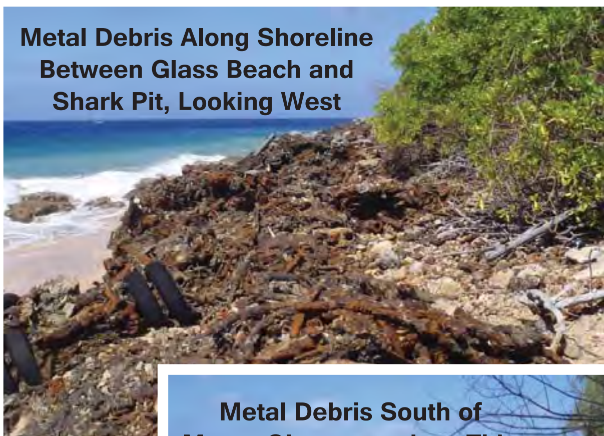
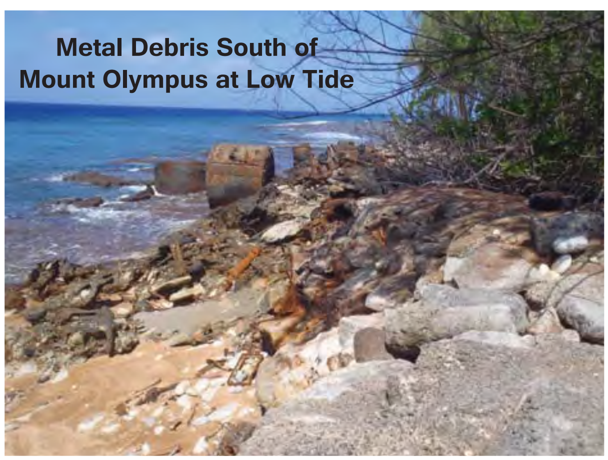
Final
Biological Assessment
For
Removal Action Activities
Associated with the Kwajalein Landfill

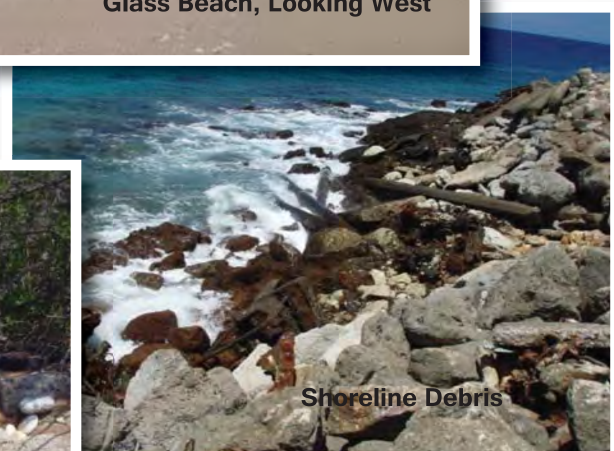


Metal Debris Along Shoreline Between Glass Beach and Shark Pit, Looking West

Start of Metal Debris at Glass Beach, Looking West



Metal Debris South of Mount Olympus at Low Tide



Shoreline Debris

January 2017

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FINAL
BIOLOGICAL ASSESSMENT
FOR
REMOVAL ACTION ACTIVITIES ASSOCIATED WITH THE KWAJALEIN LANDFILL

U.S. ARMY GARRISON–KWAJALEIN ATOLL
REPUBLIC OF THE MARSHALL ISLANDS

PREPARED FOR:

BERING–KAYA SUPPORT SERVICES

AND

U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND

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January 2017

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Acronyms and Abbreviations

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BA	Biological Assessment
BMP	Best Management Practices
°C	degrees Celsius
CITES	Convention on International Trade in Endangered Species
cm	centimeter/centimeters
CONUS	Continental United States
dB	decibel
dB_{rms}	decibel root-mean-square
DEP	Document of Environmental Protection
DPS	distinct population segments
EA	Environmental Assessment
ESA	Endangered Species Act
ft	feet/foot
in.	inch/inches
kg	kilogram/kilograms
lb	pound/pounds
L_{max}	maximum sound noise
m	meter/meters
MMPA	Marine Mammal Protection Act
μPa	micropascal
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NTU	Nephelometric Turbidity Unit
PCB	polychlorinated biphenyl
PTS	Permanent Threshold Shift
RMI	Republic of the Marshall Islands
rms	root mean square
SEL	Sound Exposure Level
U.S.	United States
UES	USAKA Environmental Standards

USAG-KA	U.S. Army Garrison–Kwajalein Atoll
USAKA	U.S. Army Kwajalein Atoll
USFWS	U.S. Fish and Wildlife Service
WWII	World War II

1 Introduction

1 Introduction

1.1 PURPOSE

The U.S. Army Garrison–Kwajalein Atoll (USAG-KA) has prepared this biological assessment (BA) to determine the extent to which the debris removal and shoreline stabilization activities associated with the Kwajalein landfill “may affect” and “are likely to adversely affect” 19 species requiring consultation under the U.S. Army Kwajalein Atoll (USAKA) Environmental Standards (UES) Section 3-4.5. The purpose of and need for the Proposed Action is to eliminate or decrease the potential for contaminants to migrate further into the environment (fish tissue, reef flat, ocean, soils, sediment, groundwater, and surface water).

Past investigations of contaminated sites at USAG-KA have identified the need for further investigation and remediation of the Kwajalein Landfill. The investigations revealed that water quality contaminants including copper, polychlorinated biphenyls (PCBs), and pesticides have been detected in groundwater monitoring wells, groundwater seeps, and inter-tidal zone surface water on the southwestern side of the island of Kwajalein. The proposed environmental cleanup project at USAG-KA is intended to reduce the release of contaminants to the environment.

1.2 REGULATORY SETTING

The UES requires USAG-KA to consult or coordinate with the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) and the US Fish and Wildlife Service (USFWS) to conserve Species and Habitats of Special Concern. The UES provides protection for a wide variety of marine mammals, sea turtles, fish, coral species, migratory birds, and other terrestrial and marine species and habitat that are considered of significant biological importance. The UES addresses procedures for consultation on effects to both protect species and habitats and those of local or regional significance.

Section 3.4 of the UES establishes the procedures for consultation to be taken “…to ensure that actions taken at USAKA will not jeopardize the continued existence of these species or result in destroying or adversely changing the habitats on which they depend.” The USAKA consultation species includes all species that could or do occur in the Marshall Islands that are listed under the Endangered Species Act (ESA) (including those that have been petitioned, are candidates, or are proposed for listing), all marine mammals protected under the Marine Mammal Protection

Act (MMPA) that could or do occur in the Marshall Islands, and all species and habitats protected under law in the Republic of the Marshall Islands (RMI).

The UES also identifies species for which coordination may be warranted. This BA also serves as a UES coordination report for the potential effects of the Proposed Action on several coordination species. No adverse effects to UES coordination species are anticipated from the Proposed Action, as discussed in the corresponding Environmental Assessment (EA) for this project (U.S. Army Garrison–Kwajalein Atoll, 2016).

1.3 PROTECTED SPECIES ADDRESSED

Species with the potential to occur in the action area have been identified using surveys conducted by USFWS and NMFS, on site specific surveys conducted for other completed construction projects on Kwajalein, and on incidental observations.

In accordance with the UES, a natural resource baseline survey must be conducted every 2 years to identify and inventory protected or significant fish, wildlife, and habitat resources. Reports of baseline surveys for terrestrial and marine species completed by USFWS and NMFS were available from 2004, 2008, 2010, and 2012. A site-specific survey for this project was conducted by NMFS in September 2015 to record marine resources off-shore in the action area (Appendix A, in Kolinski, 2015).

The 19 species shown in Table 1-1 have the potential to occur in the action area and require consultation under UES Section 3-4.5.

Table 1-1. Protected species included in this Biological Assessment.

Scientific Name	Common Name	ESA or MMPA Protected Species	UES Consultation Species
NON-CORAL MACRO-INVERTEBRATES			
Trochus (Tectus) niloticus	top shell snail		X
FISH			
Bolbometopon muricatum	bumphead parrotfish		X
Cheilinus undulatus	humphead wrasse		X
Manta alfredi	reef manta ray	ESA (C)	X
Manta birostris	oceanic giant manta ray	ESA (C)	X
Sphyrna lewini	scalloped hammerhead shark	ESA	X
SEA TURTLES			
Chelonia mydas	green turtle	ESA	X
Eretmochelys imbricata	hawksbill turtle	ESA	X
CETACEANS			
Delphinus delphis	common dolphin	MMPA	X
Grampus griseus	Risso's dolphin	MMPA	X
Peponocephala electra	melon-headed whale	MMPA	X
Stenella attenuata	offshore spotted dolphin	MMPA	X
Stenella attenuata graffmani	coastal spotted dolphin	MMPA	X
Stenella coeruleoalba	striped dolphin	MMPA	X
Stenella longirostris	spinner dolphin	MMPA	X
Stenella longirostris centroamericana	Costa Rican spinner dolphin	MMPA	X
Stenella longirostris	whitebelly spinner dolphin	MMPA	X
Stenella longirostris orientalis	Eastern spinner dolphin	MMPA	X
Physeter catodon	sperm whale	ESA, MMPA	X

Sources: Kolinski, 2015; U.S. Fish and Wildlife Service and National Marine Fisheries Service, 2006, 2010, 2012, 2013

ESA = Protected under the Endangered Species Act

(C) = Candidate for listing under the ESA

MMPA = Protected under the Marine Mammal Protection Act

Several UES coordination coral species were documented in the action area (Appendix A, Kolinski, 2015). These include the following 10 species of coral: *Acropora abrotanoides*, *Acropora digitifera*, *Hydrophora microconis*, *Leptastrea purpurea*, *Montipora digitata*, *Pocillopora damicornis*, *Pocillopora eydouxi*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites* sp. (lobate). Two coordination species of giant clam, *Tridacna squamosa* and *Tridacna maxima*, and one species of fish, the giant coral trout (*Plectropomus laevis*), were also determined to be potentially present in the action area based on previous USFWS and NMFS surveys.

No critical habitat has been designated in the RMI, and is therefore not discussed further in this document.

1.4 CONSULTATION HISTORY

Consultation with NMFS and USFWS for this project began in early 2015. Both USFWS and NMFS conducted site visits, and NMFS completed a site-specific survey for marine resources in the action area. A copy of the survey report is included in Appendix A. As noted in that report "UES consultation species were not observed in the immediate vicinity of metal debris or along potential pathways that might be used for extraction. This suggests a formal UES consultation for marine species may not be needed, particularly if reef flat clean-up activities are conducted at low tide, which would reduce sound transmittal and the potential for sea turtles and other mobile species of concern to be present in the area of affect."

The USFWS site visit did not identify any terrestrial resources that would be adversely affected by the Proposed Action; therefore, a survey report was not prepared. A Preliminary Review of the removal actions for the mound between Glass Beach and the Shark Pit was submitted to USFWS for review and comment (Appendix B). This mound area needs to be removed to facilitate the investigation of the old dump (U.S. Army Space and Missile Defense Command, 2016). The area would be cleared of vegetation, metal debris, and other items (e.g., concrete). The Service concurred with the removal action, provided that nesting terns are protected (see Mitigation Measures—Section 2.4—During Metal Debris Removal). Therefore, this area is not analyzed in this BA.

2 Description of the Action and the Action Area

2 Description of the Action and the Action Area

2.1 PROPOSED ACTION

The Proposed Action is to (1) remove and reduce the volume of metal debris along the shoreline east of the landfill area continuing to Glass Beach, from the storage area adjacent to the landfill and from the mound area between Glass Beach and Shark Pit, and to create a stable shoreline east of the landfill with a regraded, new, stone-armored revetment that is capable of withstanding storm wave energy, avoiding future erosion (by replacing the metal debris currently serving this purpose), and protecting the boundary and integrity of the landfill; and (2) monitor water quality for 6 years to evaluate remedial effectiveness.

Project Location. The project area includes the high-energy shoreline from Glass Beach to Mt. Olympus on the ocean side of the Kwajalein Island (see Figure 2-1). Extensive metallic debris and other forms of armoring (concrete and rock) have been placed along this shoreline to stabilize the shore from erosion. The shoreline debris has been deposited in these areas since sometime after World War II (WWII) and before 1988. The metallic debris consists of rebar, ship and vehicle parts, pipe, scrap metal, wire, and other debris. The current shoreline configuration is not stable and may continue to erode, which would potentially destabilize the shore around Mt. Olympus.

The high-energy shoreline is highly armored with metallic debris and to a lesser degree concrete and rock. The metallic debris is fused together in most areas, either through corrosion or with what appears to be an asphaltic matrix. The metal in this area consists of very large pieces or large conglomerations of smaller metallic debris. Some small cove-type beaches have formed between some of the larger accumulations of material. From visual field observations, it appears most of the metallic debris remains in place at the shoreline. There is a high percentage of copper or copper alloys in this metallic debris, and the metal debris (including copper wiring and pipe) is being eroded and transported by the western littoral drift into the reef flat in front of the landfill shoreline.

The western, lower energy area has a higher ratio of concrete and rock armoring to metallic debris, and the metallic debris in this area generally consists of smaller, less fused materials.

Explanation

- Current Landfill Boundary Alternative
- Shoreline with Metal Debris (Landfill Area) Alternative
- Shoreline with Metal Debris (Mt. Olympus to Glass Beach) Alternative
- Action Area
- Existing Structure

NORTH

0 250 500 1,000 Feet

Proposed Action - Action Area

Kwajalein Island

Figure 2-1

2-1_ActionArea, 3/16/2016

Metal Debris Removal. The Proposed Action would remove and reduce the total volume of metal debris along the shoreline east of the landfill area to Glass Beach. The Proposed Action also includes creation of a stable shoreline along this same shoreline with a regraded new, stone-armored, revetment capable of withstanding storm wave energy to avoid future erosion and replace the metal debris currently serving this purpose. Following construction, a 6-year water quality monitoring plan would be implemented to record water quality and evaluate remedial effectiveness.

Metal debris (pipes, vehicle parts, engines, wire, and larger metal pieces) is present throughout most of this reach of the shoreline (see Figures 2-2 and 2-3). In places, the metallic debris extends beyond the toe of the shoreline. This metal debris is being eroded and swept to the west onto the landfill shoreline and is likely a contributing cause of the high copper concentrations measured in the inter-tidal marine water near the landfill.

The Proposed Action would remove existing trash, concrete, rubble, and metal debris from the shoreline to expose the native material and reef rock under the debris. All debris removal would be strictly contained within the existing footprint of the shoreline debris disturbed area. Heavy equipment would access the metal debris from the shoreline and existing access roads and would not transit the reef flat. In-water work will be limited to hand removal of smaller debris pieces.

Concrete and stone that can be used as bedding stone for the new revetment would be sorted and stored. Stockpiled concrete on the island from prior demolition projects may be useful for bedding stone. Additional bedding and armoring stone may be procured from off-island sources. This stockpiled debris will be tested for lead-based paint, asbestos, and other possible contaminants before use. Recovered metal would be sent to the Continental United States (CONUS) for recycling, and the concrete and stone would be crushed and stockpiled for later use as aggregate in other parts of the project.

It is estimated that up to 50 percent or more of the surface shoreline material would have to be removed to access and remove the metallic debris. This would likely destabilize the already unstable shoreline and perhaps result in erosion of the area around Mt. Olympus. Therefore, removal of metallic debris in this area would also require shoreline stabilization.

Figure 2-2. Start of metal debris at Glass Beach, looking west.

Figure 2-3. Metal debris along shoreline between Glass Beach and the Shark Pit, looking west.

Shoreline Stabilization. Shoreline stabilization (revetment) will be conducted to improve the shoreline revetment along the original shoreline footprint and stop ocean erosion of the shoreline. A shoreline stabilization design has been prepared and is summarized below and in Figure 2-4. This design took into consideration future rises in sea level. The full text and figures are located in the Removal Action Memorandum and EA associated with this project.

The shoreline will be graded and compacted as necessary to achieve a stable slope (3:1 maximum slope) and to achieve the grade necessary to construct the shoreline armoring. A geotechnical investigation would be conducted to determine the design requirements for a stable slope. Geotextile fabric will be placed to prevent erosion of the sub-base.

A shoreline armoring design has been prepared, and design armor stone size is based on the anticipated storm wave energy. Extreme (i.e., storm) waves are depth-limited at the site because of the existence of the offshore reef. This means the depth of the reef acts to limit the size of the waves that can impact the shoreline unbroken. As a conservative estimate, the design wave height was based on the maximum storm wave height that would break at the reef edge at high tide level (+3.4 feet [ft] mean sea level, determined from a local NOAA Tides and Currents station) and anticipated sea level rise (+1.60 ft over 50 to 100 years) at this location. The resulting breaking wave height (5.4 ft) was used to design the necessary stone size for stability (using equations from the United States Army Corps of Engineers Coastal Engineering Manual). A 4,000-pound (lb) (2-ton) median weight stone was estimated, which has an approximate diameter of 3 ft. The median design bedding stone size is typically estimated at 10 percent of the armor stone size, yielding a 400-lb design bedding stone weight. This corresponds to an approximate diameter of 1.3 ft. Both armor and bedding stone would comprise a range of sizes around their median values of approximately 2 to 4 ft and 0.5 to 1.5 ft respectively. The final armoring design will review sea level rise value, wave energy and heights, and the near-shore depth variance.

