4-60 minutes, depending upon the type of explosive being burned. After all visible flames have subsided, the supervisor then enters the area and verifies that unsafe conditions do not exist. The operators will then go back in and clean up ash and any pop-out materials. Inspection and explosive/propellant burning pan all have run-on and run-off controls in the form of lids.

5.1.6.2 Open Detonation

The Open Detonation area will consist of six detonation pits. Operationally, the Open Detonation area will detonate in every other detonation pit each day for cool down purposes.

The Open Detonation area was sited using the MK 83 General Purpose bomb (1,000 pounds) for the fragmentation standoff distance and with a maximum of 1,000 pounds NEW per detonation (two MK 83s). The maximum calculated expected fragmentation standoff distance is 5,153 feet; however, testing indicates that with 6-15 feet of earth cover, based upon the amount of NEW being detonated, the fragmentation standoff distances may be dramatically reduced (e.g., 1,500 pounds NEW with 9-15 feet of earth cover with a 20% safety margin gives a fragmentation standoff distance of 2,800 feet. The initial site safety request for the Open Detonation range is for the 5,153 feet and with data being collected during the first 3-5 detonation and the results being reviewed and for a proposed reduction in the fragmentation standoff distance.

Each Open Detonation pit will be 6 feet by 10 feet by 6 feet and will have a tire barricade erected surrounding the pit. The tire barricade will consist of overlapping rows of tires, three deep. The detonation will be witnessed by the area supervisor from the safety point located at the calculated standoff distance for the NEW being detonated to verify the completeness of detonation or any indication of problems with the detonation.

5.1.7 Communications

The existing communications system will be upgraded or replaced so that the entire island of Kaho`olawe has radio and cellular telephone coverage to Maui (Kahului Airport and the Maui Technical Office). This expanded service will allow cost-effective voice, real time data transfer, facsimile, and electronic mail capabilities between Base Camp, field work crews, the Range Control/Operations Center, the Maui Technical Office, and the Navy and PUXB Program Management Office on Oahu. The VHF marine band radio and the access to the Federal Emergency Management Agency Disaster Preparedness Network will also be re-established.

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Section 6 Environmental Restoration/ Remediation

6.1 UXO Clearance Areas

A number of potential contamination sites that may require environmental restoration/remediation have been previously identified and are listed in Section 2.2.4, Table 13. Additional potential contamination sites containing similar waste materials may be discovered as UXO clearance operations progress. An Engineering Trade-Off Analysis (ETA), addressing removal and disposition alternatives for each identified potential wastestream, was completed and summarized in Section 4.2.

Each potentially contaminated site (known or discovered) will be assessed concurrently with clearance activities in each work area. UXO clearance will be completed; site-specific sampling and analysis plan prepared and implemented; and appropriate disposition actions completed in accordance with Section 4.2.9, Table 34.

6.2 KIRC Restoration Plan

Clearance priority areas and clearance depths will be based on the specified land uses as stated in the Kaho`olawe Use Plan. To the maximum extent possible, clearance operations will be coordinated with the Kaho`olawe Environmental Restoration Plan.

Work areas will be designated for KIRC restoration activities after UXO clearance operations and grid close out have taken place. The RC/OC will coordinate the scheduling, access, and movement control of restoration personnel with adjoining UXO clearance activities.

6.3 Erosion and Runoff Control Standards

In accordance with Section IV.D. of the RFW, site-specific erosion and runoff control standards have been developed for implementation during UXO clearance and logistical support construction activities. These standards, outlined in the Work Plan, Appendix C: Environmental and Natural Resource Protection Plan, reinforce our commitment to preserving the natural history of Kaho`olawe Island Reserve and recognize the island's status as a cultural and natural preserve. These standards were designed to protect and enhance the island's environment and natural resources during and after on-island operations, and upon KIRC and Navy approval, shall be mandatory requirements to be followed during all UXO clearance and related activities.

Soil erosion and sedimentation control provisions will be designed to comply with standards established in Chapter 20.08 – Soil Erosion and Sedimentation Control of the Maui County Code. Chapter 20.08 provides the minimum standards to safeguard life and limb and to protect property by regulating and controlling the grubbing and grading operations within the County of Maui.

