Final
Environmental Assessment
for
Proposed Dredging of Hilo Harbor

U.S. Army Corps of Engineers Honolulu District
Bldg. 230, CEPOH-PP-C
Fort Shafter, HI 96858

December 2015

EXECUTIVE SUMMARY

In accordance with the National Environmental Policy Act of 1969, this environmental assessment (EA) assesses the potential environmental impacts of maintenance dredging of the federal entrance channel and harbor basin at Hilo Harbor on Hawaii Island, Hawaii, and transit of dredged material to the U.S. Environmental Protection Agency-designated Hilo Ocean Dredged Material Disposal Site (ODMDS).

Proposed Action

The U.S. Army Corps of Engineers (USACE) proposes to conduct maintenance dredging of the federal entrance channel and harbor basin of Hilo Harbor on Hawaii Island, Hawaii. Dredging would be limited to shoaled areas where sediment has accumulated and resulted in harbor depths shallower than design depths.

Hilo Harbor is on the northeastern side of the island of Hawaii. The harbor has a 10,080-foot long breakwater protecting a 35-foot deep basin. The Hilo ODMDS is 4.5 nautical miles (8.3 kilometers) offshore of Hawaii Island. The site covers 1.03 square miles (2.66 square kilometers) in water 330 to 340 meters deep.

Dredging would be done by the USACE-owned trailing suction hopper dredge *Essayons*. Dredged material would be disposed of at the Hilo ODMDS. An estimated 85,738 to 233,171 cubic yards of material would be dredged. The minimum volume doesn't include overdredge material or avoidance areas, while the maximum volume does account for this. Dredging would be conducted for approximately 26 days. It would likely occur between February and April, 2016 or in late 2018 or be conducted in two phases, where some would be done in 2016 and the remainder in 2018.

Purpose and Need

The purpose of the proposed action is to maintain the authorized depths in the federal entrance channel and harbor basin at Hilo Harbor. The proposed action is needed to restore authorized depths needed for vessel navigation by removing sediment accumulated since the last harbor dredging 25 years ago and ensure safe vessel navigation. Sedimentation in some areas of the harbor limits the size of the vessels that can operate or the movements of those vessels.

Alternatives

The USACE analyzed two alternatives: the proposed action and the No Action Alternative. The proposed action, as described above, is USACE's Preferred Alternative. The No Action Alternative is prescribed by the Council on Environmental Quality regulations to serve as the baseline against which the proposed action and other alternatives are analyzed. This alternative is also referred to as the "future without project." Limitations in available funding necessitated that the USACE employ the *Essayons* for the majority of the dredging action. For this reason, no other alternatives that would meet the purpose and need were identified. The proposed action incorporates extensive conservation measures in the form of best management practices designed to avoid or minimize impacts on environmental resources.

Environmental Consequences

This EA evaluates potential effects on living and non-living environmental resources. The predicted effects of the proposed action and the No Action Alternative on resources are summarized in Table ES-1.

Implementing the No Action Alternative would have no significant impact on the quality of human life or the natural environment. It would have no effect on most resources. It would have long-term, indirect, moderate adverse effects on socioeconomics and transportation because continued sedimentation would adversely affect vessels ability to enter and move within the harbor, which would adversely affect socioeconomics by impairing vessel-based economic activity such as passenger ships and importing and exporting of goods.

Implementing the proposed action would have no significant impact on the quality of human life or the natural environment. With implementation of the best management practices presented in Section 2.2.6, the proposed action would have short-term, direct, negligible to moderate adverse impacts and long-term, direct, moderate beneficial impacts on other resources. The proposed action would have no effect, negligible effects, or minor effects on fish, birds, marine mammals, cultural and historic resources, and hazardous substances. It would have moderate adverse effects on benthic habitats, seagrasses, and marine invertebrates. It would have moderate adverse effects on sea turtles, primarily due to the potential to entrain sea turtles during dredging. It would have moderate adverse effects on water quality, primarily from temporary turbidity and sedimentation. It would have beneficial effects on transportation by improving conditions for safe vessel navigation and socioeconomics by supporting vessel-based economic activity such as passenger ships and importing and exporting of goods.