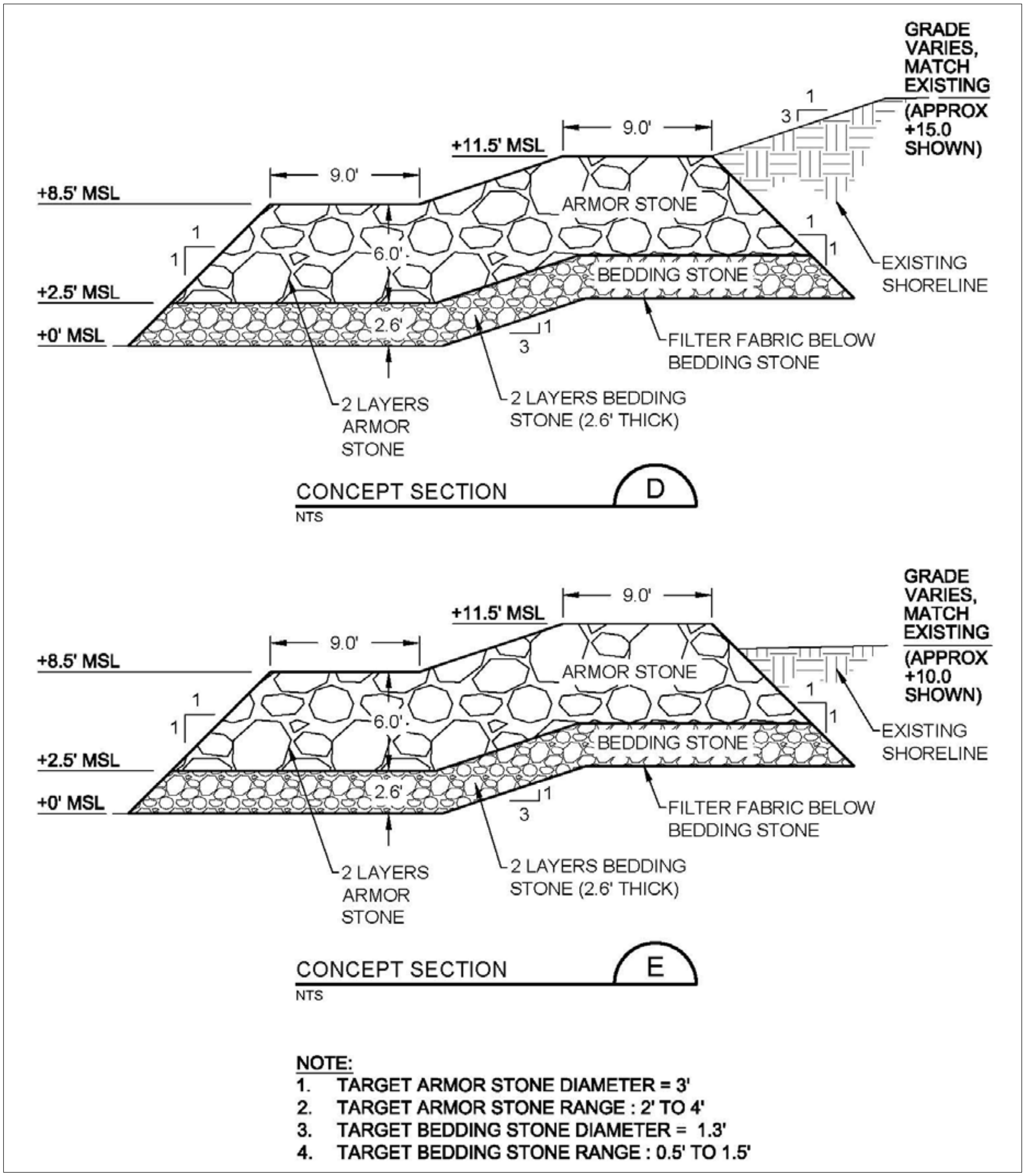

Figure 2-4. Shoreline revetment detail.

All construction would be contained within the existing footprint of the shoreline debris disturbed area; if construction maneuvering outside of the existing footprint of the shoreline debris disturbed area is required, action would be discussed with the Environmental Manager prior to execution. The reef flat is a previous disturbed area, and heavy equipment would be on the reef flat within 15 ft of the shoreline on a “as-needed” basis to accomplish the metal removal and shoreline stabilization. New fill will not be placed beyond the limits of existing fill. The limits of existing fill will be clearly marked. To limit the transport of materials or sediment, erosion control will be placed on the shoreline above the high tide level. Work will be staged and sequenced to minimize erosion of sediment or debris to the reef. Before construction begins, a heavy-duty silt curtain will be installed on the reef, just offshore of the construction extents, to act as an environmental barrier and to prevent material from eroding and reaching the reef. The silt curtain will be anchored at the bottom, and the top will have buoys so it floats on the tide. A turbidity-monitoring plan will be prepared to define the action to be taken if turbidity levels exceed 10 Nephelometric Turbidity Units (NTUs) above background levels.

The construction phase is anticipated to be 12 months. The mobilization of materials and equipment will occur over 6 months; the construction period will be 9 months. Table 2-1 provides an overview of the construction phases.

Table 2-1. Construction phase.

Construction Phase	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Contractor Mobilizes Materials and Equipment				
Construction Period				
Construct Shoreline Improvements				
Construction Management				
Construction Completion				

During execution, noise would be generated from debris removal and construction equipment used for placement of bedding and armoring stone. Table 2-2 identifies the potential noise generating activities anticipated for each component of the Proposed Action.

Table 2-2. Noise generating activities for the Proposed Action.

Item	Noise Generating Activity	Unit	Quantity
1	Remove metal debris, existing relic stone and regrade shoreline	CY	6,897
2	Heavy duty geotextile (including placement)	SY	6,492
3	Bedding stone (modified from relic stone and placed)	ton	7,985
4	Armor stone (including placement)	ton	14,288

Notes: CY = cubic yards SY = square yards

Noise sources in the project area would include equipment used within the land area such as bulldozers, compactors, dump truck, crane, excavator, and shredder. Table 2-3 shows the noise level of typical equipment that will be used during the Proposed Action.

Table 2-3. Typical in-air noise levels for equipment used in the Proposed Action.

Source	Peak In-Air Noise Level (dB)	In-Air Noise Level- 50 Feet from Sources (dB)
Air Compressor	95	78
Backhoe	116	80
Chainsaw	100	85
Compactor, Roller	104	88
Crane	90	85
Dump Truck	101	84
Excavator	107	90
Grader	108	85
Jackhammer	105	85
Portable or Standby Generator	96	82
Scraper	109	99

Sources: U.S. Department of Transportation, 2015; University of Washington, 2004

Water Quality Monitoring. Following construction, water quality monitoring will be conducted to evaluate the remedial effectiveness for the metal removal and shoreline re-armoring. Post-remedial water quality monitoring will continue for a 6-year period to evaluate changes in load of contaminants to groundwater and inter-tidal marine water. If after 6 years the monitoring data indicates the Proposed Action has not effectively restored water quality, additional alternatives could be considered and those components would be implemented. If it is determined additional alternatives would be necessary, a full re-characterization of all environmental resources would be conducted to ensure there have been no changes in the affected environment.

2.2 DEFINITION OF THE ACTION AREA

The action area for this BA is the shoreline area with metal debris from Mt. Olympus to Glass Beach shown in Figure 2-1. It is assumed that the shoreline work area from the bottom toe to the top crest is about 45 linear ft.

The action area for the project also includes the marine waters and inland areas within a 50-yard arc around those activities and the down-current extent of any plumes that may result from mobilized sediments.

2.3 ALTERNATIVES CONSIDERED

This BA analyzes the potential environmental impacts from four alternative cleanup projects at USAG-KA. The alternatives analyzed would reduce the release of contaminants to the environment at and near the Kwajalein Landfill, including:

- Removal Action Memorandum **Alternative A:** Remove metals along shoreline east of landfill; re-armor shoreline east of landfill; remove metal debris from storage area adjacent to landfill; remove debris from area between Glass Beach and the Shark Pit; and 6-year water quality monitoring plan (this is not post-closure monitoring per UES Section 3-6.5.7(c)(6)(vii)).
- Removal Action Memorandum **Alternative B:** Remove metals along shoreline east of landfill; re-armor shoreline east of landfill; remove metal debris from storage area adjacent to landfill; remove debris from area between Glass Beach and the Shark Pit; close existing landfill; construct new landfill for future refuse; stabilize shoreline at landfill; and 30-year monitoring plan for water quality
- Removal Action Memorandum **Alternative C:** Remove metals along shoreline east of landfill; re-armor shoreline east of landfill; remove metal debris from storage area adjacent to landfill; remove debris from area between Glass Beach and the Shark Pit; excavate and ship refuse to a Continental United States (CONUS) landfill; close existing landfill; construct new landfill for future refuse; and stabilize shoreline at landfill; and 30-year monitoring plan for water quality
- Removal Action Memorandum **Alternative D:** Remove metals along shoreline east of landfill; re-armor shoreline east of landfill; remove metal debris from storage area adjacent to landfill; remove debris from area between Glass Beach and the Shark Pit;

close existing landfill; transport future refuse to a CONUS landfill; stabilize shoreline at landfill; and 30-year monitoring plan for water quality

Table 2-4 summarizes the components of the Proposed Action and the Alternatives (Alternatives B, C, and D) considered.

Table 2-4. Summary of the removal action components of the Proposed Action.

Removal Action Components	Removal Action Memorandum Alternatives			
	A	B	C	D
1) Remove metals from shoreline between Glass Beach and Mt. Olympus	X	X	X	X
2) Remove metal debris from storage area adjacent to landfill	X	X	X	X
3) Remove metal debris from mound area between Glass Beach and the Shark Pit	X	X	X	X
4) Re-armor shoreline east of Landfill (Glass Beach to Mt. Olympus)	X	X	X	X
5) Close existing landfill (grading and cap)		X		X
6) Close existing landfill (excavate and ship refuse to CONUS; topsoil cover)			X	
7) Construct new landfill for future refuse		X	X	
8) Transport future refuse (incinerator ash) to CONUS landfill				X
9) Stabilize shoreline (construct new revetment—original landfill shoreline footprint only)		X	X	X
10) 6-year water quality monitoring plan (ocean/reef flat area–this is not post-closure monitoring per UES Section 3-6.5.7(c)(6)(vii))	X			
11) 30-year water quality monitoring plan (ocean/reef flat area)		X	X	X

2.4 MITIGATION AND CONSERVATION MEASURES

The USAG-KA has developed mitigation measures to minimize the impacts of the Proposed Action and Other Alternatives. The following are specific best management practices (BMPs) or mitigation measures to be used during implementation of the components.

I. BEST MANAGEMENT PRACTICES

A. Prior to Metal Debris Removal:

1. Absent further ecological evaluations, limit metal debris removal activities to proposed shorelines and reef flat areas.

2. Instruct workers in avoidance of corals and other notable marine invertebrates by training workers to take care where they walk and how they remove and transport debris on the reef.

Avoidance of corals may be most difficult along the shallow reef bench fronting the metal cliffs, as wave activity close to shore is likely to increase the focus on risks to human safety. Impacts to corals in this region are expected to be very limited, because removal activities will be restricted to reef flat and bench-top areas.

3. Instruct workers to carefully translocate any corals that occur on debris to the immediate vicinity of their original location.

4. Establish a mandatory shutdown safety zone corresponding to where protected mollusks, fish, sea turtles, and marine mammals could be disturbed within 50 yards of the shoreline. A mandatory shutdown will be invoked when protected mollusks, fish, sea turtles, or marine mammals are observed within this 50-yard area.

5. Instruct workers about compliance with BMPs for protected mollusks, fish, sea turtles, or marine mammals and provide illustrated guidance with photographs to assist in identification and avoidance of those species.

6. Instruct workers to avoid Trochus that may wander into the work area. Since minimal in-water work is proposed with this project, a need to relocate Trochus is not anticipated; however, if the species is observed in the project area, work will cease in that area until the animal has left the project vicinity.

7. An emergency spill response plan will be prepared; workers will be trained in implementation; and appropriate spill response equipment will be ready and available for deployment onsite.

8. All activities will be done in compliance with the Dredge and Fill Document of Environmental Protection (DEP) and a “Dredge and/or Unconsolidated Fill Project Description Sheet 2” would be completed by the project proponent and forwarded to the USAG-KA Environmental Engineer and the base operation contractor’s environmental department no later than 75 days prior to beginning work for coordination with and approval by the UES agencies.

B. During Metal Debris Removal:

1. If any birds are observed nesting in the immediate vicinity of staging or operations areas, demarcate nests and avoid the area. White terns may nest in pandanus trees and tropical almonds usually between January and July. However, the vegetation will be searched for white tern eggs or chicks before removal. If a white tern is observed incubating or with a chick, the tern must not be displaced. Nearby vegetation can be removed, and the tern will remain on the nest, and the nest trees can be removed after the chick fledges.

2. During installation of the heavy-duty silt curtain, ensure that protected species are not trapped inside the curtain or impacted by the curtain weights and anchors.

3. Wherever possible, conduct removal activities on reef flats by hand to limit disturbance to marine resources. The distribution of metals is greater on shorelines than on reef flat areas, with the number of items greatly decreasing beyond 33 to 66 ft from shore. This distribution should reduce the clean-up effort as land-based objects are much easier to locate, and machinery can more readily be positioned on land to remove larger items and accumulations. It appears that debris observed further out on the reef flat can be removed by hand, although in some cases items might need to be pried from the substrate.

4. As much as possible, conduct clean-up activities at low tide (see Figure 2-5), which will reduce sound transmittal and the potential for sea turtles and other mobile species of concern to be present in the action area.

Figure 2-5: Metal debris south of Mount Olympus at low tide.

5. Corals observed growing on items being removed will be scraped off and placed near to where they were initially located to the maximum extent possible. Onsite capacity for restoration, such as a trained coral expert with knowledge of restoration methods and necessary equipment, will be available in the event that coral are damaged and need to be reattached to the substrate or there is a need to salvage coral from marine debris (in the event that coral has colonized debris and is broken during debris salvage).

6. Prior to removal activities each day, beach areas will be surveyed for sea turtle tracks to find newly laid nests. Any nests will be demarcated and avoided.

7. Observers with binoculars will be posted along the shore in the immediate vicinity of the project area. If protected marine species, including Trochus, protected fish, sea turtles, or marine mammals, are seen within the safety zone, work will cease until the animal has exited the safety zone or 15 minutes has passed without re-detection of the animal in the safety zone. Work may continue if, in the best judgment of the project supervisor, the animal(s) would not be adversely affected by the activity. No attempt will be made to feed, touch, ride, or otherwise intentionally interact with sea turtles or marine mammals.

8. Observers will record all sightings of protected fish, sea turtles, and marine mammals that occur during the proposed project. Information collected will include species; any recognizable individual characteristics if possible to discern; time, location, and approximate distance from the observer to the species; and species behavior.

9. In the event of inclement weather, operations would be suspended, and all equipment would be moved to protected sites and secured with appropriate mooring devices.

10. Turbidity monitoring will be conducted daily, and activities would cease if turbidity levels exceed 10 NTUs from baseline measurement, in accordance with guidelines provided in the Dredging and Filling Document of Environmental Protection (DEP-10-002.0).

C. Following Completion of Debris Removal:

1. All salvaged material will be recycled and/or disposed of properly.

2. A report of all observations will be delivered to NMFS and USFWS in a post-activity report within 180 days of project completion.

II. BEST MANAGEMENT PRACTICES FOR EQUIPMENT USE DURING METALS REMOVAL AND REVETMENT PLACEMENT (Incorporates BMPs from I above plus these listed below)

1. Prior to any work on or near the shore, beach areas will be surveyed for sea turtle tracks to find newly laid nests. Any nests will be demarcated and avoided.

2. Special attention shall be given to verify that no UES-protected Trochus (or top shell snail), sea turtles, or marine animals are in the area where equipment, anchors, or materials are expected to contact the substrate before that equipment may enter the water. Someone trained in the identification of Trochus will survey the work area from access point into the water to the edge of the work zone to ensure any Trochus in the area are identified. If any are present, work will not progress in that area until the Trochus are no longer found in the area. Instruct workers to avoid Trochus that may wander into the work area. Since minimal in-water work is proposed, a need to relocate Trochus is not anticipated; however, if the species is observed in the project area, work will cease in that area until no Trochus are present. Surveys shall be made prior to

the start of work each day, and prior to resumption of work following any break of more than one half hour. Periodic additional surveys throughout the work day are strongly recommended.

3. All workers associated with this project, irrespective of their employment arrangement or affiliation (e.g., employee, contractor, etc.) shall be fully briefed on the BMPs and the requirement to adhere to them for the duration of their involvement in this phase of the project.

4. Instruct workers in avoidance of corals and other notable marine invertebrates (primarily Trochus sp.) by training workers to take care where they walk on the reef.

5. Develop and implement a contingency plan to control and contain toxic spills, including petroleum products, and ensure appropriate materials to contain and clean potential spills will be maintained and readily available at the work site.

6. Ensure that the project manager and heavy equipment operators will perform daily pre-work equipment inspections for cleanliness and leaks and that all construction project-related materials and equipment will be cleaned of pollutants prior to being placed in the water. All heavy equipment operations will be postponed or halted should a leak be detected, and will not proceed until the leak is repaired and equipment cleaned.

7. Ensure that fueling of construction project-related vehicles and equipment will take place at least 50 feet away from the water, preferably over an impervious surface.

8. Develop and implement a plan to prevent construction debris from entering or remaining in the marine environment during the project.

9. Develop and implement a contingency plan for the removal and adequate securing of equipment in the event of approaching storms.

10. Undergo site introductions and briefings by appropriately qualified personnel that would cover the procedures to be used to mitigate potential effects.

11. Turbidity and siltation from project-related work will be minimized and contained through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions. Silt curtains will completely enclose the operations. The area to

be enclosed with silt curtains will be verified to be clear of Trochus, sea turtles, marine mammals, and protected fish species prior to the deployment of the silt curtains.

12. All heavy material placed in the water or on shore for the revetment will be lowered slowly by equipment and placed, not dumped, into position to ensure the revetment does not roll into the marine environment.

III. BEST MANAGEMENT PRACTICES FOR AFTER-COMPLETION MONITORING OF IN-WATER METALS REMOVAL (Incorporates BMPs from I and II above plus these listed below)

1. All workers associated with this project, irrespective of their employment arrangement or affiliation (e.g., employee, contractor, etc.) shall be fully briefed on the BMPs and the requirement to adhere to them for the duration of their involvement in this phase of the project.