Storm drainage improvements and facilities shall be designed to the standards established in Title MC-15, Department of Public Works and Waste Management, County of Maui, Subtitle 0, Chapter 4, "Rules for the Design of Storm Drainage Facilities in the County of Maui." Title MC-15 governs the design of storm drainage facilities in the County of Maui.

Runoff values will be based on criteria established in Title MC-15. Hydrologic criteria will be based on the drainage area and type of drainage improvement (e.g., roadway culvert, retention basin). The method of estimating runoff quantity will be determined by the size of each task's drainage area. For drainage areas of 100 acres or less, the Rational Method will be used. For

drainage areas greater than 100 acres and all streams, the Natural Resource Conservation Service method will be used. The Natural Resource Conservation Service computer program TR55 or TR20 may be used in lieu of the Natural Resource Conservation Service hydrographic analysis method.

Permanent stabilization will include the planting of seeds and seedlings. Native and Polynesian-introduced plant species will significantly add to the cultural and natural aesthetics of the island. These plants will also provide important soil stabilization properties and increase water-holding capacity in the soils. Seeds of native plants will be collected from established sources and conform to protocols listed in the Kaho`olawe Environmental Restoration Plan (1997).

Accessible areas, where on-island materials for erosion control may be obtained, will be identified. Within each area, a visual survey will be conducted to identify the natural resources that may be suitable for erosion control. Areas will be located and identified where sand, aggregate, and rock may be quarried and stockpiled.

6.4 Impacts of the Proposed Action

Best efforts will be used to minimize impacts to the environment and historic properties during clearance activities. Environmental restoration efforts will include, to the maximum extent possible, the use of appropriate plants in certain areas for erosion control, use of alien plants for mulching, utilization of existing items on island (e.g., tires) for erosion control, and prevention of the spread of alien species through specific prevention procedures. Historic sites and endangered species that may be impacted by in-situ disposition of UXO will be protected through the use of mitigation protocols and procedures (such as protective works). PUXB's diligent use of native species will add to the cultural and environmental restoration of Kaho`olawe Island.

Section 7 Review Comments and Responses

The Public Participation Agreement, Appendix C of the Regulatory Framework, provides guidance to promote the involvement of the community and assure effective communication with the community by providing information in a timely manner, soliciting public comments, and considering those comments in the decision-making process.

Section II.D of the Public Participation Agreement states:

> "In accordance with the MOU and as described in Section III.A.2 of the RFW, the Navy, in consultation with the KIRC, will develop a Cleanup Plan. The Navy shall make the Cleanup Plan readily available to the public for a review and comment period of not less than 30 calendar days from the time it is made available.
>
> 1. During the comment period, the KIRC will assist the Navy to present the Cleanup Plan in public meetings which will be held on Oahu, Maui, Molokai, Lanai, Hawaii, and Kauai.
> 2. The KIRC will sponsor and provide notice of the meetings in consultation with the Navy. The Navy may provide additional notice in consultation with the KIRC.
> 3. The Navy will solicit public comments and prepare written responses to significant comments.
> 4. The Cleanup Plan, public comments, and written responses will be included in the administrative record files."

Preparation of the Cleanup Plan has been an iterative process involving the Navy; DoD; KIRC; PUXB; other Federal, State, and local governmental agencies; and the public at large. The Navy and KIRC have participated in numerous meetings over the past 12 months regarding the Cleanup Plan requirements and development of a recommended Table of Contents.

The KIRC has had input into the development of the Cleanup Plan and its supporting documents. The KIRC has submitted written comments to the Navy on each draft of the Cleanup Plan, as well as associated Work Plan and appendices plans, Logistics Study, and Engineering Trade-Off Analysis. Copies of these comment letters may be obtained directly from the KIRC.

The draft Cleanup Plan was made available for public distribution on May 6, 1998, thus initiating the 30 calendar day public review and comment period.

A Notice of Availability was printed in the following newspapers on May 6, 1998:

- West Hawaii Today - Hawaii (Kona)
- The Hawaii Tribune - Hawaii (Hilo)
- The Garden Island - Kauai
- Molokai Advertiser News - Molokai
- The Maui News - Maui
- Honolulu Advertiser - Oahu

On May 14, 1998, an additional Notice of Availability was printed in the Molokai Dispatch.