The predicted effects of the proposed action and the No Action Alternative on resources are summarized in Table ES-1. Because this action does not constitute a major Federal action significantly affecting the quality of the human environment, preparing an environmental impact statement is not required and signing a finding of no significant impact is appropriate.

Table ES-1. Summary of Potential Impacts to Resources from the Proposed Action and No-Action Alternative

ALTERNATIVES	Resources Evaluated[1]									
	Benthic Habitats, Seagrasses, and Marine Invertebrates	Fish	Sea Turtles	Birds	Marine Mammals	Water Quality	Socioeconomics	Cultural and Historic Resources	Transportation	Hazardous Substances
No Action	◊	◊	◊	◊	◊	◊	●	◊	●	◊
Proposed Action	●	○	●	○	○	●	■	◊	○ ■	○

Notes:
◊ No impact
○ Negligible to minor adverse impact
● Moderate adverse impact
■ Moderate beneficial impact

[1] Neither the proposed action nor the No Action Alternative would have more than negligible effects on land use, aesthetics and visual resources, noise, utilities and infrastructure, or air quality. These resources are not analyzed in detail in the EA.

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ACRONYMS AND ABBREVIATIONS

μPa	Micropascal
%	Percent
APE	Area of Potential Effect
BA	Biological assessment
BMP	Best management practice
CDP	Census Designated Place
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
DAR	State of Hawaii, Division of Aquatic Resources
dB	Decibel
DMMU	Dredged Material Management Unit
DOH	State of Hawaii, Department of Health
DOT	State of Hawaii, Department of Transportation
DPS	Distinct population segment
EA	Environmental assessment
EFH	Essential Fish Habitat
EFHA	Essential Fish Habitat Assessment
EO	Executive Order
ERDC	U.S. Army Engineer Research and Development Center
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
fps	Feet per second
FWCA	Fish and Wildlife Coordination Act
HDOT – Harbors	State of Hawaii, Hawaii Department of Transportation, Harbors Division
HRS	Hawaii Revised Statutes
Hz	Hertz (pitch or frequency)
ITP	Incidental Take Permit
kHz	Kilohertz
km	Kilometer
km^2	Square kilometer
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
nm	Nautical mile
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	NOAA National Marine Fisheries Service
NRHP	National Register of Historic Places
ODMDS	Ocean Dredged Material Disposal Site
OSHA	Occupational Safety and Health Administration
PIRO	Pacific Islands Regional Office
PTS	Permanent threshold shift
rms	Root-mean-squared
ROI	Region of influence

RPM	Revolutions per minute
SHPD	State Historic Preservation Division
SPL	Sound pressure level
TMDL	Total Maximum Daily Load
TSHD	Trailing suction hopper dredge
TTS	Temporary threshold shift
USEPA	U.S. Environmental Protection Agency
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service

1.0 INTRODUCTION, PURPOSE, AND NEED

1.1 Introduction

In accordance with the National Environmental Policy Act (NEPA) of 1969, this environmental assessment (EA) assesses the potential environmental impacts related to proposed maintenance dredging of the federal entrance channel and harbor basin at Hilo Harbor on Hawaii Island, Hawaii, and transit of dredged material to the U.S. Environmental Protection Agency (USEPA) designated Hilo Ocean Dredged Material Disposal Site (ODMDS) (Figure 1-1).

Hilo Harbor is on the northeastern side of the island of Hawaii. The harbor has a 10,080-foot long breakwater protecting a 35-foot deep basin. The Hilo ODMDS is 4.5 nautical miles (nm) (8.3 kilometers [km]) offshore of Hawaii Island. The site covers 1.03 square miles (2.66 square kilometers [km^2]) in water 330 to 340 meters deep.

U.S. Army Corps of Engineers (USACE) proposes to do maintenance dredging of the federal entrance channel and harbor basin at Hilo Harbor on Hawaii Island, Hawaii, (Figure 1-2) to achieve design depths in these areas.

Maintenance dredging is proposed at four other Hawaii deep-draft commercial harbors in 2016 and 2018: Honolulu, Kalaeloa Barber's Point, Kahului, and Nawiliwili. Dredging would be done by the USACE-owned trailing suction hopper dredge (TSHD) *Essayons*. Dredged material would be disposed of at the Hilo ODMDS. An estimated 85,738 to 233,171 cubic yards of material would be dredged. The minimum volume doesn't include overdredge or avoidance areas, while the maximum volume does. Dredging would be conducted for approximately 26 days. It would likely occur between February and April 2016 or late 2018, as part of the five harbor maintenance dredge action. Depending on the *Essayons* schedule and progress, dredging in Hilo Harbor could occur over these two years, where some would be done in 2016 and the remainder in 2018.