2. Instruct workers in avoidance of corals and other notable marine invertebrates (primarily Trochus sp.) by training workers to take care where they walk on the reef during collection of water quality samples.

3. Instruct workers to avoid Trochus that may wander into the work area. Since minimal in-water work is proposed with the water quality monitoring, a need to relocate Trochus is not anticipated; however, if the species is observed in the project area, workers will actively avoid Trochus while collecting the water quality sampling.

4. If any birds are observed nesting in the immediate vicinity of water quality access points on shore, demarcate nests and avoid the immediate area while accessing the water quality collection point. White terns may nest in pandanus trees and tropical almonds usually between January and July, but may occur outside that season. If a white tern is observed incubating or with a chick, the tern must not be disturbed.

5. Prior to collection of the water quality samples, beach areas where access to the marine environment will be used will be surveyed for sea turtle tracks to find newly laid nests. Any nests will be demarcated and avoided. Additionally, someone trained in the identification of Trochus will survey the area from access point into the water to the collection point to ensure

any Trochus in the area are identified to the water quality sample collector, if other than the trained monitor.

6. Constant vigilance shall be kept for the presence of UES-protected marine species during all aspects of the water quality collection effort.

7. Water samples will be collected in clean containers and brought to shore. For any sample requiring treatment at collection (preservative, acidification, etc), the sample bottle will be filled on shore from the clean container used to collect the original sample.

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3 Species Considered

This BA addresses 19 federally-listed and UES consultation species that have been recorded on Kwajalein and have the potential to occur in the action area. Those species are summarized in Table 1-1. Species that were excluded from further analysis met one or more of the following conditions:

- Species does not occur nor is expected in the action area during the time period activities would occur; and/or
- Species occurs only occurs in habitats that are not present in the action area.

UES consultation species excluded from further analysis include all consultation corals and two mollusks, which were not observed during site-specific surveys; the Ratak Micronesian pigeon, which does not have habitat in the Action Area and has not been recorded on Kwajalein; as well as several fish, sea turtle, and marine mammal species for which no recorded or anecdotal observations have been reported.

3.1 MOLLUSKS

3.1.1 Top Shell Snail (*Tectus niloticus*)

Species Description. *Tectus niloticus* is a UES consultation species and is a member of the family Tegulidae, a family of marine gastropod mollusks containing several hundred species. It has a conical shaped shell and usually reaches a maximum diameter of 4.7 to 6 inches (in.) at the base of the shell or the shell width (Nash, 1993). The typical adult shell is 5 in. long. All members of this snail family are herbivores (feeds on marine algae) and occasionally detritivores. This snail inhabits shallow tropical reefs and is nocturnal.

Top shell snails are dioecious, having separate sexes, but they do not exhibit external dimorphism, meaning that the sexes cannot be differentiated by external morphology. Sexes are readily distinguished by histological examination of the gonads: male gonads are pale brown to creamy white, and mature female gonads are dark green (Nash, 1993).

Habitat and Distribution. The top shell snail is typically found in water shallower than 40 ft. Although some species are occasionally found in the low intertidal zone and can tolerate brief aerial exposure, all members of Tegulidae are generally found at subtidal depths (U.S. Air Force, 2015; Dumas et al., 2010; Tardy et al., 2008).

Large specimens (greater than 4 in.) are visible from the surface in clear waters. *Tectus* sp. generally avoids bottoms of sand and living corals. Population density generally decreases in deeper areas, while the mean size of individuals increases (Sealifebase Site, 2010).

This species occurs throughout the Indo-Pacific, and due to its commercial value it has been translocated or introduced to many Indo-Pacific regions. *Tectus* is one of the most important coastal resources of the Pacific Islands, providing a significant source of income for communities in Cook Islands, Federated States of Micronesia, Palau, French Polynesia, Marshall Islands, New Caledonia, Papua New Guinea, Solomon Islands, Vanuatu, and Wallis (U.S. Army Garrison–Kwajalein Atoll, 2012a).

Threats. All members of the family Tegulidae are subject to predation by specialist invertebrates and vertebrates, but principally by octopus and triggerfish (Family Balistidae). The rate of predation decreases as the animals grow, and it is thought that the largest individuals are not preyed on because there are no predators large enough to take them (U.S. Air Force, 2015; McClanahan, 1990).

Tectus niloticus is a highly sought after resource in the Pacific and Indo-Pacific regions. This has resulted in the species being over-harvested. By 2007 the Solomon Islands, Fiji, and Papua New Guinea have the most depleted stocks, with four surveyed sites in the Solomon Islands in 2006 averaging a density of 11 *Tectus* per hectare (Lasi, 2010).

USAKA Distribution. This species is fairly widespread and common in the Kwajalein Atoll. The top shell snail has been observed at all 11 of the Kwajalein Atoll islets as well as on reefs in the Mid-Atoll Corridor and is frequently found during biennial surveys. A site specific survey for this project was conducted in 2015 and is included in Appendix A. That survey located one *Tectus niloticus* individual, which was seen on outer reef flat areas between the Surfer's Steps and Mount Olympus, approximately 590 ft from shore (Kolinski, 2015). This is outside of the Action Area for the Proposed Action.

3.2 FISH

3.2.1 Bumphead Parrotfish (*Bolbometopon muricatum*)

Species Description. The bumphead parrotfish is a UES consultation species. It can grow to 4 ft in length and 110 lb, making it the largest parrotfish in the Scaridae family. Adults have dull green coloring, with pale yellow or pink on the front of the head. Males and females have similar coloration. Juveniles range from green to brown, with five rows of small, white spots. Adults have a steep head profile, with a distinct, bulbous forehead, fleshy lips, and exposed teeth. Large individuals (more than 24 in. long) have an almost vertical profile (WildEarth Guardians, 2009).

Habitat and Distribution. Bumphead parrotfish are found primarily on shallow 3 to 50 ft barrier and fringing reefs during the day, and in caves and shallow sandy lagoon habitats at night. They are recorded from many areas across the Indo-Pacific: the Red Sea, East Africa, Asia, Australia, the Line Islands, Tonga, and other island nations in the western and South Pacific. Their range also extends through some U.S. territories, including American Samoa, Guam, the Northern Mariana Islands, and outlying islands such as Wake Island (Kobayashi et al., 2011).

Threats. The coral reef habitat used by this species is vulnerable to adverse impacts from human activities, climate change, and natural disaster. It has also declined drastically due to overfishing. The coral habitat and food resources of this species are threatened by disease and predation. The increased rarity of this species makes it increasingly vulnerable to extirpation from stochastic event (WildEarth Guardians, 2009).

USAKA Distribution. One bumphead parrotfish adult was recorded during the 2008 biennial surveys on the ocean side of the Kwajalein islet off shore from the landfill area (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 2010). No other recordings of this species in the Kwajalein Atoll have been made during biennial surveys. It is now considered uncommon or rare, and is virtually extinct in Guam, Marshall Islands, parts of Fiji and East Africa, and is declining rapidly in Palau (Chan et al., 2012).

3.2.2 Humphead Wrasse (*Cheilinus undulatus*)

Information below is taken from the 2012 petition to list the humphead wrasse under the ESA (WildEarth Guardians, 2012).

Species Description. The humphead wrasse (also referred to as Napoleon wrasse) is a UES consultation species. It is one of the world's largest reef fishes and is the largest member of the Labridae family (wrasses). This species can grow up to 6 ft in length and weigh up to 420 lb. Females rarely exceed 3 ft, weigh less, and live longer than males. Small juveniles are black and white with large dark spots that produce a series of dark bands. As they grow, their color changes to pale green with a vertically elongated spot on each scale, which tend to form vertical bars on the fish. Two black lines extend posteriorly from each eye through all stages of color change. The larger adults are green, blue, or blue-green with wavy yellow lines near the head and a spindle-shaped dark bar on each scale; scales can exceed about 4 in. in diameter. Large adults have a large, bulbous bump on the forehead and thick, fleshy lips.

Habitat and Distribution. Juveniles occur in coral-rich areas of lagoon reefs, particularly among live thickets of staghorn, *Acropora* spp. corals, in seagrass beds, murky outer river areas with patch reefs, shallow sandy areas adjacent to coral reef lagoons, and mangrove and seagrass areas inshore (Russell, 2004). Adults are more common offshore than inshore, their presumed preferred habitat being steep outer reef slopes, reef drop-offs, reef tops, channel slopes, reef passes, and lagoon reefs. They are usually found in association with well-developed coral reefs (Russell, 2004).

The humphead wrasse is widely distributed, but nowhere common. Its range encompasses almost the entire Indo-Pacific region, stretching from Egypt, down the eastern coast of Africa to Madagascar; up to Sri Lanka; all of Southeast Asia; northern Australia and the Great Barrier Reef; and up to the southern islands of Japan. It has been recorded from the following locations: Israel, Saudi Arabia, Tanzania, Christmas Island, Indonesia, the Philippines, the Marshall Islands, Fiji, Federated States of Micronesia, Palau, Papua New Guinea, and Samoa. Within U.S. waters, it occurs in American Samoa, Guam, the Line Islands, and the Northern Mariana Islands.

Threats. The uncommon populations of this species have been in decline due to threats from overharvest as well as habitat destruction and degradation (National Marine Fisheries Service, 2009). The humphead wrasse is especially vulnerable to overharvest by both legal and illegal fishing activities due to their long lifespan, large size, and unique life history of female to male sex change later in life (National Marine Fisheries Service, 2009). Another significant threat to the decline of the species is habitat loss and degradation, specifically destruction and degradation of reef habitats, which is ongoing throughout the Indo-Pacific (National Marine Fisheries Service, 2009).

USAKA Distribution. Three adult humphead wrasse were recorded at two ocean-side survey sites during the 2008 biennial surveys on the Kwajalein islet. Both sites were offshore from the landfill area in deeper ocean (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 2010). The species was also recorded during 2010 surveys on the lagoon side and off the northern ocean side of Kwajalein (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 2012). Since 2008, humphead wrasse has been recorded at 17 surveys sites on 9 islets in the Kwajalein Atoll and in the Mid-Atoll Corridor (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 2013).

3.2.3 Reef Manta Ray (*Manta alfredi*)

Species Description. The reef manta ray has pale to white shoulder patches, with a small bright white spot on the leading edge (marking the spiracle, or opening where water is drawn into the gills). Black spots or markings are almost always present in the “chest” area between the two pairs of gill slits on the underside. The mouth area is whitish or grayish (best seen from below or when viewed head-on). In addition, there is no spine at the base of the tail. A few individuals are entirely black except for a white blaze mark on the underside. This species of manta grows to a maximum of about 18 ft from wingtip to wingtip (Marshall et al., 2009).

Habitat and Distribution. Mantas are commonly sighted inshore, but also found around offshore coral reefs, rocky reefs, and seamounts (Marshall et al., 2009). Mantas can be found within 30 degrees north and south of the equator in the Pacific, Indian, and Atlantic Oceans, and are more likely to be found nearshore in shallow coastal areas with productive upwelling. Manta rays have been sighted with some frequency in Japan, Hawaii, the Canary Islands, the Red Sea, Sri Lanka, and Thailand, the Solitary Islands, Australia, French Polynesia, Senegal, Durban, South Africa, the Maldives, and Perth, Australia.

Threats. The main threat to this species is fishing, whether targeted or incidental. Manta rays are currently killed or captured by a variety of methods including harpooning, netting, and trawling. These rays are easy to target because of their large size, slow swimming speed, aggregative behavior, predictable habitat use, and lack of human avoidance (Marshall et al., 2011). Manta species have a high value in international trade markets. Their gill rakers are particularly sought after and are used in Asian medicinal products. This market has resulted in directed fisheries for manta rays which are currently targeting these rays in unsustainable numbers. Over 1,000 manta rays are caught per year in some areas (Marshall et al., 2009).

Aside from directed fisheries, manta rays are also incidentally caught as bycatch in both large-scale fisheries and small netting programs such as shark control bather protection nets (Marshall et al., 2009).

USAKA Distribution. Sightings of the reef manta ray have not been recorded during biennial surveys; however, anecdotal information indicates that *Manta alfredi* has been observed in the Kwajalein lagoon (T. Craven, Pers. Comm., 2016).

3.2.4 Oceanic Giant Manta Ray (*Manta birostris*)

Species Description. The oceanic giant manta ray is the largest ray in the world, its "wing span" averaging about 22 ft across, but measured at almost 30 ft in rare cases. It has distinct triangular pectoral wings that arch backwards, and cephalic fins on either side of its mouth that can be unfurled and angled to direct water and plankton into its mouth. They are classically dark on top and white underneath, but often have light marks on top and dark spots underneath that are unique to each ray (Passarelli and Piercy, 2016).

Habitat and Distribution. The manta occurs over the continental shelf near reef habitats and offshore islands. It swims by flapping its large pectoral fins, and is usually observed near the surface or in the mid-waters of reefs and lagoons. It inhabits temperate, tropical, and subtropical waters worldwide, between 35°N and 35°S latitudes. In the western Atlantic Ocean, this includes South Carolina (United States) south to Brazil and Bermuda. Occasionally this ray is observed as far north as New Jersey and San Diego. Other locations include the east coast of Africa, in the Gulf of Aden, Red Sea, Arabian Sea, the Bay of Bengal, as well as the Indo-Pacific (Passarelli and Piercy, 2016).

Threats. The main threat to this species is fishing, whether targeted or incidental. Manta rays are currently killed or captured by a variety of methods including harpooning, netting, and trawling. These rays are easy to target because of their large size, slow swimming speed, aggregative behavior, predictable habitat use, and lack of human avoidance. Manta species have a high value in international trade markets. Their gill rakers are particularly sought after and are used in Asian medicinal products. This market has resulted in directed fisheries for manta rays which are currently targeting these rays in unsustainable numbers. Over 1,000 manta rays are caught per year in some areas (Marshall et al., 2011).

Aside from directed fisheries, manta rays are also incidentally caught as bycatch in both large-scale fisheries and small netting programs such as shark control bather protection nets. In some populations, such as the ones identified at Isla de la Plata, Ecuador, Laje de Santos, Brazil, and the Similan Islands, Thailand, high percentages of all individuals encountered or identified have evidence of entanglement or are dragging lines or nets (Marshall et al., 2011).

USAKA Distribution. The oceanic giant manta ray was observed on the lagoon side of the Kwajalein islet during the 2010 biennial surveys (U.S. Fish and Wildlife Service/National Marine Fisheries Service, 2012).

3.2.5 Scalloped Hammerhead Shark (*Sphyrna lewini*)

The following information comes from the NMFS Final Rule for *Threatened and Endangered Status for Distinct Population Segments of Scalloped Hammerhead Sharks* under 79 Federal Register 38213 (National Oceanic Atmospheric Administration, 2014), the 2014 Status Review Report for this species (Miller et al., 2014), and from the 11 August 2011 petition for listing for this species, *Petition To List the Scalloped Hammerhead Shark (Sphyrna lewini) under The U.S. Endangered Species Act Either Worldwide Or As One Or More Distinct Population Segments* (WildEarth Guardians and Friends of Animals, 2011).

Species Description. The scalloped hammerhead is a UES consultation species and the only shark species listed as threatened or endangered under the ESA. The scalloped hammerhead is the second largest hammerhead shark, with a maximum total length of about 12 to 13.8 ft. Males mature at 4.6 to 5.4 ft and reach at least 9.7 ft, while females mature at about 7 ft and reach at least 10.1 ft. At birth, pups average 1.4 to 1.8 ft in length.

The body of the shark is spindle-shaped, with a large first dorsal fin and low second dorsal and pelvic fins. The rear margin of the pectoral fin is straight, with ventral tips dusky in adults and occasionally black in juveniles. The front teeth of the scalloped hammerhead are straight, while the rest have oblique cusps (unlike the great hammerhead, which has serrated teeth).

The scalloped hammerhead can be distinguished from other hammerheads by its unique head. Like all hammerheads, the scalloped hammerhead has an elongated head, with eyes and nostrils on the lateral ends. The scalloped hammerhead has a central indentation of the head, followed by two more indentations, one on each side of the center. This gives the head a scalloped appearance. The coloration of the scalloped hammerhead ranges from a brownish-gray to bronze color on its back, with a white underside. The ends of the head are slightly swept back, and the mouth is broadly arched.

Habitat and Distribution. The scalloped hammerhead is a circumglobal species, living in temperate and tropical seas along coastal zones and in deep water adjacent to them. Scalloped hammerheads rarely venture into waters cooler than 72 degrees Fahrenheit (°F). Populations occur in portions of the Atlantic, Pacific, and Indian oceans. In the Atlantic, the species lives in waters from New Jersey to Uruguay, including the Gulf of Mexico and the Caribbean; and in the eastern Atlantic, it ranges from the Mediterranean and Senegal to the Democratic Republic of the Congo (formerly Zaire). Three distinct population segments (DPS) of scalloped hammerhead occur in the Pacific Ocean, including the Indo-West Pacific DPS that encompasses the Marshall Islands. Populations in the Pacific occur offshore of Thailand, Vietnam, Indonesia, China, Japan, Philippines, Australia, and New Caledonia. In the eastern Pacific, the scalloped hammerhead ranges from southern California (including the Gulf of California) to Panama, Ecuador, and northern Peru, and in waters off Hawaii and Tahiti. Finally, in the Indian Ocean, the species exists from South Africa, Maldives, and the Red Sea to Pakistan, India, and Myanmar.

Threats. Both target and bycatch capture in fisheries is a significant cause of mortality for the species. Because scalloped hammerheads aggregate in large schools, large numbers may be captured with minimal effort. They are sought for their highly valuable fins, and are being increasingly targeted in some areas.