The text of the Notice of Availability follows:

NOTICE OF AVAILABILITY
NAVY CLEANUP PLAN AND
ENGINEERING TRADE-OFF ANALYSIS (ETA)
FOR UNEXPLODED ORDNANCE CLEARANCE AND REMOVAL AT
KAHO'OLAWE ISLAND, HAWAII

The U.S. Navy has initiated a clearance and removal action in a manner consistent with 40 CFR 300, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), to clear, treat, and dispose of unexploded ordnance and ordnance related explosives (UXO/OE) and UXO-related remnants on the Island of Kaho'olawe, Hawaii. Several alternatives for the treatment or disposition of UXO/OE and UXO-related remnants that are safe-to-move were evaluated as part of the Engineering Trade-off Analysis (ETA). In addition, the ETA evaluated several alternatives for the removal, treatment, and disposition of other than UXO contaminants. The ETA evaluated such factors as cost, effectiveness, and implementability of each alternative. The proposed treatment or disposition alternative for UXO/OE and UXO-related remnants is the open burn treatment method. The proposed alternatives for the removal, treatment, and disposition of the other contaminants varied depending on the type of contamination and the media of contamination. The Cleanup Plan summarizes the purpose, goals and objectives, project approach, site characterization, source, nature and extent of contamination, UXO clearance and disposal operations (including abbreviated discussions relating to the ETA), logistical support improvements, environmental restoration/remediation, and project closeout.

The Cleanup Plan and ETA are currently available for review and comment by any interested agencies, individuals, and groups at the following locations:

Island of Hawaii:

- Kailua – Kona Library
  76-140 Hualalai Rd.
  Kailua-Kona, HI 96740
- Hilo Regional Library
  P.O. Box 647
  Hilo, HI 96720

Island of Maui:

- Hana Library
  P.O. Box 490
  Hana, HI 96713
- Lahaina Library
  680 Wharf Street
  Lahaina, HI 96761
- Wailuku Regional Library
  P.O. Box B
  Wailuku, HI 96793

Island of Lanai:

- Lanai Public and School Library
  P.O. Box A-149
  Lanai, HI 96763

Island of Molokai:

- Molokai Library
  P.O. Box 395
  Kaunakakai, HI 96748

Island of Oahu:

- Kaho'olawe Island Reserve Commission
  33 South King Street, Suite 501
  Honolulu, HI 96813
- State Main Library
  478 South King Street
  Honolulu, HI 96813
- Pearl City Regional Library
  1138 Waimano Home Road
  Pearl City, HI 96782
- Kaimuki Regional Library
  1041 Koko Head Ave.
  Honolulu, HI 96816
- Kaneohe Regional Library
  45-829 Kamehameha Hwy
  Kaneohe, HI 96744

Island of Kauai:

- Kauai Regional Library
  4344 Hardy Street
  Lihue, HI 96766

The Cleanup Plan may be reviewed on the Internet website of the Pacific Division, Naval Facilities Engineering Command's homepage at:

http://www.efdpac.navfac.navy.mil

Click on "PACDIV News", and a Kaho'olawe icon will appear. Click on the icon, and choose either of two options: "Cleanup Plan" or "ETA".

Individual copies of the Cleanup Plan will be available for purchase during the 30-day Public Participation review at a cost of $23.00 per copy. Individual requests, along with a check or money order made payable to Parsons - UXB, may be mailed to:

Parsons - UXB, JV
Attn.: CLUP
1357 Kapiolani Blvd., Suite 1120
Honolulu, HI 96814-7181

Written comments are encouraged and should be mailed to the address below no later than June 5, 1998

Contact: Mr. Don Rochon, Navy Public Affairs Officer
C/O Pacific Special Contracts, Code 0223
Pacific Division, Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300
Telephone: (808) 471-0774

In addition, the Administrative Record File is also available for public review. The Administrative Record File includes documents such as past studies and reports that form the basis for the selection of clearance and removal actions at the site. Please contact the Public Affairs Officer at the aforementioned address and telephone number.