This EA has been prepared in accordance with the NEPA of 1969, the implementing regulations of the Council on Environmental Quality (CEQ) (Title 40 *Code of Federal Regulations* [CFR] Parts 1500 through 1508), and USACE's procedures for implementing NEPA, 33 CFR Part 230 and Engineer Regulation 200-2-2, Procedures for Implementing NEPA (USACE 1988).

Sediments in the proposed dredge area were evaluated to determine their suitability for ocean disposal, in accordance with protocols in the *Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual* (USEPA and USACE 1991). Only those areas that meet criteria for ocean disposal are included in this proposed action. Sediments that fail to meet the chemical or toxicological criteria for ocean disposal will be left in place during this proposed action.

1.2 Authority

Hilo Harbor on the northeastern side of Hawaii was initially authorized under the Rivers and Harbors Act of 1907, with subsequent work authorized in 1912 and 1925. Initial harbor construction was completed in 1930. Maintenance dredging of Hilo Harbor was authorized under the Rivers and Harbors Act of March 2, 1919 (Chapter 95, 40 Statute 1275) and September 1954 (Title 1 of Public Law 83–780).

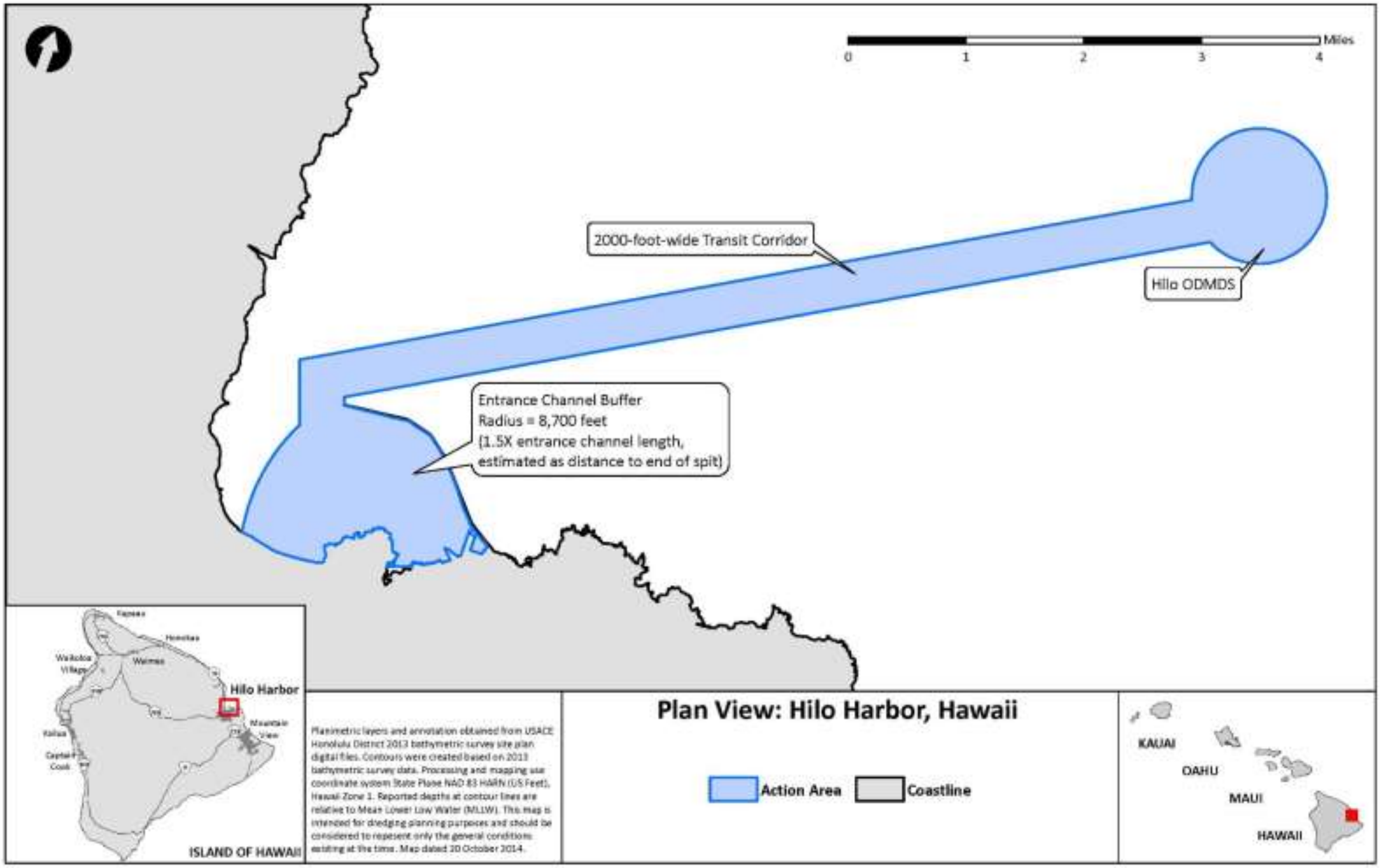

Figure 1-1. Overview of Project Area

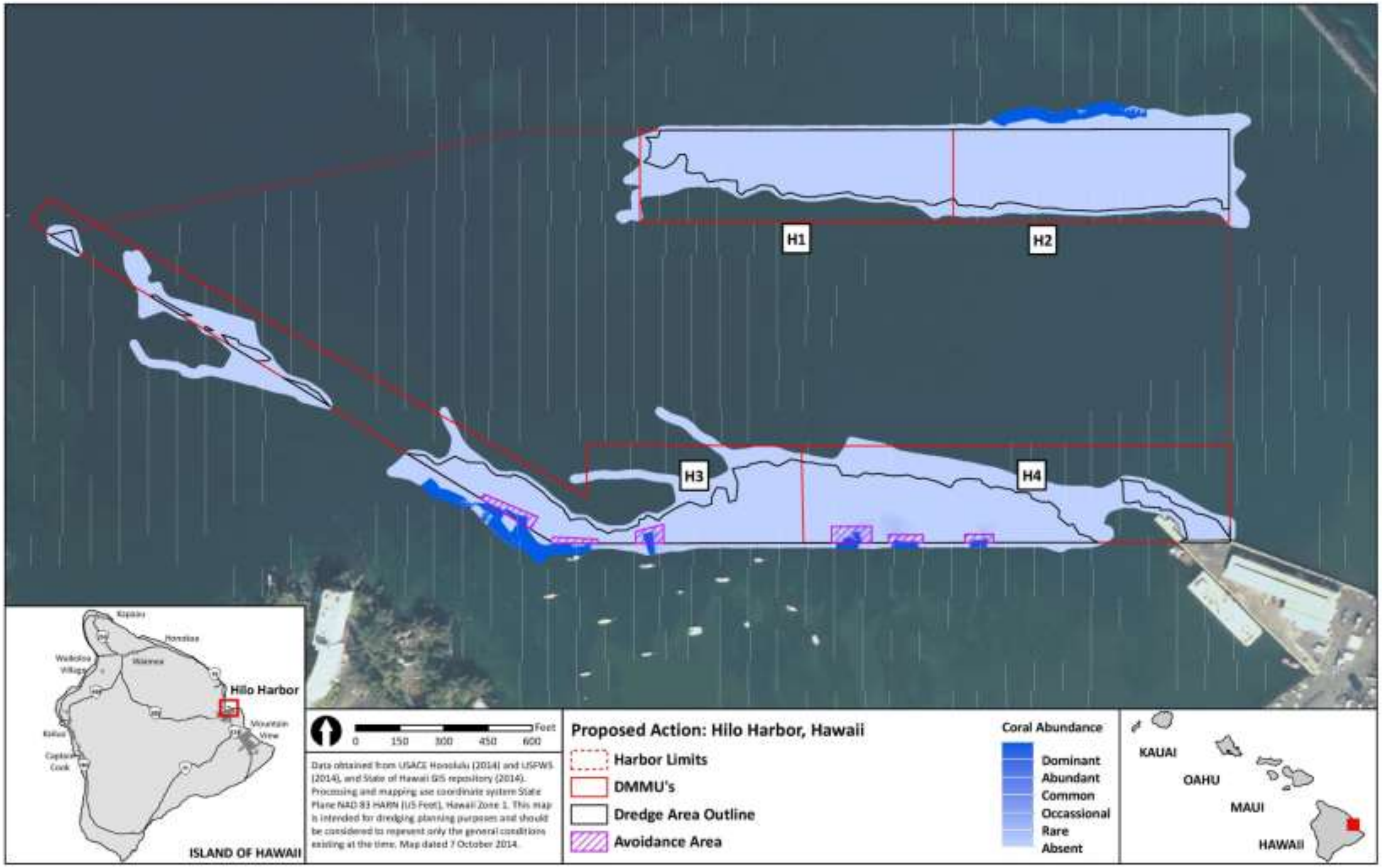

Figure 1-2. Harbor Area Detail

The State of Hawaii, Department of Transportation, Harbors Division (HDOT – Harbors), is responsible for maintaining depths in berthing and mooring areas. The proposed action does not include dredging of State-managed harbor areas.

1.3 Purpose and Need