USAKA Distribution. There are no recorded sightings of scalloped hammerhead shark in the Action Area, and it has not been recorded around the Kwajalein islet during any biennial surveys. Scalloped hammerhead sharks might occur in the deep ocean waters near USAG-KA; however, they are primarily coastal in terms of habitat preference. Scalloped hammerheads are not well studied in the deep waters near Kwajalein Atoll (U.S. Air Force, 2015). A solitary adult scalloped hammerhead shark was observed by NMFS and USFWS biologists in approximately

25 ft of water seaward of the atoll reef west of Roi-Namur Islet (M. Molina, Pers. Comm., 2014 in U.S. Air Force, 2015). It is unlikely that any scalloped hammerhead sharks would transit within the Action Area, due to the close proximity to the shoreline.

3.3 SEA TURTLES

Information in this section is taken directly from the *Recovery Plan for U.S. Pacific Populations of the Green Turtle* (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1998a), *Green Sea Turtle (Chelonia mydas) 5-Year Review: Summary and Evaluation* (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2007a), *Recovery Plan for US Pacific Populations of the Hawksbill Turtle (Eretmochelys imbricata)* (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 1998b), and *Hawksbill Sea Turtle (Eremochelys imbricata) 5-Year Review: Summary and Evaluation* (U.S. Fish and Wildlife Service/National Marine Fisheries Service, 2007b), unless otherwise noted.

3.3.1 Green Turtle (*Chelonia mydas*)

Species Description. The green turtle is the largest member of the marine turtle family Cheloniidae and is found throughout the Pacific, Indian, and Atlantic oceans and the Mediterranean Sea. Green turtles are distinguished from other sea turtles by their smooth carapace with four pairs of lateral scutes, a single pair of prefrontal scutes, and a lower jaw-edge that is coarsely serrated. Adult green turtles may weigh more than 220 lb and exceed 3 ft in carapace length. The common name of this species refers to the green color of its subdermal fat. The carapace color of adult turtles ranges from light to dark brown, sometimes with an olive cast, radiating or wavy lines, and/or dark blotches. The plastron typically is yellowish to orange, and in the east Pacific often has a grayish cast.

Habitat and Distribution. The green turtle is found in tropical and subtropical coastal and open ocean waters of the Atlantic, Pacific, and Indian oceans, generally between 30°N and 30°S (Hirth, 1997). There are 9 major nesting populations in the Pacific Ocean and at least 166 smaller nesting sites (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2007a). Green turtle habitat varies by life stage. Hatchlings live in the open ocean for several years. Once reaching the juvenile stage, they congregate in shallower coastal feeding areas (Carr, 1987; Bresette et al., 2006). Green turtles spend most of their lives as late juveniles and adults in relatively shallow waters (10 to 33 ft) with abundant seagrass and algae, near reefs or rocky areas used for resting (National Marine Fisheries Service and U.S. Fish and Wildlife

Service, 2007a). They are highly migratory; both males and females typically migrate seasonally along coastal routes from breeding areas to feeding grounds, while some populations migrate across entire ocean basins (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2007a).

Threats. The green sea turtle was listed under the ESA due to excessive commercial harvest, a lack of effective protection, evidence of declining numbers, and habitat degradation and loss (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2007a). The harvest of eggs and nesting females for food remains a primary threat to the species across the Pacific Ocean (Maison et al., 2010). In addition, green sea turtles are susceptible to the same potential threats that are generally applicable to all turtle species known to occur in the Action Area. There are no known threats in the Action Area that are specific to only green sea turtles.

USAKA Distribution. Few data are available to assess population dynamics for sea turtle species, both green and hawksbill, within the Marshall Islands. Turtle sightings around the USAKA islets are not unusual but are not common. In 2010, four green turtle nests were discovered near the housing area on northeast Kwajalein (U.S. Army Garrison-Kwajalein Atoll, 2013).

3.3.2 Hawksbill Turtle (*Eretmochelys imbricata*)

Species Description. Hawksbills are recognized by their relatively small size (carapace length less than 3 ft), narrow head with tapering beak, and strongly serrated posterior margin of the carapace and thick, overlapping shell scutes. In addition, they may be distinguished from green sea turtles by the transverse division of the prefrontal scales into two pairs (these scales are elongate and undivided in Chelonia) (Pritchard and Trebbau, 1984). The carapace of adult turtles is dark brown with faint yellow streaks and blotches; the scales on the dorsal side of the flippers and head are dark brown to black with yellow margins; the ventral side of the flippers and the plastron are pale yellow, with scattered dark scales on the flippers (Witzell and Banner, 1980).

Habitat and Distribution. The hawksbill turtle is the most tropical of the world's sea turtles, rarely occurring higher than 30°N or lower than 30°S in the Atlantic, Pacific, and Indian oceans. A lack of nesting beach surveys for hawksbill turtles in the Pacific Ocean and the poorly understood nature of this species' nesting have made it difficult for scientists to assess the population status of hawksbills in the Pacific (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1998b). Hatchlings live in the open ocean before settling into nearshore habitats as older juveniles. Juvenile and adult hawksbills are considered the “most coastal” of all sea turtles, preferring coral reefs (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2013). Reefs provide shelter for resting hawksbills day and night, and they are known to repeatedly visit the same resting areas. Hawksbills are also found around rocky outcrops and high-energy shoals—optimum sites for sponge growth—as well as mangrove-lined bays and estuaries (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2013). Once sexually mature, hawksbill turtles migrate between foraging grounds and breeding areas at intervals of several years (Mortimer and Bresson, 1999).

Threats. The hawksbill shell has been prized for centuries by artisans and their patrons for jewelry and other adornments. Despite being prohibited under the Convention on International Trade in Endangered Species (CITES), trade remains a critical threat to the species (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2007b). Hawksbill turtles are susceptible to the same potential threats that are generally applicable to all turtle species known to occur in the Action Area. There are no known threats in the Action Area that are specific to only hawksbill turtles.

USAKA Distribution. Few recordings of hawksbill turtles around Kwajalein Atoll are available. Based on their reported occurrence in island groups on all sides of the RMI, it is likely that hawksbills occur in low abundance around other atolls and islands of the RMI, including Kwajalein (U.S. Army Garrison-Kwajalein Atoll, 2013). A hawksbill sea turtle adult female was observed digging a nest and dropping eggs on Omelek, Kwajalein Atoll in mid-May 2009 (U.S. Army Garrison-Kwajalein Atoll, 2013).

3.4 CETACEANS

3.4.1 Common Dolphin (*Delphinus delphis*)

The following information is from the NOAA Fisheries, Office of Protected resources web site at http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/commondolphin_shortbeaked.htm (National Oceanic Atmospheric Administration, 2012a).

Species Description. Short-beaked common dolphins are a UES consultation species of small dolphins that are under 9 ft long and weigh about 440 lb. As adults, males are slightly larger than females. They have a rounded “melon,” moderately long beak, and a sleek but robust body with a tall, pointed, triangular, “falcate” “dorsal” fin located in the middle of the back. This species can be identified by its distinct bright coloration and patterns. A dark gray cape extends along the back from the beak and creates a “V” just below the dorsal fin on either side of the body. There is a yellow/tan panel along the flank, between the dark cape and white ventral patch, forward of the dorsal fin. This bold coloration forms a crisscrossing “hourglass” pattern. A narrow dark stripe extends from the lower jaw to the flipper. There is also a complex color pattern on the facial area and beak that includes a dark eye patch. The coloration and patterns of young and juvenile dolphins are muted and pale, but become more distinguishable and bolder as they mature into adulthood. These morphologies can be variable and distinct based on different geographic and regional populations.

Habitat and Distribution. Common dolphins prefer warm tropical to cool temperate waters (52 to 88°F) that are primarily oceanic and offshore, but still along the continental slope. The distribution of short-beaked common dolphins varies over time based on interannual changes, oceanographic conditions and seasons. They can occur on the continental shelf or farther offshore. Off the U.S. west coast, the majority of the populations are found off of California, especially during the warm-water months. Off the U.S. east coast, they are more common north of Cape Hatteras, North Carolina. During summer through autumn, large aggregations can be found near Georges Bank, Newfoundland, and the Scotian Shelf. Other distinct populations can be found off of northern Europe, the Black Sea, Newfoundland, the Mediterranean Sea, Africa, Japan, the southwestern Pacific, southern Australia, and New Zealand.

Threats. Short-beaked common dolphins are commonly incidentally taken in a number of fisheries in the Atlantic Ocean. Incidental “take” in fishing gear, including longlines, driftnets, gillnets, and trawls. They are also hunted for their meat and oil in Russia, Japan, and by nations bordering the Black Sea and Mediterranean Sea. Historically, fishing operations, specifically the tuna purse seine industry in the eastern tropical Pacific, killed significant numbers of short-beaked common dolphins.

USAKA Distribution. Limited information is available on the occurrence of common dolphin in the Action Area. This species could transit on the ocean side near Kwajalein Island, although they have not been observed during biennial surveys. It is unlikely that any common dolphins would transit within the Action Area, due to the close proximity to the shoreline and relatively shallow waters.

3.4.2 Risso's Dolphin (*Grampus griseus*)

The following information is from the NOAA Fisheries, Office of Protected Resources web site at http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/rissosdolphin.htm (National Oceanic Atmospheric Administration, 2012b).

Species Description. Risso's dolphins, sometimes called "gray dolphins," have a robust body with a narrow tailstock. These medium sized cetaceans can reach lengths of approximately 8.5 to 13 ft and weigh 660 to 1,100 lb. Males and females are usually about the same size. They have a bulbous head with a vertical crease, and an indistinguishable beak. They have a tall, "falcate," sickle-shaped dorsal fin located mid-way down the back. Calves have a dark cape and saddle, with little or no scarring on their body. As Risso's dolphins age, their coloration lightens from black, dark gray, or brown to pale gray or almost white. Their bodies are usually heavily scarred, with scratches from teeth raking between dolphins, as well as circular markings from their prey (e.g., squid), cookie-cutter sharks (*Isistius brasiliensis*), and lampreys. Mature adults swimming just under the water's surface appear white.

Habitat and Distribution. Risso's dolphins have a cosmopolitan distribution in oceans and seas throughout the world from latitudes 60°N to 60°S. In the Northern Hemisphere, their range includes the Gulf of Alaska, Gulf of Mexico, Newfoundland, Norway, Persian Gulf, and Red Sea. They are known to inhabit the Mediterranean and Black Sea. In the Southern Hemisphere, their range includes Argentina, Australia, Chile, South Africa, and New Zealand. Little or nothing is known of their migration patterns or movements, but they may be affected by movements of spawning squid and oceanographic conditions.

Threats. Bycatch in fishing gear is the primary threat to Risso's dolphins. Several types of fishing gear, including gillnets, longlines, and trawls, have been documented to incidentally "take" this species. Historically, large numbers of Risso's dolphins were killed incidental to tuna purse seine fishing in the eastern tropical Pacific Ocean.

This species has been directly hunted for meat and oil in Indonesia, Japan (drive fishery), the Caribbean (the Lesser Antilles), and the Solomon Islands. The populations in some of these areas where fisheries interactions and hunts occur may have declined in local abundance.

USAKA Distribution. Limited information is available on the occurrence of Risso's dolphin in the Action Area. This species could transit on the ocean side near Kwajalein Island, although they have not been observed during biennial surveys. It is unlikely that any Risso's dolphins would transit within the Action Area, due to the close proximity to the shoreline and relatively shallow waters.

3.4.3 Melon-headed Whale (*Peponocephala electra*)

The following information is from the NOAA Fisheries, Office of Protected Resources web site at http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/melonheadedwhale.htm (National Oceanic Atmospheric Administration, 2012c).

Species Description. Melon-headed whales are small members of the dolphin group. They can reach a length of 9 ft and weight of 460 lb. They have a small head with a rounded melon and no discernable beak. Their dorsal fin is relatively large, and they have pointed, tapering flippers (pectoral fins). The body color is dark with a large dorsal cape and dark areas on the side of the face that are not always readily apparent.

Habitat and Distribution. Melon-headed whales are found worldwide in tropical and subtropical waters. They have occasionally been reported at higher latitudes, but these movements are considered to be beyond their normal range, because the records indicate these movements occurred during incursions of warm water currents (Perryman et al., 1994). Melon-headed whales are most often found in offshore deep waters but sometimes move close to shore over the continental shelf. This species is not known to migrate.

Mass strandings (those of three or more animals) of melon-headed whales were reviewed in Brownell et al. (2006). Of the 29 documented mass strandings of this species, 5 have occurred in the Pacific islands, and one of these was in the Marshall Islands in 1990, at Kwajalein Atoll (others were in Hilo, Hawai`i in 1841, Palmyra Atoll sometime before 1964, Malékoula Island, Vanuatu in 1972, and Hanalei Bay, Kauai in 2004). This indicates that some individuals of this species are at least occasionally in these waters. The events at Palmyra and Kwajalein Atolls were unusual because the stranding occurred inside the atoll's lagoon, and only a small number of animals were involved.

Threats. Melon-headed whales are susceptible to the same potential threats that are generally applicable to all cetacean species known to occur in the Action Area. There are no known threats in the Action Area that are specific to only melon-headed whales.

USAKA Distribution. Limited information is available on the occurrence of melon-headed whales in the Action Area. This species could transit on the ocean side near Kwajalein Island, although they have not been observed during biennial surveys. It is unlikely that any melon-headed whale would transit within the Action Area, due to the close proximity to the shoreline and relatively shallow waters.

3.4.4 Offshore Spotted Dolphin (*Stenella attenuata attenuata*)

Unless otherwise noted, this information and citations below come from Riseman (1999).

Species Description. The offshore spotted dolphin becomes spotted with age. Its dorsal surface is dark gray but covered in paler spots, while its paler ventral surface is covered with dark spots. Another distinguishing feature is the spotted dolphin's bright, white snout. It also has melon, a fatty area located on its forehead. The inshore spotted dolphins tend to be larger in size than offshore dolphins. Males also typically have larger body sizes than females, yet females have longer rostra. The spotted dolphin has between 29 and 37 small, rounded teeth on either side of its upper and lower jaws. It has pectoral fins (on the sides), a dorsal fin (on the central back), and tail flukes. The blowhole, used for breathing and communication, is located on the top of the head.

Habitat and Distribution. The offshore spotted dolphin lives in the Atlantic, Indian, and Pacific oceans. It migrates seasonally to the Japanese coast and is the most common cetacean in the Gulf of Mexico. (Lang, 1996; Nowak, 1997)

Threats. Because offshore spotted dolphins tend to swim with yellowfin tuna, Pacific fishermen use sightings of these dolphins to help them locate their yellowfin tuna targets. The majority of deaths are a consequence of yellowfin tuna fishing operations. The enormous nets used to catch these tuna can unintentionally entangle dolphins as well as fish. Between 1985 and 1990, almost 130,000 were killed each year because of the tuna fish catching methods. Because of regulations such as requiring improvements in fishing equipment, this number has decreased substantially by 100,000 deaths per year. Some spotted dolphins are killed intentionally by Japanese fishermen. Between 500 and 2,000 spotted dolphins are harvested annually to be eaten by the Japanese (Bernard and Hohn, 1989; Chivers and Myrick, 1993; Nowak, 1997; Perrin et al., 1994).

USAKA Distribution. Limited information is available on the occurrence of offshore spotted dolphin in the Action Area. This species could transit on the ocean side near Kwajalein Island, although they have not been observed during biennial surveys. It is unlikely that any offshore spotted dolphin would transit within the Action Area, due to the close proximity to the shoreline and relatively shallow waters.

3.4.5 Coastal Spotted Dolphin (*Stenella attenuata graffmani*)

Unless otherwise indicated, the following information and citations come from the NOAA Office of Protected Resources website: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/spotteddolphin_pantropical.htm (National Oceanic Atmospheric Administration, 2012d).

Species Description. Like other dolphins of the genus *Stenella*, these are relatively small dolphins, reaching lengths of 6 to 7 ft and weighing approximately 250 lb at adulthood. They have long, slender snouts or beaks. Like the Atlantic spotted dolphin (*Stenella frontalis*), coastal spotted dolphins are without spots when born, accumulating them as they age until they are almost completely covered with overlapping patterns. Coastal spotted dolphins are also distinguished by a dark “cape” or coloration on their backs stretching from their head to almost mid-way between the dorsal fin and the tail flukes and by a white-tipped beak.

Habitat and Distribution. Animals of the northeastern stock are found in the eastern tropical Pacific Ocean far at sea. Coastal spotted dolphins are found within 100 miles of the coast. A Hawaiian stock occurs throughout the islands but is not considered depleted. The entire species itself can be found in all oceans of tropical and subtropical climate worldwide.

Threats. Due to the as yet unexplained association between large yellowfin tuna and some dolphins in the eastern tropical Pacific Ocean, these stocks of spotted dolphins have been the targets of the tuna purse-seine fishery that uses the dolphins’ locations to find tuna. Many dolphins used to be caught in the nets and suffocated. Currently, fishing methods for tuna imported into the United States under the Dolphin-Safe program do not allow such destructive fishing practices. The northeastern spotted dolphin is considered to be the dolphin species most affected by the tuna purse-seine fishery in the eastern tropical Pacific Ocean. Interactions with tourists are a growing issue for the Hawaiian stock.

USAKA Distribution. Limited information is available on the occurrence of coastal spotted dolphin in the Action Area. This species could transit on the ocean side near Kwajalein Island, although they have not been observed during biennial surveys. It is unlikely that any coastal spotted dolphin would transit within the Action Area, due to the close proximity to the shoreline and relatively shallow waters.

3.4.6 Striped Dolphin (*Stenella coeruleoalba*)

Unless otherwise indicated, the following information and citations come from the NOAA Office of Protected Resources web site: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/stripeddolphin.htm (National Oceanic Atmospheric Administration, 2012e).