The U.S. Navy and the Kaho'olawe Island Reserve Commission will jointly have a public review meeting on each island. The meeting's purpose is to present and receive public comments on the Cleanup Plan and ETA. The meeting dates and locations are:

Island	Date	Time	Location
Hawaii - Kona	May 11, 1998 (Monday)	7:00 p.m. to 10:00 p.m.	Hale Halawai 75-5760 Alii Drive Kailua – Kona, HI
Hawaii - Hilo	May 12, 1998 Tuesday	7:00 p.m. to 10:00 p.m.	University of Hawaii, Hilo Campus 200 W. Kawili Street Campus Center, Room 306 – 307 Hilo, HI
Kauai	May 13, 1998 (Wednesday)	7:00 p.m. to 10:00 p.m.	Kauai Community College Dining Room 3-1901 Kaumualii Hwy Lihue, HI
Molokai	May 14, 1998 (Thursday)	7:00 p.m. to 10:00 p.m.	Mitchell Pauole Community Center Ainoa & Alamalama Kaunakakai, HI
Lanai	May 18, 1998 (Monday)	7:00 p.m. to 10:00 p.m.	Lanai Public and School Library Fraser Avenue Lanai City, HI
Maui	May 19, 1998 (Tuesday)	7:00 p.m. to 10:00 p.m.	Wailuku Community Center 279 Hala Place Wailuku, HI
Oahu	May 20, 1998 (Wednesday)	7:00 p.m. to 10:00 p.m.	State Capitol Auditorium Punchbowl Street Honolulu, HI

As stated in the Notice of Availability, seven (7) public meetings were scheduled during the 30-day comment period. Table 37 summarizes the participation at these public meetings.

Table 37: Public Participation Meetings

Location	Date	Registered Attendees/ Commentors	Public Comments Received
Big Island - Kona	May 11, 1998	4	4
Big Island - Hilo	May 12, 1998	26	16
Kauai	May 13, 1998	17	20
Molokai	May 14, 1998	26	57
Lanai	May 18, 1998	3	6
Maui	May 19, 1998	77	49
Oahu	May 20, 1998	69	49
Written Comments	June 5, 1998	26	434
	TOTAL	248	635

In addition to submitting comments at the public participation meetings conducted on each island, the public was given opportunity to submit written comments during the comment period. In accordance with the Public Participation Agreement and consistent with CERCLA, the Navy has responded to each significant comment, and these responses are attached as follows:

- Tab A -- contains the comments received during the public participation meetings and the corresponding responses
- Tab B -- includes a synopsis of the written comments submitted to the Navy and the associated responses
- Tab C -- contains full copies of the written comments submitted to the Navy

The draft responses to public comments were reviewed with the KIRC staff and presented at the KIRC workshop and public meeting on June 24, 1998. The draft responses will be distributed to all identified commentors at the public meetings and to those providing written comments prior to the end of the 30-calendar day comment period (June 5, 1998). In addition, two additional public meetings were schedule to review draft responses -- one on Maui during the week of July 6, 1998 and one on Oahu during the week of July 20, 1998.

As a result of the public participation process, 14 revisions have been incorporated into the Cleanup Plan. A summary of these revisions is show in Table 38.

Table 38: Cleanup Plan Revisions Resulting from Public Participation Process

Section	Revision
1.1.2	Clarified historical text
1.4.1 Table 1	Revised text -- Tier II - removal or clearance of UXO from no more than 30% in aggregate of the surface of the island Added text that PKO accesses under the Consent Decree remain in effect
1.6.1.2 Figure 8	Revised figure -- KIRC Executive Director reports to the Kaho`olawe Island Reserve Commission