The purpose of the proposed action is to maintain the authorized depths of the federal entrance channel and harbor basin at Hilo Harbor. The proposed action is needed to restore authorized depths needed for vessel navigation by removing sediment accumulated since the last harbor dredging 25 years ago and ensure safe vessel navigation. Sedimentation in some areas of the harbor limits the size of the vessels that can operate or the movements of those vessels. Sedimentation within Hilo Harbor is as much as 20 feet shallower than the authorized design depths ranges, with accumulation generally more pronounced along the periphery of the harbor.

2.0 PROPOSED ACTION AND ALTERNATIVES

This section presents the proposed action and the No Action Alternative. No other alternatives were considered because only the proposed action meets the project purpose and need. The proposed action described in Section 2.2 is USACE's Preferred Alternative.

2.1 No Action Alternative

CEQ regulations require the No Action Alternative be analyzed as a baseline against which the impacts of the proposed action and other alternatives can be evaluated (40 CFR 1508.25(b)(1)). This alternative is also referred to as the "future without project."

Under the No Action Alternative, the USACE would not dredge Hilo Harbor in 2016 and/or 2018. This alternative would postpone but not eliminate maintenance dredging altogether because authorized depths are needed to allow safe vessel movement in the harbor. Sedimentation in some areas of the harbor currently restrict access by deep-draft vessels.

2.2 Proposed Action

The proposed action is to do maintenance dredging of the federal entrance channel and harbor basin of Hilo Harbor to restore design depths. Sediment has been accumulating since 1990, when the harbor was last dredged. Dredging would be conducted for approximately 26 days. It would likely occur between February and April, 2016 or late 2018 or be conducted in two phases, where some would be done in 2016 and the remainder in 2018. An estimated 85,738 to 233,171 cubic yards of sediment would be dredged. The minimum volume doesn't include overdredge or avoidance areas, while the maximum volume accounts for this. Dredged material would be transported to the USEPA-designated Hilo ODMDS.