Species Description. Striped dolphins are some of the most abundant and widespread dolphins in the world. These dolphins can reach lengths of about 9 ft and weigh up to 350 lb for males and 8 ft and 330 lb for females. They have a small to medium-sized robust, sleek body with a long, defined beak and round "melon" (forehead). The “dorsal” fin is “falcate,” tall, and located mid-back. Their distinct and striking coloration pattern with a complex of bold thin stripes that extend from the eye to the flipper and another set of stripes down the side of the body to the anal region distinguishes it from other cetacean species, and is the origin of its common name. The beak, tapered flipper, tail, and back, or cape, are dark blue/gray. The area just above the side stripe is bluish or light gray and creates a contrasting shoulder blaze that curves back and up toward the animal’s dorsal fin. The ventral side is white to pinkish, and much lighter than the rest of the body. The markings and coloration of this species may vary by individual and geographical location. Calves and juveniles may have more muted colorations and patterns.

Habitat and Distribution. Striped dolphins have a cosmopolitan distribution. They are mainly found in tropical and warm temperate waters seaward of the continental shelf from 50°N to 40°S. Their range includes Greenland, northern Europe (United Kingdom, Denmark), the Mediterranean Sea, and Japan to Argentina, South Africa, Western Australia, and New Zealand. This species occurs in the U.S. off the west coast, in the northwestern Atlantic and in the Gulf of Mexico. They can also be found in the waters off of Hawaii, but do not occur in the colder temperate and boreal waters of Alaska. This species has been documented outside their normal range in areas such as the Faroe Islands, southern Greenland, the Kamchatka Peninsula, and Prince Edward Island.

Threats. Striped dolphins are taken as bycatch or interact with a number of fisheries, such as in pelagic trawls, gillnets, driftnets, purse seine nets, and hand-harpoons. They have been subjected to drive hunts in Japan and taken in the Caribbean and Sri Lanka. During the mid-twentieth century it is estimated that as many as 21,000 animals were caught and killed each year. In the early 1990s, more than 1,000 dolphins died in the Mediterranean Sea from a "morbillivirus epizootic," which may have been triggered by pollution (e.g., organochlorines), and fewer available prey. Environmental toxins and contaminants lower the disease immunity of these animals.

USAKA Distribution. Limited information is available on the occurrence of striped dolphin in the Action Area. This species could potentially transit on the ocean side near Kwajalein Island, although they have not been observed during biennial surveys. It is unlikely that any striped dolphin would transit within the Action Area, due to the close proximity to the shoreline and relatively shallow waters.

3.4.7 Spinner Dolphin (*Stenella longirostris*)

Species Description. Adults range from 4 to 7.7 ft and reach a body mass of 50 to 174 lb. The rostrum of this species is relatively long and narrow. It also has a triangular or sub-triangular dorsal fin. Spinner dolphins generally have a tripartite color pattern consisting of a dark gray dorsal field or cape, lighter lateral field and white or very light-grey ventral field. There is also a dark band that runs from the eye to the flipper, bordered above by a thin light line. However, variation in body form and color pattern is more pronounced in spinner dolphins than in any other cetacean (Jefferson et al., 1993).

Three subspecies of spinner dolphin are also UES consultation species. These include the Costa Rican or Central American spinner, the whitebelly spinner, and the Eastern spinner.

Habitat and Distribution. Spinner dolphins have a pantropical distribution. They occur in all tropical and subtropical waters between 40°N and 40°S (Jefferson et al., 1993).

Threats. Throughout their range, the largest threat to spinner dolphins is bycatch by fisheries in purse-seine, gillnet, and trawl fisheries (Perrin et al., 1994), often in high numbers.

USAKA Distribution. Recordings of spinner dolphins in the Kwajalein Atoll were available from 2005 to 2007 (see Table-3-1). This includes observations near the project area (such as the

Shark Pit and Oceanside, off of the Kwajalein golf course). This species could transit on the ocean side near Kwajalein Island. It is unlikely that any spinner dolphins would transit within the Action Area, due to the close proximity to the shoreline and relatively shallow waters.

Table 3-1. Documented occurrences of spinner dolphins at USAG-KA.

Date	Location	Number of Dolphins
23 October 2005	Near Carlson	50
21 June 2006	Shark Pit	6
27 July 2006	Near Helipad on Illeginni Islet	100
26 February 2007	Outside SAR, along the reef	100
23 February 2007	Oceanside, southwest of Kwajalein Atoll	36
1 March 2007	Between Legan and Lone Palm	100
3 May 2007	South Pass	60
3 May 2007	Oceanside, off Kwajalein Golf Course	50
3 May 2007	Oceanside, off Big Bustard	30
11 May 2007	Lagoon Meck	30
15 May 2007	Near Pattorhead Buoys 1-3	10
1 June 2007	West Lagoon	5

Source: U.S. Air Force, 2007 in U.S. Air Force, 2015

3.4.8 Costa Rican Spinner Dolphin (*Stenella longirostris centroamericana*)

Species Description. The Costa Rican spinner dolphin subspecies are poorly known, but appear to have a similar color pattern to spinner dolphins, although it may lack the white ventral patches (Jefferson et al., 1993).

Habitat and Distribution. The Costa Rican sinner dolphin is found in coastal waters over the continental shelf of the tropical eastern Pacific Ocean, primarily from the Gulf of Tehuantepec in southern Mexico southeast to Costa Rica (Bearzi et al., 2012).

Threats. Throughout their range, the largest threat to spinner dolphins is bycatch by fisheries in purse-seine, gillnet, and trawl fisheries, often in high numbers (Bearzi et al., 2012).

USAKA Distribution. Limited information is available on the occurrence of Costa Rican spinner dolphin in the Action Area. This species could potentially transit on the ocean side near Kwajalein Island, although they have not been observed during biennial surveys. It is unlikely that any Costa Rican spinner dolphin would transit within the Action Area, due to the close proximity to the shoreline and relatively shallow waters.

3.4.9 Whitebelly Spinner Dolphin (*Stenella longirostris longirostris*)

Species Description. The whitebelly spinner dolphin subspecies appears to represent a hybrid between Eastern spinner and Gray's spinner dolphins. Whitebelly spinners are more robust, with a two-part color pattern and less exaggerated sexual dimorphism than the other stocks in the eastern tropical Pacific (Jefferson et al., 1993).

Distribution. The whitebelly spinner dolphin occurs mainly around oceanic islands in the tropical Atlantic, Indian, and western and central Pacific east to about 145°W (Rice, 1998). However, the distribution in the Atlantic is not well known, especially in South American and African waters; the known range can be expected to expand considerably in those areas with increased attention to the cetacean faunas there. The southernmost record is from New Zealand, more than 2,000 km south of what is thought to be the normal range but still well north of sub-Antarctic waters (Bearzi et al., 2012).

Threats. Throughout their range, the largest threat to spinner dolphins is bycatch by fisheries in purse-seine, gillnet, and trawl fisheries, often in high numbers (Bearzi et al., 2012).

USAKA Distribution. Limited information is available on the occurrence of whitebelly spinner dolphin in the Action Area. This species could potentially transit on the ocean side near Kwajalein Island, although they have not been observed during biennial surveys. It is unlikely that any whitebelly spinner dolphin would transit within the Action Area, due to the close proximity to the shoreline and relatively shallow waters.

3.4.10 Eastern Spinner Dolphin (*Stenella longirostris orientalis*)

Species Description. The Eastern spinner dolphin subspecies has a monotone steel grey color pattern, with white only as patches around the genitals and axillae. They have the most exaggerated sexual dimorphism.

Habitat and Distribution. The Eastern spinner dolphin inhabits pelagic waters of the eastern tropical Pacific east of about 145°W, from 24°N off Baja California south to 10°S off Peru (Bearzi et al., 2012).

Threats. Throughout their range, the largest threat to spinner dolphins is bycatch by fisheries in purse-seine, gillnet, and trawl fisheries, often in high numbers (Bearzi et al., 2012).

USAKA Distribution. Limited information is available on the occurrence of the Eastern spinner dolphin in the Action Area. This species could transit on the ocean side near Kwajalein Island, although they have not been observed during biennial surveys. It is unlikely that any Eastern spinner dolphin would transit within the Action Area, due to the close proximity to the shoreline and relatively shallow waters.

3.4.11 Sperm Whale (*Physeter catodon*)

Species Description. The sperm whale is the largest toothed cetacean. The body is somewhat laterally compressed and the head is huge (one-quarter to one-third of the total length, and an even greater proportion of the total bulk) and squarish when viewed from the side. The lower jaw is narrow and underslung. The single S-shaped blowhole is set at the front of the head and is offset to the left. The flippers are wide and spatulate, and the flukes are broad and triangular with a nearly straight trailing edge, rounded tips, and a deep notch. There is a low rounded dorsal hump and a series of bumps, or crenulations, on the dorsal ridge of the tail stock. The body surface tends to be wrinkled behind the head. Sperm whales are predominantly black to brownish grey, with white areas around the mouth and often on the belly. Functional teeth are present in the lower jaw only. The bushy-shaped blow projects up to 5 m and, because of the position of the blowhole, is directed forward and to the left (Jefferson et al., 1993).

Habitat and Distribution. Sperm whales are distributed from the tropics to the pack-ice edges in both hemispheres, although generally only large males venture to the extreme northern and southern portions of the range (poleward of 40° latitude). Deep divers, sperm whales tend to inhabit oceanic waters, but they do come close to shore where submarine canyons or other physical features bring deep water near the coast.

Threats. Direct harvest was the main cause of the initial depletion of sperm whales. Currently threats to sperm whales include injury from marine debris, oceanic contaminants and pollutants, ship strikes, anthropogenic noise, and interactions with fishery gear. All of these threats appear to have a low effect on sperm whales (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2010).

USAKA Distribution. Sperm whales have been observed at USAKA on the ocean side of the atoll (U.S. Army Garrison–Kwajalein Atoll, 2012b). A pod of 28 sperm whales including one calf was seen on 2 July 2009 between Legan and Illeginni on the ocean side (The Kwajalein Hourglass, 2009 in U.S. Army Garrison-Kwajalein Atoll, 2012b). These whales could potentially transit near Kwajalein Island, although they have not been observed or heard during biennial surveys. It is unlikely that any sperm whales would transit within the Action Area, due to the close proximity to the shoreline.

4 Effects of the Action

4 Effects of the Action

This section describes the probable effects of five potential stressors on protected species that could occur in the Action Area. The five stressors analyzed are (1) *direct impact* from debris removal and shoreline protection activities, (2) *turbidity or sedimentation,* (3) *exposure to noise* produced by machinery or other construction activities, (4) *wastes and discharges* from construction activities or equipment, and (5) *loss or degradation of habitat*, including shelter and/or forage resources.

This BA provides an assessment of each of these potential stressors to determine if their effects are expected to be significant (size and severity of the effect), discountable (whether an effect is likely to occur), or beneficial (effects that only benefit species; no individual organism experiences adverse effect).

For each species, the potential for the Proposed Action to cause direct, indirect, or cumulative effects is analyzed and a determination of effects is made.

4.1 STRESSORS

4.1.1 Direct Impact

The Proposed Action will use heavy equipment and include movement of large pieces of metal debris and placement of stone and other shoreline armoring materials. Some pieces of metal debris that require removal are beyond the shoreline toe on the reef flat and may be pried from the substrate. Equipment or debris that is loosened from the shoreline or substrate during removal could come in physical contact with mollusk, fish, turtle, or marine mammal species in the Action Area. Direct physical impact with equipment or shoreline armoring materials can have severe impacts to these species including injury or death. The Action Area includes a relatively small in-water area, however, and the species must be directly beneath the equipment or debris in order to be injured or killed by direct impact. Additionally, the potential for any impacts to UES coordination corals is very low, as removal activities would be restricted to reef flat and bench-top areas.

The following mitigation and conservation measures will be used to avoid direct physical impact to protected species from heavy equipment or debris:

- All activity for metal debris removal and shoreline stabilization would occur on the shoreline and will take place during periods of low tide, so protected species in the marine environment would not be exposed to debris as it is removed.
- Equipment would be positioned on the shoreline and would not transit the reef flat.
- Workers would be trained in identification and avoidance of these species if their activities require them to enter the marine environment.
- Observers with binoculars will be posted along the shore in the immediate vicinity of the project area. If protected marine species are seen within the safety zone, work will cease until the animal has exited the safety zone or 15 minutes has passed without re-detection of the animal in the safety zone.
- Prior to removal activities each day, beach areas will be surveyed for sea turtle tracks to find newly laid nests. Any nests will be demarcated and avoided.
- Workers will be instructed to carefully translocate any UES coordination corals that occur on debris to the immediate vicinity of their original location.

In the event that *Trochus* is observed within the project area, work will immediately cease. Since this species is mobile, there is potential for it to enter the action area, but may require a longer period of time (multiple days) to leave the area. To avoid direct impacts to *Trochus* from relocation, project work and equipment that may cause direct impacts would temporarily relocate to another area along the shoreline. Activity in that area could proceed once the project supervisor concludes the *Trochus* would not be adversely affected by the activity.

Given that the mitigation and conservation measures would reduce the potential for direct physical impact to protected mollusks, fish, sea turtles, and marine mammals, and that those species are unlikely to occur in the Action Area during periods of low tide and would likely avoid the project area due to the activity occurring on site, the probability of debris or equipment directly contacting any protected species is discountable. Additionally, the probability of nesting sea turtles on the shoreline being exposed to heavy equipment, metal debris, or shoreline armoring materials is also discountable because sea turtles have not been recorded to nest on this shoreline.

4.1.2 Turbidity or Sedimentation

Debris removal and shoreline stabilization activities have the potential to increase the turbidity in the ocean water surrounding the Action Area. Removal of debris would temporarily loosen shoreline sands and soils. The turbidity increase above baseline levels would be temporary and localized to the area where the debris removal is occurring. The turbidity should decrease rapidly with the cessation of the work since the materials in the project area are larger particles of sand, which rapidly settle from the water column.

The following mitigation and conservation measures will be used to reduce an increase to turbidity and sedimentation impacts on protected species and their habitats:

- Installation of a heavy-duty silt curtain before construction begins, just offshore of the construction extents, would act as an environmental barrier to prevent material from eroding and reaching the reef.
- During installation of the heavy-duty silt curtain, care will be taken to ensure that protected species are not trapped inside the curtain or impacted by the curtain weights and anchors.
- During debris removal and shoreline stabilization, turbidity will be monitored within 50 m of the shoreline, both up current and down current of the work area, on a daily basis. If the turbidity in the project area exceeds 10 NTUs above background (baseline) levels, work will cease until the turbidity levels are below 10 NTUs above background per the requirements stipulated in the existing *Dredging and Filling Document of Environmental Protection*, DEP-10-002.0
- A mandatory shutdown safety zone corresponding to where protected mollusks, fish, sea turtles, marine mammals could be disturbed would be established within 50 yards of the shoreline, and work will cease if an animal is observed in the safety zone. A mandatory shutdown will be invoked when protected fish, sea turtles, or marine mammals are observed within this 50-yard area.
- Work would occur on the shoreline and during periods of low tide to reduce the level of increased turbidity.

For other projects in the Kwajalein Atoll, data has been collected that supports the effectiveness of using a silt curtain to control turbidity. The Roi Fuel Pier Repair project required monitoring of turbidities outside the silt curtain at the project site and at two background stations outside the influence of the project. The lowest turbidities at the background stations ranged from 0.08 to 0.23 NTUs. While the project was dredging the pier site, turbidities outside the silt curtains at the project site were 0.73 and 3.00 NTUs above the lowest turbidities at either of the two background stations. Turbidity in the project area while dredging was ongoing averaged only 2.00 NTUs above background (U.S. Army Kwajalein Atoll, undated).

Mollusks. Terrestrial sediment runoff and deposition can significantly impact mollusk health by blocking light, directly smothering and abrading tissue, reducing larval survival, reducing coral polyp activity, and reducing the reproductive rate (Dodge et al., 1974; Rogers, 1983; Jokiel et al., 2014). *Trochus niloticus* lives in relatively high energy areas on the reef and as such can tolerate short periods of increased turbidity such as those happening during storm and extreme tide situations. With the use of a silt curtain to control turbidity and the cessation of work when turbidity exceeds 10 NTUs, effects to *Trochus* in the Action Area are unlikely.

Fish. High suspended sediment levels can affect fish, manta rays, and scalloped hammerhead sharks in a variety of ways, including: (1) adversely affecting their swimming, reducing growth, reducing disease tolerance, or causing death (normally caused by clogging gill filaments); (2) reducing habitat quality (suitability), particularly spawning habitats affecting eggs and developing larvae by smothering; (3) forcing the modification of migration patterns; (4) reducing food availability (primary production, plants, and benthic invertebrates); and (5) altering predatory efficiency (Berry et al., 2003). Since BMPs will be implemented to reduce turbidity in the water surrounding the Action Area, fish are unlikely to be affected in any of these ways.

Sea Turtles. Turtles transiting the project area could be affected by increased turbidities through effects on foraging success. However, because BMPs will be used to contain particulates, project personnel will search the areas for presence of these species prior to implementing BMPs, and those personnel have high probabilities of detecting sea turtles that occur in the area, it is very unlikely that turtle foraging would be affected by sediment or turbidity produced by the project.

Marine Mammals. Cetaceans could be indirectly affected by impacts from turbidity on their prey items, fish and invertebrate species. Toothed whales (e.g., members of the dolphin family and sperm whale) have a sophisticated sonar system (echolocation), so any likelihood of impaired navigation or predator detection would probably not be an issue. Additionally, natural events such as storms and tidal currents stir up substantial amounts of sediments, and any animals occurring in the project area are exposed to these turbidity events on a regular basis. Marine mammals are very unlikely to occur in the Action Area, especially when activities are conducted during periods of low tide, and observers will implement a mandatory shutdown if a marine mammal is seen in the safety zone. In combination with other BMPs, this would make effects on marine mammals from any increased turbidity unlikely to occur.

The use of a heavy-duty silt curtain to contain turbidities and posting observers to search for presence of protected species prior to erecting the silt curtains should result in little chance for mollusk, fish, turtles, or marine mammals to be affected by the project. Given the mitigation and conservation measures that will be implemented, the effectiveness of the silt curtain, and the very low likelihood that protected species would transit the Action Area during project activities, the probability of turbidity affecting any protected species is discountable.