Section	Revision
1.6.3 Figure 11	Deleted "if appropriate" under Scoping Meeting
2.1.4.4	Added reference to the Protect Kaho`olawe Foundation Water Resources Study of 1990.
2.1.7.2	Deleted reference to the tires being military features that have the potential to become eligible for inclusion on the National Register
2.1.9.2	Added text regarding PKO and University of Hawaii operated weather station at Kealialuna
2.2	Added text that there are no records of depleted uranium based ordnance used on Kaho`olawe.
3.3.3.5.1	Added text that "only chemicals approved by the United States government for agriculture purposes will be permitted for use on Kaho`olawe.
3.3.3.7.4	Clarified debris/remnants collection, staging at DRMO Interim Storage Facility, and transport to DRMO - Barber's Point
4.1.3.3.3 Table 22	Revised Off-Island Recycling for vehicle batteries to delete "in Hawaii"
4.1.5.3.1 4.1.5.3.2 4.1.6.4.1 4.1.7 Table 26 4.2.7.3.3 4.2.7.3.4 Table 28 4.2.8.3.2 Table 34	Clarified text regarding disposition of batteries and asbestos
7	Completed section on Review Comments and Responses
11	Revised Denfeld entry; added Protect Kaho`olawe Foundation Water Resources Study reference.

In accordance with the Public Participation Agreement directives, the Cleanup Plan, public comments, and written responses will be included in the administrative record files.

Tab A: Public Meeting Comments and Draft Responses

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Tab B: Written Comments and Draft Responses

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Tab C: Full Text Written Comments

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Section 8 Hawaiian Terminology[1]

Ahupua`a	A land division usually extending from the uplands to the sea.
Ali`i	Chief, chiefess, officer, ruler, monarch, peer, headman, noble, aristocrat, king, queen, commander; royal, regal, aristocratic, kingly; to rule or act as a chief, govern, reign; to become a chief.
Hakioawa	Location of ancient settlement on the northeastern cost of Kaho`olawe.
Hale Halawai	Grass-thatched meeting house.
Honokanai`a	Location of the Navy Base Camp on southwestern coastline of Kaho`olawe. Meaning – "The playground of the nai`a (dolphins). Sometimes referred to as Honokanai`a and Smugglers Cove on early maps.
`Ili	Land section, next in importance to ahupua`a and usually a subdivision of an ahupua`a.
Kaho`olawe	To be carried away.
Kahu o ka `āina	Stewards of the land.
Kanaloa	The major Hawaiian god who was a guardian of ocean resources, marine life, and ocean navigation.
Kapu	Taboo, prohibition; special privilege or exemption from ordinary taboo; sacredness; prohibited, forbidden; sacred, holy, consecrated; no trespassing, keep out.
Kealaikahiki	A point on the southwestern coast of Kaho`olawe, also the name for the channel of water on the western side of Kaho`olawe between Kaho`olawe and Lanai. Meaning – "The pathway to Tahiti".
Kohem~lamalama O Kanaloa	The beacon of light of Kanaloa.
Kuhina Nui	Prime minister.
Lua Makika	The crater of Pu`u Moa`ulanui.
Māhele	Land reform of 1848 initiated by Kamehameha III which replaced the traditional Hawaiian concept of land stewardship with the western legal concept of land ownership.
Makahiki	Ancient festival beginning about the middle of October and lasting about four months. On Kaho`olawe, a Makahiki

[1] Definitions from the Hawaiian Dictionary, Mary Kawena Pukui and Samuel H. Elbert, 1986

	procession follows the “Makahiki Trail” from Hakioawa to Kealaikahiki.
Mele	Song, anthem, or chant of any kind.
Mo`olelo	Story, tale, myth, history, tradition, literature, legend, journal, log, yarn, fable, essay, chronicle, record, article.
`Ohana	Family, relative, kin group.
Pu`uhonua	A place of refuge, sanctuary, asylum, place of peace and safety.
Pu`u Moa`ulaiki	A traditional site used in Hawaiian navigation. Sometimes referred to as Pu`u Moaula.
Pu`u Mōiwi	Site of the adze quarry; said to be the second largest in Hawaii.
Wahi Pana	Legendary place.