The region of influence (ROI) for the proposed action consists of (1) the entrance channel and harbor basin of Hilo Harbor, (2) a "buffer" zone around the harbor entrance channel, (3) a straight line route between the harbor and the Hilo ODMDS, and (4) the Hilo ODMDS (Figure 1-1).

Hilo Harbor is on the northeastern side of the island of Hawaii. The harbor has a 10,080-foot long breakwater protecting a 35-foot deep basin. The entrance channel and turning basin would be dredged to 35 feet below the mean lower low water line (Figure 1-2).

The Hilo ODMDS is 4.5 nm (8.3 km) offshore of Hawaii Island, outside of the 3-nm limit of state waters in accordance with the Submerged Lands Act of 1953. The site covers 1.03 square miles (2.66 km^2) in water 330 to 340 meters deep. The USEPA designated the Hilo ODMDS and four other ODMDS for the Hawaiian Islands in 1981 (46 Federal Register 313-314) pursuant to section 102(c) of the Marine Protection, Research and Sanctuaries Act of 1972, as amended (also known as the Ocean Dumping Act). An environmental impact statement prepared in support of the designation estimated that the Hilo ODMDS would receive dredged material every 5 years (USEPA 1980). However, the Hilo ODMDS has not received any dredged material in about 25 years. Impacts at the ODMDS that were evaluated during the establishment of the site are not subject to additional analyses associated with disposal of dredged material consistent with the intended permitted use of the ODMDS (Ross 2014), so impacts of the proposed action on benthic habitat at the Hilo ODMDS are not required to be analyzed in this EA.