4.1.3 Exposure to Noise

Sources of noise from the Proposed Action will be generated by heavy equipment based on the shoreline and placed approximately 10 to 20 ft from the water. The types of noise sources and the maximum sound noise (L_{max}) generated by each piece of equipment are summarized in Table 2-3. The Proposed Action has a maximum in-air sound level of 116 decibels (dB), and would diminish to less than 100 dB over 50 ft away from the construction. This does not exceed the 120 dB in-water noise threshold for continuous non-impulsive noise for behavioral effects to marine mammals.

The coupling of land-based vibrations and nearshore sounds into the underwater acoustic field is not well understood. In-air noise measurements use a standard reference sound pressure of 20 micropascals (μPa), or 0 dB. In-water measurements use a standard reference sound pressure of 1 micropascal (re 1 μPa). The difference (of about 26 dB) between the sound pressure levels of an air reference pressure and those of a water reference pressure can be compared by inserting their respective reference pressures in the following equation: difference (dB) = 20log10 (air reference pressure/water reference pressure) = 26 dB (Bradley and Stern, 2008). Most standards for assessing potential impact of sounds on marine resources, use the root-mean-square (dB_{rms}) of an acoustic pulse. In the discussion below, all further references to Sound Pressure Level (SPL) assume dB_{rms} re 1 μPa.

Sounds generated from onshore construction activities from the Proposed Action are not likely to enter the water column at levels that would cause physical, physiological, or behavioral responses in marine mammals or other marine resources that might occur near the shoreline.

The following mitigation and conservation measures will be used to reduce noise-related impacts on protected species:

- A mandatory shutdown safety zone corresponding to where protected mollusks, fish, sea turtles, and marine mammals could be disturbed would be established within 50 yards of the shoreline, and work will cease if an animal is observed in the safety zone. A mandatory shutdown will be invoked when protected fish, sea turtles, or marine mammals are observed within this 50-yard area.
- Work would occur on the shoreline and during periods of low tide to reduce sound transmission in water.

Mollusks. Although the study of invertebrate sound detection is still rather limited, it is becoming clear that many marine invertebrates are sensitive to sounds and related stimuli (Popper and Hawkins, 2016). This sensitivity has been demonstrated in tropical waters where crustacean and coral larvae can respond to acoustic cues (e.g., reef noise) (Vermeij et al., 2010). Since they occur infrequently in the area and have not been recorded in the immediate Action Area, and because noise generation would be limited to periods of low tide to reduce transmission through water, the in-water noise is unlikely to affect protected mollusks.

Fish. Fish utilize sound for navigation and selection of habitat, mating, predator avoidance and prey detection, and communication. Impeding the ability of fish to hear biologically relevant sounds might interfere with these critical functions and use of the ”acoustic scene” or ”soundscape” to learn about the overall environment. Larval stages of coral reef fish can detect and are attracted to the sound of coral reefs, thereby using reef noise as an acoustic cue for orientation (Simpson et al., 2004).

Fish can experience injury at ≥ 206 dB_{rms} Sound Exposure Level (SEL) (re: 1 μPa) in water (see Table 4-1) and behavior modification at ≥ 150 dB_{rms}. The Proposed Action has a maximum in-air noise level of 116 dB and less than 100 dB at 50 ft away from the construction. If a fish occurred 50 ft from these sound sources these noise levels are not likely to cause behavioral modifications or injury.

Table 4-1. Harassment levels and biological thresholds for fish.

In-Water Sounds- Biological Thresholds For Fish		
Functional Hearing Group	Behavior Effects Threshold	Injury Threshold
Fish (all sizes)	≥ 150 dBrms	≥ 206 dB cumulative SEL
Fish (2 grams or larger)	≥ 150 dBrms	≥ 187 dB cumulative SEL
Fish (under 2 grams)	≥ 150 dBrms	≥ 183 dB Peak

Source: Fisheries Acoustic Working Group, 2008
Notes: dB: decibels; rms: root-mean-square; SEL: Sound Exposure Level

Sea Turtles and Marine Mammals. The UES is the regulatory document for environmental issues for activities at USAKA. Although the MMPA is not applicable at USAKA, the UES incorporates the intent of the MMPA in its requirements. For purposes of this BA, the MMPA criteria are used for analyses. Specific threshold criteria are not established for sea turtles, therefore this analysis uses the NMFS marine mammal thresholds, which provides a conservative approach in favor of the turtles.

Given that hearing is one of the most important sensory receptors for marine mammals, noise could affect marine mammals in several ways and are highly variable (Richardson et al., 1995). Marine mammals can show the full range of types of behavioral response, including altered headings; fast swimming; changes in dive, surfacing, and respiration patterns; and changes in vocalizations (National Research Council, 2003).

The cetacean permanent threshold shift (PTS) for exposure to in-water sounds is ≥ 180 dB_{rms} re: 1 μPa (i.e., Level A Harassment—zone of hearing loss, discomfort, or injury) (see Table 4-2). Acoustic thresholds that would be expected to cause adverse behavioral responses in marine mammals have not been identified for the purposes of the Endangered Species Act of 1973, as amended. However, under the MMPA, exposure to impulsive in-water sounds at ≥ 160 dB_{rms} re: 1 μPa or exposure to non-impulsive sound (continuous noise) is ≥ 120 dB_{rms} re: 1 μPa are used as thresholds for behavioral responses that would qualify as Level B Harassment. Using the MMPA thresholds as a benchmark, the Proposed Action has a maximum in-air noise level of 116 dB and will be less than 100 dB 50 ft away from the construction. These noise levels would not exceed a Level B Harassment. Additionally, the maximum radius over which the noise may influence is very small compared to the distribution ranges of marine mammals in the region. If a sea turtle or marine mammal occurred 50 ft from these sound sources, these noise levels are not expected to cause behavioral modifications or injury.

Table 4-2. Harassment levels and biological thresholds for marine mammals.

In-Water Sounds- Biological Thresholds for Marine Mammals Under MMPA		
Criterion	Criterion Definition	Threshold
Level A	PTS (injury) conservatively based on Temporary Threshold Shift	≥ 180 dB_{rms} for cetaceans
Level B	Behavioral disruption for impulsive noise (e.g., impact pile driving)	≥ 160 dB_{rms}
Level B	Behavioral disruption for non-pulse noise (e.g., vibratory pile driving, drilling)	≥ 120 dB_{rms}

Source: National Oceanic Atmospheric Administration, 2016

Notes: dB: decibels; rms: root-mean-square; SEL: Sound Exposure Level

Conducting debris removal and shoreline stabilization during periods of low tide would effectively prevent marine species and other mobile species of concern from being exposed to noise at received levels that might be expected to cause adverse consequences. Increased noise levels may result in temporary avoidance of the immediate area around the work site; however, since these protected marine species are highly mobile and distributed widely throughout the region, temporary avoidance of a small part of the reef habitat during a limited number of hours each day would have insignificant effects.

4.1.4 Wastes and Discharges

Construction wastes may include plastic trash and bags that may be ingested and cause digestive blockage or suffocation in protected fish, sea turtles, or marine mammals. Corals can be directly affected by plastic macro debris as well, mainly by suffocation, shading, or abrasion. Larger waste may include discarded sections of ropes and lines, which may entangle marine life (Laist, 1997).

There will be equipment operating at the shoreline, where fuels could spill or hydraulic fluids could leak and be discharged into the marine environment. Equipment spills, discharges, and run-off from the project area could contain hydrocarbon-based chemicals such as fuel oils, gasoline, lubricants, hydraulic fluids, and other toxicants. The impacts of hydrocarbons are caused by either the physical nature of the oil (physical contamination and smothering) or by its chemical components (toxic effects and bioaccumulation) (Saadoun, 2015). Depending on the chemicals and their concentration, the effects of exposure may range from animals temporarily avoiding an area to death of the exposed animals.

The following mitigation and conservation measures will be used to reduce waste and discharge impacts on protected species:

- An emergency spill response plan would be prepared, workers would be trained in implementation, and appropriate spill response equipment would be ready and available for deployment onsite.

- All work will be performed in compliance with the Kwajalein Environmental Emergency Plan.
- Storage or disposal of waste (hazardous and non-hazardous) removed during debris removal and shore stabilization activities would be performed in accordance with the requirements in Chapter 3-6 (Material and Waste Management) of the UES.
- Any hazardous materials release or spill will be reported and cleaned up in a timely manner using established procedures.
- Any spill would be immediately isolated and contained if it can be accomplished safely. Supervisors will be notified immediately and 911 contacted if required.

Local and federal regulations prohibit the intentional discharge of toxic wastes and plastics into the marine environment. Additionally, the mitigation and conservation measures are intended to prevent the introduction of wastes and toxicants into the marine environment; therefore, construction-related discharges and spills would be infrequent, small, and quickly cleaned if they do occur. The potential for exposure of protected mollusks, fish, sea turtles, and marine mammals to construction-related wastes and discharges is discountable.

4.1.5 Habitat Loss or Degradation

No permanent loss or degradation of in-water habitat would occur from the Proposed Action, and the only short-term change in habitat quality could be a temporary and isolated increase in turbidity (Section 4.1.2). Once debris removal and shoreline construction are complete, habitat conditions are expected to improve due to improvements in water quality, and the Proposed Action would have long-term, beneficial impacts to habitat for protected species.

The following mitigation and conservation measures will be used to reduce impacts on protected species in-water habitats:

- Installation of a heavy-duty silt curtain before construction begins, just offshore of the construction extents, would act as an environmental barrier to prevent material from eroding and reaching the reef.
- Equipment will be positioned on the shoreline and would not transit the reef flat.

The Proposed Action also includes a 6-year water quality monitoring period to evaluate changes in load of contaminants to groundwater and inter-tidal marine water. This will provide quantitative data on improvements to the in-water habitat in the Action Area.

Aquatic community receptors including aquatic plants, aquatic invertebrates, and fish were evaluated considering the following assessment endpoint: survival, growth, and reproduction of aquatic community receptors. Copper is highly toxic in aquatic environments and has effects on fish and invertebrates including damage, and interferes with osmoregulatory processes (U.S. Army Public Health Command, 2012). Copper bioconcentrates in many organs in fish and mollusks; however, there is low potential for bioconcentration in fish, but high potential in mollusks (U.S. Army Public Health Command, 2012). Copper, in particular, is known to negatively affect various life history stages of many common coral reef marine invertebrates (Heslinga, 1976; Reichelt-Brushett and Harrison, 2000, 2005; Nystrom et al., 2001; Bielmyer et al., 2010) and may be accumulating, along with other contaminants, in locally-utilized fisheries resources in the area (U.S. Army Public Health Command, 2012). The addition of iron in waters where it is otherwise naturally limited may be stimulating an increase in cyanobacteria and algae abundance (National Marine Fisheries Services and U.S. Fish and Wildlife Services, 2006), and may have tipped the balance or at least enhanced the risk of a phase shift to “black reefs” in iron exposed areas (Kelly et al., 2012).

Kolinski (2015) noted that qualitatively, the reefs within the project zone do appear to be in a degraded state (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2006, 2012); however, seasonal wave energy, tidal driven aerial exposure, and warming waters likely confound or act synergistically in generating this condition. The removal of the metal debris likely would result in a net benefit for the entire community that would far outweigh the short-term risks to coral (Kolinski, 2015). Kolinski reported: “Overall, the ecological benefits of reduced metal concentrations are expected to, over time, greatly exceed project related impacts on UES coordination corals in this area.”

4.2 CUMULATIVE EFFECTS

No reasonably foreseeable nonfederal projects have been identified in the Action Area; therefore, no cumulative effects are expected. Analysis of long-term water quality monitoring results may indicate a need for further remediation. If it is determined that additional alternatives, such as landfill closure or off-island removal of waste, would be necessary, a full re-analysis of all environmental resources would be conducted to ensure there have been no changes in the affected environment.

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5 Effects Determination Summary

5 Effects Determination Summary

Based on the analyses presented in this BA, the Proposed Action "may affect, but is not likely to adversely affect" the 19 species of mollusk, fish, sea turtle, and marine mammal that may occur in the Action Area. Because of the combination of physical barriers that will be placed between the Proposed Action and the marine environment, the infrequent occurrence of protected species in the Action Area, and their low density when they occur, protected species are unlikely to be exposed to one or more of the potential stressors resulting from the Proposed Action. The probability of an exposure event is small enough to be considered discountable. In the unlikely event that individuals are exposed to one of the stressors, exposures would occur at intensities that are unlikely to have biologically meaningful for those individuals; any responses are expected to be insignificant.

Table 5-1 summarizes the determinations for each species group of the 19 species evaluated in this BA.

Table 5-1. Summary of effects determination.

Stressor	Species Type	No Effect	May Affect but Not Likely to Adversely Affect	Likely to Adversely Affect
Direct Contact	Mollusks		X	
	Fish		X	
	Sea Turtles		X	
	Marine Mammals		X	
Turbidity and/or Sedimentation	Mollusks		X	
	Fish		X	
	Sea Turtles		X	
	Marine Mammals		X	
Exposure to Noise	Mollusks		X	
	Fish		X	
	Sea Turtles		X	
	Marine Mammals		X	
Wastes and Discharges	Mollusks		X	
	Fish		X	
	Sea Turtles		X	
	Marine Mammals		X	
Habitat Loss/Degredation	Mollusks		X	
	Fish		X	
	Sea Turtles		X	
	Marine Mammals		X	

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6 References

6 References

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Appendix A
Marine Biological Assessment and Conservation Recommendations for Planned Removal of Bulk Metal Waste from the Southwestern Shoreline and Reef Flats of Kwajalein Islet, United States Army Kwajalein Atoll, Republic of the Marshall Islands

Marine Biological Assessment and Conservation Recommendations for Planned Removal of Bulk Metal Waste from the Southwest Shoreline and Reef Flats of Kwajalein Islet, United States Army Kwajalein Atoll, Republic of the Marshall Islands

FINAL REPORT

Prepared by:

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U.S. Army Space and Missile Defense Command
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21 October 2015

Abstract: A survey of metal debris on reef flat habitats was conducted on the southwest side of Kwajalein Islet, Republic of the Marshall Islands to evaluate the risks of proposed metal removal to marine species designated to be of concern in the United States Army Kwajalein Atoll Environmental Standards (UES). UES procedures for designated species include consultation and coordination. One UES consultation species, the top-snail *Tectus* (*Trochus*) *niloticus*, was observed, but individuals were located in areas where project activities are not likely to occur. UES coordination species, in particular scleractinian corals, were relatively few in number and widely scattered throughout the project zone. Impacts to a few individuals of these species are likely, but may be mitigated through thoughtful avoidance where feasible and translocation when necessary. Conservation recommendations are provided to guide impact minimization. The ecological benefits of reduced metal concentrations are expected to greatly exceed project related impacts to marine UES coordination species in this area.

Introduction

A removal of bulk metal waste from the southwest shoreline and shallow nearshore waters of Kwajalein Islet, United States Army Kwajalein Atoll (USAKA), Republic of the Marshall Islands (RMI), is being proposed to reduce metal contaminant levels in environments that exceed criteria established in the USAKA Environmental Standards or UES (UES 2014, Bering-KAYA Support Services 2014). The metal debris is a remnant of post-World War II disposal and landfill activities that resulted in islet extension and shoreline protection. The continued erosion of the debris may be affecting adjacent marine biological communities with adverse risks to human health through fisheries in the area (USAPHC 2014). Debris removal at this time will be limited to shoreline and shallow reef flat habitats, and replacement with concrete rip rap will be proposed for some areas to reduce shoreline exposure to wave-induced erosion.

USAKA activities with the potential to impact species and habitats in the RMI are regulated through processes established within the UES (2014), an international agreement between the RMI and United States Governments. The UES require that USAKA related impacts to a variety of "listed" species and habitats be evaluated through consultation and/or coordination procedures with the National Marine Fisheries Service (NMFS) and/or U.S. Fish and Wildlife Service (USFWS). Previous marine biological surveys in the general area of the proposed activity have highlighted the presence of both UES consultation and coordination species (USFWS 2011, USFWS and NMFS 2012). This report provides information on a recent survey to evaluate debris dispersion in marine environments within the proposed action area and the risks of the proposed action to UES listed species.

Methods

Shoreline and reef flat habitats along the southwest side of Kwajalein Islet, from Glass Bleach to the Surfers' Steps (Figure 1), was examined for metal debris and nearby UES consultation and coordination species on 13 and 14 September 2015 by Dr. Steven P. Kolinski and Dr. Robert Schroeder, NMFS. Grid style search patterns were walked at low tide along the shores, reef flats and upper reef crests, with distances of 5 to 20 meters (m) between surveyors and grid routes. Metal objects observed beyond 10 to 20 m from shore were, if small and close to shore, carried and deposited on shore, with descriptions, images and the location of larger or embedded items and those further out being recorded using a digital camera and Garmin GPS unit (descriptions and locations of most items within 10 to 20 m of shore were not recorded as they were determined to be easily visible from shore for removal). Observations of UES consultation and coordination species were recorded throughout the surveyed areas, with specific emphasis given to the risk of species injury that may be associated with anticipated debris removal mechanisms.

Results

Glass Beach Area

The reef flat at Glass Beach extended out from shore approximately 25 m, with the length of shoreline surveyed approximately 160 m (Figure 1). The bottom substrate consisted mainly of consolidated limestone pavement with accumulated sands on the western end (Figure 2). Metal

Figure 1. Reef flat areas surveyed for UES consultation and coordination species, from Glass Beach to the Surfers' Steps, Kwajalein Islet. Red-labeled points indicate locations of observed metal debris at distances greater than 10 to 20 m from shore (see Appendix).

debris appeared most dense along the western portion of the beach, but was limited on the outer portion of the reef flat, with a total of 3 small items recorded (Figure 1; Figures A-1 to A-3, Appendix). No UES consultation species were observed in the area. A few scattered UES coordination coral species were present on the outer reef flat and reef crest areas and included *Porites* sp. (lobate) and *Pocillopora meandrina* (Figure 2). All metal items observed appeared readily removable by hand with no risk to UES coordination species.