Section 9 Definitions

Ammunition	A contrivance charged with explosives, propellants, pyrotechnics for initiating compositions used for military purposes.
Burning Areas	Area of site where waste munitions are open burned. Also called burning ground(s), burning site(s), and open-burning area(s) or site(s).
Composite Propellant	A propellant consisting of two or more energetic constituents. Also known as multi-based propellant.
Deactivation Furnace	A furnace wherein small arms ammunition through 20mm and other small loaded ammunition components such as primers, detonators and certain fuzes are destroyed by exposing them to high temperatures. Also call Destruction Chamber or Retort Furnace.
Decontamination	Levels of decontamination are assigned, based upon local determination, to all items which have been subject to liquid or long term vapor contamination.
	X — A single X indicates that the level of decontamination is unknown or the item is contaminated.
	XXX — 3X indicates the item has been examined and surface decontaminated by approved procedures and no contamination can be visually noted on accessible surfaces or in concealed housings, etc. It is not safe to be treated with open flame, high temperature heating devices, cutting devices, or hammering devices.
	XXXXX — 5X indicates the item is clean and may be released from government control without precautions or restrictions.
Deepwater Disposal	Ocean dumping of unserviceable ammunition and explosives in water at least 500 fathoms deep and more than 10 miles from shore. Also called Deepwater Dumping.
Deflagration	A rapid chemical reaction in which the output of heat is sufficient to enable the reaction to proceed and be accelerated without input of heat from another source. Deflagration is a surface phenomenon with the reaction products flowing away from the reacted material along the surface at subsonic velocity. The effect of a true deflagration under confinement is an explosion; confinement of the reaction increases pressure, rate of reaction and temperature, and may cause transition into a detonation.
Demilitarization	The rendering of propellants, explosives, pyrotechnics, ammunition, and other ordnance harmless or ineffective for military use.
Detonation	A violent chemical reaction within a chemical compound or mechanical mixture involving heat and pressures; the reaction proceeds through the reacted material toward the unreacted material at a supersonic velocity. A detonation, when the material is located on or near the surface of the ground, is normally characterized by formation of a crater.

Energetic Material(s)	Any chemical compound(s) or mixture(s) of substances which, when initiated, result in the rapid evolution of energy. Such materials include PEP materials and some of their ingredients, precursors, and by-products.
Explosion	A chemical reaction of any chemical compound or mechanical mixture which, when initiated, undergoes a very rapid combustion or decomposition releasing large volumes of highly heated gases which exert pressures on the surrounding medium. Depending on the rate of energy release, an explosion can be categorized either as a deflagration or a detonation.
Explosive	Any chemical compound or mixture of substances which, when subjected to suitable initiating impulses or agents such as flame, spark, heat, impact, or friction (whether applied mechanically or electrically), will undergo chemical and physical transformations at speeds varying from extremely rapid to virtually instantaneous resulting in sudden and rapid development of very high pressure in the surrounding medium. The term applies to materials that either detonate or deflagrate.
Explosive Limit	The maximum quantity of explosives or ammunition permitted in a magazine, production building, or other specified area. Explosive limits are based on quantity-distance damage considerations and are expressed in net pounds of explosive, number of rounds or units, or other measurement units. Also called Explosive Quantity.
Flashing	The removal of residual PEP materials from munitions casings, ammunition components, and contaminated processing equipment by open burning or other incineration techniques.
High Explosive	An explosive in which the transformation from its original composition and form, once initiated, proceeds with virtually instantaneous and continuous speed throughout the total mass, accompanied by the rapid evolution of a large volume of gas and heat, causing very high pressure and widespread shattering effect. Some authorities classify high explosives by their sensitivity to initiation as “primary” explosives, those that are very sensitive and “secondary” explosives, those that are relatively insensitive. Primary explosives are also referred to as initiating explosives.
Incineration	The process by which combustible solids, liquids, or gasses are burned and changed into combustion products.
Magazine	A structure designed and specifically designated for the storage of PEP, ammunition, or other ordnance items. A common type of magazine is an earth covered arch-type known as an igloo.
Open Burning	The burning of materials, in the open air or in a receptacle, without significant control of the combustion and in such a manner that the products of combustion are emitted directly into the ambient air without passing through a device intended to control gaseous or particulate emissions.
Open Detonation	There are two methods for OD: blow-in-place (BIP) and a centrally located open detonation pit. BIP must be done on items deemed not