Figure 2. Glass Beach at low tide (left and center), with scattered UES coordination corals located mainly on the outer reef flat away from metal debris (right)

Shark Pit and the Metal Cliffs (edge of Glass Beach to Mount Olympus)

Coastline from the western edge of Glass Beach to Mount Olympus (approximately 525 m linear distance; Figure 1) contained the vast majority of metal shoreline debris at Kwajalein Islet, with aggregation and heavy erosion forming metal cliff-like shore-break structures. The majority of reef flat in this area is covered with historical landfill, with limited submerged bench-like formations extending to approximately 5 m from shore along the upper reef crest (Figure 3). UES consultation species were not observed along the shallow bench formations in this region. However, scattered UES coral coordination species were observed, including *Porites* sp. (lobate) and *Pocillopora meandrina*. Ocean waves at this location break very close to shore. Use of large machinery, such cranes, gradalls, other forklifts and/or front-loaders, will be used to facilitate removal of debris, but it is anticipated such machinery will mainly reach out from shoreline-based positions.

Figure 3: Main metal debris area along southwest Kwajalein Islet. Dark formations in the images are eroded metal. UES coordination coral species (*Porites* sp.) shown off eroded metal edge in lower right image.

Landfill Area (Surfers' Steps to Mount Olympus)

The reef flat between the Surfers' Steps and outer landfill region of Mount Olympus extended up to approximately 225 m from shore with a length of shoreline approximately 660 m (Figure 1). The bottom substrate along the inner reef flat consisted mainly of sand, algae and scattered corals with consolidated limestone pavement and an increase in coral cover and diversity occurring in the outer reef flat areas (Figure 4). Metal debris in this region was located mainly on and within 20 m of the shoreline; however, a total of 19 metal items/aggregations were identified further out (Figure 1; Figures A-4 to A-22, Appendix), with the furthest-most item resting approximately 100 m from shore. The only UES consultation species observed was *Tectus* (*Trochus*) *niloticus*, which was seen on outer reef flat areas approximately 180 m from shore. A variety of UES coordination species were observed, including the giant clam *Tridacna squamosa* and the corals *Acropora abrotanoides*, *A. digitifera*, *Hydnophora microconos*, *Leptastrea purpurea*, *Montipora digitata*, *Pocillopora damicornis, P. eydouxi*, *P. meandrina, P. verrucosa,* and *Porites* sp. (lobate). Coral distributions on and in the vicinity of metal debris were very limited. All metal items on the reef flat appeared amendable to removal by hand, with impacts to UES coordination species in most cases easily avoidable.

Figure 4: Reef flat along southwest Kwajalein Islet between the Surfers' Steps and Mount Olympus. Coral cover and diversity increases on the outer reef flat (lower left). *Pocillopora damicornis* coral colony observed growing on tire (lower right).

Discussion

The removal of metal debris from Kwajalein Islets' shoreline and reef flat environments may help reduce chronic metal contaminant inputs into adjacent nearshore habitats, which should be of benefit to many marine organisms and the people who utilize them. Copper, in particular, is known to negatively affect various life history stages of many common coral reef marine invertebrates (Bielmyer et al. 2010, Coglianese and Martin. 1981, Heslinga 1976, Reichelt-Brushett and Harrison 2000, 2005, Nystrom et al. 2001) and may be accumulating, along with other contaminants, in locally utilized fisheries resources in the area (USAPHC 2014). The long-term erosion of iron structures in coral reef waters where iron is otherwise naturally limited has been correlated with degradative community changes that include a reduction in corals and calcifying crustose coralline algae, with an increase in turf algae, fleshy macroalgae and cyanobacteria (Kelly et al. 2012). Kwajalein Atoll is likely to naturally reside in iron limited waters, as the major natural source of iron in the vicinity, basalt, is well capped with calcified coral reef accumulations. Cyanobacteria blooms in direct proximity to isolated submerged pieces of iron are commonly observed on reefs at USAKA (USFWS and NMFS 2006, S. Kolinski, NMFS, pers. obs.). Qualitatively, the reefs within the project zone do appear to be in a degraded state (USFWS and NMFS 2012, 2006); however, seasonal wave energy, tidal driven aerial exposure, and warming waters likely confound and/or act synergistically in generating this perception.

The distribution of metals was greater on shorelines than on reef flat areas, with the number of items greatly decreasing beyond 10 to 20 m from shore on reef flats. This distribution should ease the overall clean-up effort as land-based objects are much easier to locate, and machinery can more readily be positioned on land to address larger items and accumulations. All debris observed further out on the reef flats appeared amenable to removal by hand, although in some cases items may need to be pried from the substrate.

UES consultation species were not observed in the immediate vicinity of metal debris or along potential pathways that might be used for extraction. However, the top-snail *Tectus* (*Trochus*) *niloticus* is mobile and, while observed specific to outer reef flats during low tides in this survey, it may work its' way inshore as tides rise. *T. niloticus* is easy to recognize, so avoidance should be possible if awareness and caution are both employed. Limiting in-water work to low-tide periods may reduce the chances for encountering mobile UES consultation species, including sea turtles, and will likely enhance their visibility if present within a desired work area. Any affects from sound transmissions through the water are also likely to be reduced at periods of low tide. Transplantation may be an option to pursue to minimize impacts to *T. niloticus* if needed; however, such activity would require prior evaluation through UES consultation procedures. Sea turtle tracks were not observed on shoreline sands during this survey, but some of the beach approaches may be suitable for turtle nesting. Impacts to sea turtle nests might best be avoided by surveying beach areas for tracks prior to removal activities each day, and demarcating and then avoiding any nests that are laid.

UES coordination species were fairly sparse where metal debris was located; however, minor impacts to coordination corals are likely to occur. Avoidance of most of the corals in the project area may be possible if workers are trained to take care where they walk and how they remove and transport debris on the reef. Corals observed growing on items being removed might simply be scrapped off and placed near to where they were initially located. Avoidance may be most difficult along the shallow reef bench fronting the metal cliffs, as wave activity close to shore is likely to increase the focus of risks to that of human safety. Impacts to corals in this region are expected to be very limited, as long as removal activities are restricted to reef flat and bench-top areas. Overall, the ecological benefits of reduced metal concentrations are expected to, over time, greatly exceed project related impacts to UES coordination corals in this area.

Snorkel and dive evaluations of reef areas beyond the shallow crest were initially planned for this survey but could not be conducted due to weather conditions and a lack of boat support. Bulk metals have previously been observed in deeper habitats along the proposed project shoreline, particularly in the Shark Pit region as shown in Figure 5. Removal of metal debris beyond reef flat areas is not presently being proposed in this phase of remediation activities; however, documenting the location, amounts and type of debris in adjacent deeper habitats may

Figure 5. Bulk metal debris located beyond reef flat bench and crest habitats at the Shark Pit, Kwajalein Islet, RMI (images collected in 2008 by S. Kolinski, NMFS).

be useful to understanding potential metal contamination sources if UES criteria exceedance issues continue.

Conservation Recommendations

1. Absent further ecological evaluation, limit metal debris removal activities to proposed shorelines and reef flat areas.
2. Survey intended work areas each day just prior to in-water activities to ensure UES consultation species are not present. Document findings for each days' activities.
3. Educate workers in general identifications of UES species of concern. Instruct workers to avoid *T. niloticus*, corals and other notable marine invertebrates where feasible, particularly when transiting reef flat areas. A UES consultation will need to occur if *T. niloticus* are intended to be transplanted.
4. Limit in-water activities to periods of low tide to reduce opportunities for encounters with UES consultation and coordination species, enhance observing such species if present within the work area, and to limit the potential effects of mechanical sound transmissions through the water.
5. Implement previous project related best management practices for USAKA activities for sediment control (if needed) and sea turtle and/or marine mammal sightings.
6. Instruct workers to carefully translocate any corals that occur on debris to the immediate vicinity of their original location.
7. Workers should be instructed not to fish in the general area and should be made aware of the risks associated with regionally identified contaminants that may have entered the food chain.
8. Survey coastal areas prior to work activities each day for signs of turtle nesting activity. If nesting is identified/suspected, demarcate the area and contact the USFWS to work out how best to proceed with debris removal in the region where the nest is located. Prior coordination/consultation with the USFWS on such events is recommended.
9. Work with the USFWS to address potential project related impacts to birds, bird habitat and other terrestrial species of concern.

Acknowledgements

The field surveys were conducted in coordination with Glen Shonkwiler (SMDC) and Derek Miller (USAG-KA). Craig Vrabel (HDR) provided guidance on project area boundaries and debris removal techniques. Thomas Craven (SMDC) provided edits and comments which were incorporated and addressed in the manuscript. Thanks to Dr. Robert Schroeder for assisting with the survey fieldwork.

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Appendix

Metal Debris on Glass Beach Reef Flat

Figure A-1. Metal debris located at 8º43.018'N 167º 43.330'E (reference stick is 0.5 m).

Figure A-2. Metal debris located at 8º43.019'N 167º 43.312'E (reference stick is 0.5 m).

Figure A-3. Metal debris located at 8º43.028'N 167º 43.296'E (reference stick is 0.5 m).

Metal Debris on Reef Flat Fronting Landfill (Surfers Steps to Mount Olympus)

Figure A-4. Metal debris located at 8º43.155'N 167º 43.042'E (reference stick is 0.5 m).

Figure A-5. Metal debris located at 8º43.179'N 167º 43.030'E (reference stick is 0.5 m).

Figure A-6. Metal debris located 8º43.209'N 167º 42.989'E (reference stick is 0.5 m).

Figure A-7. Metal debris located at 8º43.230'N 167º 42.988'E (reference stick is 0.5 m).

Figure A-8. Metal debris located at 8º43.240'N 167º 42.990'E (reference stick is 0.5 m).

Figure A-9. Metal debris located at 8º43.251'N 167º 42.979'E.

Figure A-10. Metal debris located at 8º43.261'N 167º 42.961'E (reference stick is 0.5 m).

Figure A-11. Metal debris located at 8º43.293'N 167º 42.935'E (reference stick is 0.5 m).

Figure A-12. Metal debris located at 8º43.313'N 167º 42.919'E (reference stick is 0.5 m).

Figure A-13. Metal debris located at 8º43.317'N 167º 42.919'E (reference stick is 0.5 m).

Figure A-14. Metal debris located at 8º43.347'N 167º 42.896'E (reference stick is 0.5 m).

Figure A-15. Metal debris located at 8º43.400'N 167º 42.901'E (reference stick is 0.5 m).

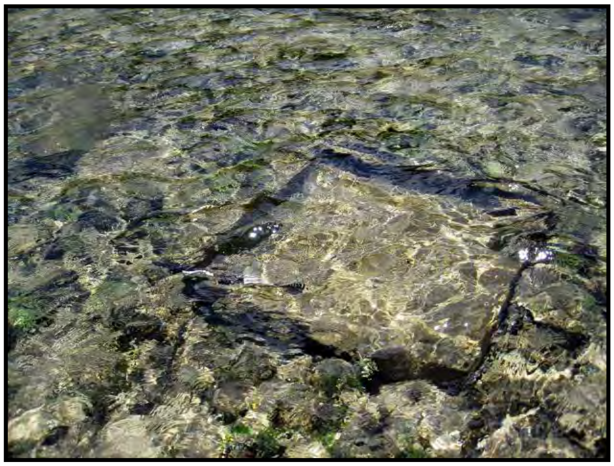

Figure A-16. Metal debris located at 8º43.385'N 167º 42.924'E.

Figure A-17. Metal debris located at 8º43.376'N 167º 42.923'E (reference stick is 0.5 m).

Figure A-18. Metal debris located at 8º43.227'N 167º 43.038'E (reference stick is 0.5 m).

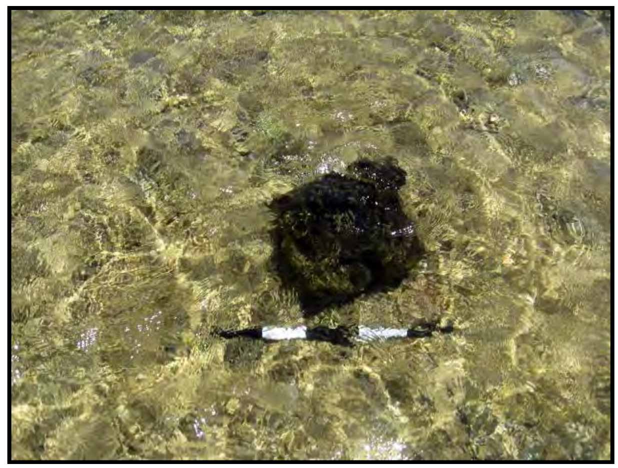

Figure A-19. Metal debris located at 8º43.221'N 167º 43.034'E (reference stick is 0.5 m).

Figure A-20. Metal debris located at 8º43.196'N 167º 43.043'E (reference stick is 0.5 m).

Figure A-21. Metal debris located at 8º43.187'N 167º 43.042'E.


Figure A-22. Metal debris located at 8º43.229'N 167º 43.045'E (reference stick is 0.5 m).

Appendix B
Preliminary Review—Removal Action Activities Associated With the Kwajalein Landfill—Removal of Metal Debris Between Glass Beach and the Shark Pit, U.S. Army Garrison–Kwajalein Atoll

From: Michael Fry

Sent: Sunday, July 10, 2016 11:21 PM

To: Craven, Thomas M CIV USARMY SMDC (US)

Cc: Dan Polhemus; Miller, Derek D CIV USARMY USAG (US) ; Aljure, Gustavo A CTR USARMY SMDC (US); Anthony Montgomery

Subject: [Non-DoD Source] RE: Removal Action Activities Associated with the Kwajalein Landfill - Preliminary Review- Removal of Metal Debris between Glass Beach and the Shark Pit. (UNCLASSIFIED)

Aloha Tom,

Dan Polhemus is away on family business.

The Service concurs with the decision to remove the mound near Glass Beach and revegetate the area. We will consult on appropriate vegetation at a later date.

Attached are the Service comments on the glass beach mound removal action and a photo of a white tern nesting in a tree on the golf course in 2014.

We would expect white terns to nest in Pandamus trees and tropical almomds anywhere on Kwajalein island. If an incubating tern is discovered, or a white tern chick, the tree it is in cannot be removed during the nesting season.

Adjacent vegetation can be removed, and the tern will remain in the nest tree until the chick fledges. At that time the tree can be removed.

Thanks very much,

Michael Fry

White Tern 2014 Nesting on Kwajalein Golf Course

COMMENT FORM

COMMENT INCORPORATOR:	**DATE: July 10, 2016**
COMMENTOR: Michael Fry	**ORGANIZATION OF COMMENTOR: USFWS, Pacific Islands Fish and Wildlife Office**
TITLE **OF DOCUMENT:** Preliminary Review: Removal Action Activities Associated with the Kwajalein Landfill - Removal of Metal Debris between Glass Beach and the Shark Pit U.S. Army Garrison, Kwajalein Atoll	**DATE OF DOCUMENT: 8 June 2016**

ITEM NO.	PAGE NO.	SECT NO.	LINE NO.	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES *(Exact wording of suggested change)*	INCOR-PORATED? *(Yes/No)*	HOW COMMENT WAS INCORPORATED *(If not incorporated, why?)*
1	8	5.0	10			White terns may nest in Pandamus trees		
2						and in Tropical Almonds. White terns were		
3						seen nesting in trees on the golf course		
4						during the 2014 biological inventory. A		
5						photo of a white tern incubating an egg in a		
6						tree on the golf course is attached.		
7						white terns are protected under the		
8						Migratory Bird Treaty Act, and nests cannot		
9						be destroyed during the nesting season. If		
10						a white tern is observed incubating or with		
11						a chick, the tern must not be displaced.		
12						Nearby vegetation can be removed, and		
13						tern will remain on the nest, and the nest		
14						tree can be removed after the chick		
15						fledges.		
16	11	6.4				The Service agrees that this vegetation		
17						removal will not have adverse effects in		
18						the long term. Replacement of shrubs will		
19						be beneficial		
20	12	7.0				The Service concurs with the removal		
21						action, provided nesting terns are protected		

Removal Action Activities Associated with the Kwajalein Landfill
Preliminary Review—Removal of Metal Debris between
Glass Beach and the Shark Pit
U.S. Army Garrison–Kwajalein Atoll

1.0 INTRODUCTION

The United States (U.S.) Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT) is executing the Compliance Cleanup Program at U.S. Army Kwajalein Atoll (USAKA) for U.S. Army Garrison–Kwajalein Atoll (USAG-KA). As part of the Cleanup Program, the USAKA Environmental Standards (UES) Appropriate Agencies reviewed the Draft Removal Action Memorandum (RAM) analyzing cleanup alternatives for the Kwajalein Landfill in early 2016. Since the release of that document, another adjacent area has come to light as a potential issue. The area in question is a roughly 3-acre vegetated mound at the west end of the runway between Glass Beach and the Shark Pit. In March 2016, there was a near miss between an approaching aircraft and a vehicle attempting to traverse the road near the end of the runway. The near miss was attributed to the vehicle occupants' view of the approaching aircraft being obscured by the vegetated mound. The mound was already under investigation to determine if it covered the old dump area used from the 1940's to the 1960's prior to the creation in the 1960's of the portion of the island on which the landfill now sits. The metal debris piles on the shoreline between Glass Beach and the Shark Pit are also believed to be remains of this dump area. The U.S. Army is preparing a Draft Environmental Assessment (EA) for the removal action activities associated with the Kwajalein Landfill. Based on the results of environmental analysis for this EA, the U.S. Army has drafted this preliminary review in accordance with UES Section 3-4.6.3 (a), as a synopsis to discuss the alteration of the mound area between Glass Beach and the Shark Pit (Figure 1).

2.0 BACKGROUND

Kwajalein is the largest island in the Kwajalein Atoll located in the western chain of the Republic of the Marshall Islands (RMI) in the West Central Pacific Ocean. Approximately 1,200 to 1,500 people live on the island. Kwajalein Island is approximately 748 acres in size; the U.S. Government created 205 of those acres after World War II by filling in the reef flat (U.S. Army Space and Missile Defense Command, 2016).

Explanation

- Project Area
- Existing Structure

NORTH

0 50 100 200 Feet

Project Area

Kwajalein Island

Figure 1

Kwajalein shoreline on the south and east area of the island in front of the mound has extensive metallic debris and other objects (concrete and rock) that have been placed along these areas to stabilize the shore from erosion. The shoreline debris has been deposited in these areas since sometime after World War II and before 1988. The metallic debris consists of rebar, ship and vehicle parts, pipe, scrap metal, wire, and other debris. The current shoreline configuration is not stable in either area and may continue to erode, which would potentially destabilize the existing, regraded landfill, or proposed new landfill and Mt. Olympus.

3.0 PROJECT AREA

Based on the 2016 RAM for the Kwajalein Landfill, the area between Glass Beach and the Shark Pit is a mound of heavily vegetated debris along and up-gradient from the shoreline between Glass Beach and the Shark Pit (the project area). The project area is covered with managed vegetation. An April 2016 geophysical survey determined that the mound is approximately 5% metallic debris. The other materials could not be determined with the geophysics performed, although it also has a significant amount of concrete debris on the surface. It is estimated that the debris mound covers approximately 3 acres and includes approximately 30,000 cubic yards of material. The mound is vegetated with kiden (*Tournefortia argentea)*, konnat (scaevola) (*Scaevola taccada*), ni (coconut trees) *(Cocos nucifera),* topo (beach morning glory) (*Ipomoea imperati and/or Ipomoea pes-caprae*), ekkon (tropical almond) (*Terminalia catappa*), lukwej (kamani) (*Calophyllum inophyllum*), kaonon (*Cassytha filiformis*), and kio (possibly *Sida fallax*); a bob (*Pandanus tectorius*) is near the mound, but not on top of it. Figures 2 and 3 are photos of some of the vegetation identified on the mound.

Suspected kio *(Sida fallax)*

Tropical almond *(Terminalia catappa)*

Leaves of tropical almond *(Terminalia catappa)*

Explanation

Mound Vegetation

Kwajalein Island

Figure 2

Kaonon *(Cassytha filiformis)*

Kiden *(Tournefortia argentea)*

Leaves of lukwej (kamani) *(Calophyllum inophyllum)*

Explanation

Mound Vegetation

Kwajalein Island

Figure 3

4.0 ACTIVITY DESCRIPTION

This mound area needs to be removed to improve the line-of-sight visibility for aircraft on the west end of the runway (U.S. Army Space and Missile Defense Command, 2016). The area would be cleared of vegetation, metal debris, and other items (e.g., concrete).

Removal

To remove the mound and the visual obstruction, the area would be cleared and grubbed of vegetation, metal debris, and other items (e.g., possibly including concrete). The metal debris and other items would be excavated, sorted, and tested. Recyclable metal would be sent off-island for recycling. Soil would be stockpiled and tested. Clean soil would be determined through visual observations and analytical testing. After appropriate testing, any asbestos or other hazardous material (e.g., copper, polychlorinated biphenyls [PCBs], lead-based paint [LBP], pesticides) would be handled appropriately. Clean soil would be stockpiled, and if contaminated soil is identified, it would be shipped to CONUS for disposal. All remaining refuse would be placed in the existing landfill.

Revegetation

The area would be revegetated with an appropriate grass, shrubs, and/or trees. To prevent the planting of vegetation that may affect the line-of-sight visibility for aircraft in the future, USAG-KA would confer with the U.S. Fish and Wildlife Service (USFWS) to determine appropriate vegetation.

5.0 ENVIRONMENTAL SETTING

TERRESTRIAL SPECIES AND HABITAT USE

Vegetation

Kwajalein Island has undergone extensive development since the 1930s, and as a result, very little native vegetation is present. No threatened or endangered vegetation species have been identified on or offshore of Kwajalein. The open areas of vegetation identified in the 2010 surveys are considered managed and contain nonnative grasses and weeds that are maintained by mowing. Small areas of herbaceous strand still exist along the coast in some places, and patches of littoral shrub land dominated by the genera *Tournefortia* and *Scaevola* are present in some areas (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 2012). No littoral shrub or herbaceous strand vegetation has been recorded in the project area. The mound is vegetated with kiden (*Tournefortia argentea)*, konnat (scaevola) (*Scaevola taccada*), ni (coconut trees) *(Cocos nucifera),* topo (beach morning glory) (*Ipomoea imperati and/or Ipomoea pes-caprae*), ekkon (tropical almond) (*Terminalia catappa*), lukwej (kamani) (*Calophyllum inophyllum*), kaonon (*Cassytha filiformis*), and kio (possibly *Sida fallax*); a bob (*Pandanus tectorius*) is near the mound, but not on top of it. See Section 8.1 of mitigation measures for the revegetation process for the project area.

Avian Wildlife

Kwajalein Island attracts a variety of migratory birds due to its relatively large size, fresh water habitats, and expansive areas of managed vegetation (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 2012). Surveys for shorebirds and seabirds have been conducted bi-annually by the USFWS for almost 20 years, and during these surveys, over 30 different avian species have been recorded on Kwajalein Island. Table 1 is a list of all bird species recorded on USAKA and on Kwajalein Island.

The most commonly observed bird species include black noddies (*Anous tenuirostris minutus*), white terns (*Gygis alba*), Pacific golden plovers (*Pluvialis fulva*), ruddy turnstones (*Arenari interpres*), whimbrels (*Numenius phaeopus*), and wandering tattlers (*Heteroscelus incanus*). The introduced Eurasian tree sparrow (*Passer montanus*) was also a common avian species recorded on Kwajalein Island during the 2010 surveys. The common birds are either seabirds, which nest on the ground or in trees, or are migratory shorebirds, which nest in the Arctic in warmer months and migrate to winter and forage at USAKA and other Central Pacific islands. During the 2010 survey on Kwajalein Island, the largest numbers of migratory birds were observed in the water catchments, drainage ditches, and puddles near the runways and in adjacent managed vegetation (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 2012).

The 2010 surveys noted that ruddy turnstones, Pacific golden plovers, and whimbrels foraged and rested on grass during periods of high tide and foraged the shoreline and exposed reef flat during low tide. Shorebirds were noted to frequently forage more on the southern and eastern shores where there is no riprap, and seabirds were present feeding offshore in this same area (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 2012).

Nesting seabirds observed during the 2010 surveys included black-naped terns (*Sterna sumatrana*) and white terns (*Gygis alba*). Black-naped tern chicks were observed on harbor buoys, and white terns were observed nesting in numerous locations around the island. White tern chicks were observed in large trees, near the town center and building areas, but not along the golf course (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 2012). No nesting seabirds were recorded near the landfill area.

The only UES consultation avian species, the Ratak Micronesia pigeon (*Ducula oceania ratakensis*), has not been observed on Kwajalein and does not have the potential to occur in the project area. Several UES coordination avian species have the potential to occur in the project area as shown in Table 1. No U.S. federally listed terrestrial wildlife species have been identified on Kwajalein Island. No observations of seabirds nesting in the project area have been recorded. See Section 8.2 of mitigation measures for the avian wildlife within the project area.

Non-Terrestrial Wildlife

Non-Avian Terrestrial Wildlife: Other non-avian terrestrial wildlife species include a limited number of native invertebrates, such as blue-spot butterfly (*Hypolimnas bolina*) and vertebrates, such as blue-tailed skink (*Emoia caeurelocauda*), as well as non-native, introduced domestic dogs (*Canis lupus familiaris*), cats (*Felis catus*), and black rats (*Rattus rattus*) (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 2012). No focused surveys of native terrestrial wildlife have been conducted on Kwajalein Island.

Marine Wildlife: Sea turtles are known to nest and haul out on Kwajalein Island; however, there is no known sea turtle nesting or haul out area within the project area; therefore, there would be no effect to sea turtles. See Section 8.3 of mitigation measures for the avian wildlife within the project area. See Section 8.3 of mitigation measures for the avoidance of potential sea turtles within the project area.

Table 1. List of bird species observed throughout USAKA during 1996-2010 biological inventories.

Common Name	Scientific Name	UES Coordination Species	Observed on Kwajalein Island During 1996-2010 Surveys
short-tailed shearwater	*Puffinus tenuirostris*		
sooty shearwater	*Puffinus griseus*	X	
wedge-tailed shearwater	*Puffinus pacificus*	X	
brown booby	*Sula leucogaster*	X	X
red-footed booby	*Sula*	X	
great frigatebird	*Fregata minor*	X	X
Pacific reef heron	*Egretta sacra*	X	X
mallard	*Anas platyrhynchos*	X	X
northern pintail	*Anas acuta*	X	X
American wigeon	*Anas americana*		X
black-bellied plover	*Pluvialis squatarola*	X	
Pacific golden plover	*Pluvialis fulva*		X
common ringed plover	*Charadrius hiaticula*	X	
semipalmated plover	*Charadrius semipalmatus*	X	X
lesser (Mongolian) sand-plover	*Charadrius mongolus*	X	
marsh sandpiper	*Tringa stagnatilis*	X	
common greenshank	*Tringa nebularia*	X	X
wood sandpiper	*Tringa glareola*	X	X
wandering tattler	*Heteroscelus incanus*	X	X
gray-tailed tattler	*Heteroscelus brevipes*	X	X
whimbrel	*Numenius phaeopus*	X	X
bristle-thighed curlew	*Numenius tahititensis*	X	X
Hudsonian godwit	*Limosa haemastica*	X	X
bar-tailed godwit	*Limosa lapponica*	X	X
ruddy turnstone	*Arenaria interpres*	X	X
red knot	*Calidris canutus*	X	X
sanderling	*Calidris alba*	X	X
red-necked stint	*Calidris ruficolla*	X	X
pectoral sandpiper	*Calidris melanotos*	X	X
sharp-tailed sandpiper	*Calidris acuminata*	X	X
curlew sandpiper	*Calidris ferruginea*	X	
ruff	*Philomachus pugnax*	X	
long-billed dowitcher	*Limnodromus scolopaceus*	X	X
Japanese snipe	*Gallinago hardwickii*		
common snipe	*Gallinago*	X	X
black-naped tern	*Sterna sumatrana*	X	X

Common Name	Scientific Name	UES Coordination Species	Observed on Kwajalein Island During 1996-2010 Surveys
great crested tern	*Sterna bergii*	X	X
white-winged tern	*Chlidonias leucopterus*	X	X
brown noddy	*Anous stolidus*	X	X
black noddy	*Anous tenuirostris minutus*	X	X
white tern	*Gygis alba*	X	X
long-tailed cuckoo	*Eudynamis taitensis*	X	
Eurasian tree sparrow	*Passer montanus*		X
chicken	*Gallus gallus domesticus*		

Source: U.S. Fish and Wildlife Service and National Marine Fisheries Service, 2006;2010; 2012

6.0 DIRECT AND INDIRECT IMPACTS

Potential impacts from the planned activity to terrestrial biological resources were analyzed against a list of possible stressors that are applicable to the planned activity. The stressors analyzed include (1) *direct impacts,* such as removal or displacement, (2) *exposure to noise* from machinery or other sources, (3) *wastes and discharges*, and (4) *habitat loss or degradation*, including shelter or forage resources.

6.1 Direct Impacts

Localized direct impacts from vegetation removal would occur. This vegetation removal within the project area comprises approximately 3 acres. The project area currently consists of heavy shrubs (mainly *Scaevola* and *Tournefortia argentea*), a small number of coconut trees, and other low-growing ground covering (i.e., morning glory). No observation of nesting or foraging habitat for avian species has been recorded for the project area. No observation of loafing for avian species has been recorded for this project area.

Temporary direct impacts to potential nesting habitat, potential foraging, and potential loafing could occur from removal of vegetation. The 2010 survey by USFWS and the National Marine Fisheries Service observed the black-naped tern nesting on Kwajalein Island using the concrete platforms at the fuel pier on the lagoon side. White terns were observed nesting in large trees near the town center and building areas (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2012). No observations of seabird nesting or loafing in the project area have been recorded (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2012).

Therefore, there would be no adverse effect from direct impacts associated with the potential nesting habitat, foraging, and loafing of avian species from the removal of vegetation from the project area.

6.2 Exposure to Noise

Increased noise levels from earth-moving equipment used during vegetation and debris removal would not negatively affect wildlife resources. Current noise levels are consistent with an industrial area, and increases from machinery and workers would be short-term and temporary. Wildlife species that may use this area for shelter, foraging, and loafing may be temporarily displaced by increased noise within 50 feet, but the project area includes only a small portion of the available foraging and loafing habitat on the island. Once removal activities are complete, noise levels would return to existing levels, and terrestrial wildlife species would be expected to return to the area. Therefore, there would be no adverse effect from noise associated with the potential avian (nesting habitat, foraging, and loafing) and other terrestrial species from the removal action in the project area. Additionally, the removal would not change the current noise exposure to avian and other terrestrial species from aircraft landing and take-off.

6.3 Wastes and Discharges

Construction (removal of vegetation and metal, concrete, and coral debris) wastes may include small plastic trash and bags that may be ingested and cause digestive blockage or suffocation in birds. Equipment spills, discharges, and run-off from the project area could contain hydrocarbon-based chemicals such as fuel oils, gasoline, lubricants, hydraulic fluids, and other toxicants, and could contaminate the soil or impact vegetation. The mitigation measures described in Section 8.4 are intended to prevent the introduction of wastes and toxicants into the terrestrial environment; therefore, construction-related discharges and spills would be infrequent, small, and quickly cleaned if they do occur. Therefore, these measures should prevent any avian or other terrestrial species from being adversely affected by exposure to waste and discharges.

6.4 Habitat Loss or Degradation

Removal of vegetation may eliminate some potential nesting, foraging, and loafing habitat; however, no migratory birds or other wildlife resources have been recorded using the project area. Although seabirds and shorebirds have been observed foraging and feeding along the shoreline and exposed reef flat at low tide on the southern shores, the presence of workers and equipment is likely to discourage them from using the immediate project area. Impacts would be expected to be temporary behavioral changes, and the project area includes only a small portion of the available foraging habitat on the island. Therefore, there would be no adverse effects from habitat loss or degradation to terrestrial species from the removal action.

7.0 CONCLUSIONS OF EVALUATION

Overall there would be no adverse effects to any avian or other terrestrial species from the removal of the mound as it relates to (1) *direct impacts,* such as removal or displacement, (2) *exposure to noise* from machinery or other sources, (3) *wastes and discharges*, and (4) *habitat loss or degradation*, including shelter or forage resources.

The area would be revegetated with appropriate plants that would not obscure the line-of-sight visibility for aircraft in the future. Once removal activities are complete, noise levels would return to existing levels, and any terrestrial wildlife species would be expected to return to the area. mitigation measures described in Section 8.4 are intended to prevent the introduction of wastes and toxicants into the terrestrial environment; therefore, construction-related discharges and spills would be infrequent, small, and quickly cleaned if they do occur.

The cumulative impacts would be beneficial because (1) the removal of the mound would provide better access along the beach to further reduce the amount of metal debris on the island; (2) it would provide access to any additional metallic debris buried by the mound; and (3) it would improve the line-of-sight visibility for aircraft on the west end of the airplane runway.

Therefore, based on the evaluation of the potential stressors, it has been concluded that no long-term adverse effect to vegetation and terrestrial wildlife is anticipated from the removal of the mound.

8.0 MITIGATION MEASURES

8.1 Revegetation

1. USAG-KA will confer with USFWS to determine the appropriate plants (grasses, shrubs, and/or trees, etc.) to best revegetate the project area.

2. Selected vegetation would enhance wildlife habitat but not affect line-of-sight visibility for aircraft.

8.2 Avian Species

1. Prior to removal activities each day, the project area would be surveyed (walk the area) to ensure there are no tree or ground nesting birds in the area.

2. If any avian species are observed nesting in the project area, nests should be demarcated, and the USAG-KA Environmental Manager should be contacted.

8.3 Sea Turtles Avoidance

1. Although the project area is not a known location for sea turtle haul-out or nesting, prior to removal activities each day, beach area would be surveyed (walk the area) for sea turtles and sea turtles tracks to observe newly laid nests.

8.4 Hazardous Material and Wastes

1. Perform work in compliance with the Kwajalein Environmental Emergency Plan.
2. Storage or disposal of waste (hazardous and non-hazardous) removed during removal activities would be performed in accordance with the requirements in Chapter 3-6 (Material and Waste Management) of the UES.
3. Due to the fragile ecosystem on Kwajalein Island, a hazardous materials release or spill must be reported and cleaned up in a timely manner. The following procedures for hazardous materials shall be used:
    a. In case of a spill, call 911 to notify the Fire Department, and report the spill in accordance with the revised SPI 1530.
    b. Report any spill leaving a visible sheen on the water.
    c. Report any ground spill totaling 1 gallon (3.8 liters) or larger.
    d. All spills regardless of size must be cleaned up immediately.
    e. Call 911 in case of an emergency.

   f. Hazardous materials include but are not limited to oil, gasoline, diesel, paint, solvents, aviation fuels, pesticide, bleach, and hydraulic fluid.

4. An employee discovering a spill shall:
   a. Immediately isolate and contain any spillage if it can be accomplished safely. If possible, the employee would have a spill response kit on site for potential fuel and other POL spills.
   b. Notify immediate supervisor.
   c. Immediately call 911 for large spills. Answer all questions asked by the dispatcher.
   d. Meet the responding crew at the spill site.

9.0 REFERENCES

U.S. Army Space and Missile Defense Command, 2016. Draft Kwajalein Landfill Source Metals Removal Action Memorandum, U.S. Army Garrison Kwajalein Atoll, Republic of the Marshall Islands. Site ID CCKWAJ-002. February.

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