	safe-to-move. The open detonation method is used when items can be moved to a centrally located pit. The items are placed in the pit, packed with explosives, and detonated.
Ordnance	Military material such as combat weapons of all kinds, including ammunition and equipment required for their use.
PEP	Propellants, explosives, or pyrotechnics, see Waste PEP.
PEP- Contaminated Dunage	Combustible non-energetic materials such as cleaning rags, cardboard shipping boxes, wood or other building materials, etc. that have become contaminated with PEP materials.
PEP- Contaminated Equipment	Munitions production, processing, shipping, storage, and other related equipment contaminated with PEP materials.
PEP- Contaminated Wastes	Consist of various non-energetic materials which have become contaminated with propellants. Explosives and/or other such energetic or hazardous materials. Such wastes include cleaning shipping boxes, wood or other building materials.
Popping	Detonation of primers or other small ordnance by heat.
Propellant	High energy material that provides the energy required to propel a projectile -- an explosive charge for propelling a bullet, shell, or the like; also a fuel, either solid or liquid, for propelling a rocket or missile.
Pyrotechnics	High energy materials used in military devices intended primarily to generate smoke.
Rocket Motor	That portion of a rocket loaded with solid propellant.
Safety Distances	Safety distances are empirical distances in relation to quantity of explosives. They are the minimum distances permitted for separation of facilities within a hazard area of possible explosions and for separations of the explosive hazard from inhabited buildings, passenger railroads, and public highways in order to control the magnitude of damage, loss of life, and serious injuries. Separation distances are not absolute safe distances but are relative protective or safe distances and must be graduated as to risk to provide for selected types of protection.
Stability	The ability of any ammunition or explosive to withstand adverse conditions and deterioration while in storage or use.
Standard Operating Procedure (SOP)	A document which prescribes operator instructions in a defined course of action for processing a work unit. An SOP includes specifications, safety instructions and performance standards.
Waste	Consists of waste ordnance, waste PEP, PEP-contaminated wastes and PEP-contaminated equipment.
Waste PEP	Propellants, explosives, or pyrotechnic (PEP) and other such energetic or hazardous materials which do not, or cannot be refined to meet the required specifications. Such wastes consist of off-specification and scrap materials which are generated from primary production, loading, rework, demilitarization, and resource recovery operations.

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Section 10 Glossary of Terms

A.D.	anno Domini
ATD	Advanced Technology Demonstrations
ANSI	American National Standards Institute
ARAR	Applicable or Relevant and Appropriate Requirements
ASCII	American Standard Code for Information Interchange
ASQC	American Society for Quality Control
ATA	Austin, Tsutsumi & Associates, Inc.
ATP	Ammunition Transfer Point
BIP	Blow in Place
BU	Builder, Utility
BuShips	U.S. Navy Bureau of Ships
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CM	Construction Mechanic
CO/OIC	Commanding Officer/Office in Charge
COMNAVBASE	Commander, Naval Base, Pearl Harbor
COTR	Contracting Officer Technical Representative
CNO	Chief of Naval Operations
CSH	Cultural Surveys Hawaii
CSO	Construction Safety Officer
DASA	Defense Atomic Support Agency
DDESB	Department of Defense Explosive Safety Board
DMS	Data Management System
DoD	Department of Defense
DRMO	Defense Reutilization Management Office
EE/CA	Engineering Evaluation/Cost Analysis
EGF	Electronic Grid File
EHA	Explosive Holding Area
EO	Equipment Operator
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ETA	Engineering Trade-Off Analysis
FAR	Federal Acquisition Regulations
GPR	Ground Penetrating Radar
HAR	Hawaii Administrative Rules
HERO	Hazards of Electromagnetic Radiation to Ordnance
HRS	Hawaii Revised Statutes
IR	Infrared
JPG	Jefferson Proving Ground
KID	Kaho`olawe Island Database
KIGIS	Kaho`olawe Island Geographic Information System
KIRC	Kaho`olawe Island Reserve Commission

LTR	Logic Trunk Routing
LZ	Landing Zone
MCC	Maui County Code
MSDS	Material Safety Data Sheet
MOU	Memorandum of Understanding
MTO	Maui Technical Office
NAVEODTECHDIV	Naval Explosive Ordnance Disposal Technology Division
NEW	Net Explosive Weight
NTR	Navy Technical Representative
O&M	Operation & Maintenance
OB/OD	Open Burn/Open Detonation
OPS	Operations
OSA	Open Storage Area
OSHA	Occupational Safety and Health Act
PACNAVFACENGCOM	Pacific Division Naval Facilities Engineering Command
PARSONS	Parsons Infrastructure and Technology Group, Inc.
PCP	Pentachlorophenol
PEP	Propellant Explosive Pyrotechnics
PKO	Protect Kaho`olawe `Ohana
PMO	Program Management Office
POL	Petroleum, Oils, and Lubricants
PUXB	Parsons - UXB Joint Venture
QAPP	Quality Assurance Program Plan
QC	Quality Control
RC/OC	Range Control/Operations Center
RFW	Regulatory Framework
RO	Reverse Osmosis
ROYAL	Royal Contracting Company
SPCC	Spill Prevention Control and Countermeasures
TNT	Trinitrotoluene
TDEM	Time-Domain Electromagnetic
U of H	University of Hawaii
USCINCPAC	Commander in Chief, U.S. Pacific Command
UXB	UXB International, Inc.
UXO	Unexploded Ordnance
UXO/OE	Unexploded Ordnance/Ordnance and Explosives
VFR	Visual Flight Rules
VHF	Very High Frequency
VT	Variable Time

Section 11 References

"Kaho`olawe The Island That Is Wearing Out-A Problem Solved". *The Sunday Honolulu Advertiser* 14 Jan. 1912: 1.

Memorandum of Understanding (MOU) between the United States Navy and the State of Hawaii/Quitclaim Deed from the United States to the State of Hawaii, May 6, 1994.

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Section 12 Document Availability

The Cleanup Plan and Engineering Trade-Off Analysis are available for public review at the following locations:

Island of Hawaii:

Kailua – Kona Library
76-140 Hualalai Road
Kailua-Kona, HI 96740

Hilo Regional Library
P. O. Box 647
Hilo, HI 96720

Island of Maui:

Wailuku Regional Library
P. O. Box B
Wailuku, HI 96793

Lahaina Library
680 Wharf Street
Lahaina, HI 96761

Hana School and Community Library
Hana High School and Elementary Campus
Hana Highway
Hana, HI

Island of Lanai:

Lanai Public and School Library
P. O. Box A-149
Lanai, HI 96763

Island of Molokai:

Molokai Library
P. O. Box 395
Kaunakakai, HI 96748

Island of Oahu:

Kaho`olawe Island Reserve Commission
33 South King Street, Suite 501
Honolulu, HI 96813

State Main Library
478 South King Street
Honolulu, HI 96813

Kaimuki Regional Library
1041 Koko Head Avenue
Honolulu, HI 96816

Kaneohe Regional Library
45-829 Kamehameha Highway
Kaneohe, HI 96744

Pearl City Regional Library
1138 Waimano Home Road
Pearl City, HI 96782

Island of Kauai:

Kauai Regional Library
4344 Hardy Street
Lihue, HI 96766

The Cleanup Plan will be available on the Internet website of the Pacific Division, Naval Facilities Engineering Command at:

http://www.efdpac.navfac.navy.mil

Click on “PACDIV News”, and a Kaho`olawe icon will appear. Click on the icon, and choose either of two options: “Cleanup Plan” or “ETA”.

Copies of the Cleanup Plan will be available for purchase during the 30-day Public Participation review at the cost of $23 per copy. Send a request and check or money order to:

Parsons-UXB, JV
Attn: CLUP
1357 Kapiolani Blvd., Suite 1120
Honolulu, HI 96814-7181

The Administrative Record File is available for public review at:

Program Management Office
Kaho`olawe Island Reserve UXO Clearance Project
Pearl Harbor Naval Shipyard
Building 371A
Pearl Harbor, HI 96860-7300

The following documents are also available for public review at the Wailuku Regional Library on Maui and the State Main Library on Oahu:

- Work Plan
- Appendix A – Program Management Plan
- Appendix B – Health and Safety Plan
- Appendix C – Environmental and Natural Resources Protection Plan
- Appendix C, Attachment 1 -- Engineering Trade-Off Analysis
- Appendix D – Historic Preservation Plan
- Appendix E – Transportation Plan
- Appendix F – Facilities, Equipment, and Infrastructure Plan
- Appendix G – Range Control Operations Plan
- Appendix H – Quality Assurance Project Plan
- Appendix I – Close Out Plan
- Logistics Study