2.2.1 Dredging Limitations

The *Essayons* is configured to dispose of dredged material only in the ocean. It is unable to transfer the material to a barge or onto the shore. In addition, upland disposal options are generally more costly than disposal in the approved ODMDS, and may be physically problematic given the significant volume of dredge material. Because of these limitations, the *Essayons* will only dredge sediment that meets the USEPA's criteria for ocean disposal, and will determine the other methods of dredging and disposal for sediment that does not meet this criteria, as part of a separate action.

The USACE contracted Tetra Tech, Inc. to sample and analyze sediments in the proposed dredging areas of the harbor to determine suitability for ocean disposal. The sampling design first delineated four Dredged Material Management Units (DMMUs) in accordance with USEPA guidance for testing dredged materials for ocean disposal (USEPA and USACE 1991). The four DMMUs delineated in Hilo Harbor are H1 through H4 (Table 2-1). Composite sediment samples from each DMMU were analyzed for chemical constituents and toxicity to benthic marine invertebrates. Sediment samples from all DMMUs met the USEPA standards for ocean disposal.

The USEPA Region IX reviewed the Hilo Harbor Maintenance Dredge Sediment Characterization Study (Tetra Tech 2015) and concurred with the recommendation for each DMMU's ocean disposal determination. The USEPA will prepare an official memorandum stating its concurrence, which is expected in December 2015.

Table 2-1. Hilo Harbor DMMUs and Approximate Dredge Volume

DMMU	Maximum Dredged Material Volume (cubic yards)	Minimum Project Depth Dredged Material Volume (cubic yards)[a]
H1[b]	55,709	16,844
H2[b]	55,709	16,844
H3	60,876	26,025
H4	60,877	26,025
Total	**233,171**	**85,738**

Notes:
DMMU = Dredged Material Management Unit
[a] Minimum project depth dredge volumes do not include overdredge volumes.
[b] Based on informal consultations with the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NOAA Fisheries) and U.S. Fish and Wildlife Service (USFWS), a portion of DMMU H1 and H2 that supports corals will not be dredged because the USACE wants to avoid potential impacts to coral (see Figure 1-2) for this action. The volume estimates represent only the area to be dredged, not the area of coral habitat that will be avoided.

The maximum area to be dredged and the volume of dredged material shown in Table 2-1 may be reduced during implementation of the proposed action due to one or both of these factors:

Factor 1: Areas that would be avoided during dredging to reduce impacts to biologically sensitive habitats, based on benthic surveys by USFWS under contract to USACE, pursuant to the Fish and Wildlife Coordination Act (FWCA).

Factor 2: Physical constraints of the *Essayons* prevent it from dredging specific areas because of limited access to harbor corners and narrow spaces or because the suction mechanism cannot dredge large, hard substrate types such as remnant reefs, large boulders, and coral rubble.

The following areas will be excluded from the proposed action due to the factors listed above:

- Within 30 feet of the aggregate reef/hard bottom along the southern portion of the dredge footprint that supports greater than 50 percent (%) coral cover, as identified and recommended in USFWS (2014).

2.2.2 Dredging Methodology

Maintenance dredging would be done by the USACE TSHD *Essayons*. Hopper dredge technology is described below, highlighting specific relevant characteristics of the *Essayons*.

A TSHD, or hydraulic hopper dredge, is a self-propelled vessel with a section of the hull compartmented into sediment containment chambers called hoppers. This dredge uses powerful pumps that entrain a slurry of water and dredged material from the seafloor through a long intake pipe called a dragarm. The dragarm is suspended over the side of the vessel fitted with a suction opening called a draghead. The draghead is a weighted intake device that is dragged along the bottom to help loosen the soil before suctioning. As the vessel moves the draghead over the dredge area, the suction velocity of the pumps generates the slurry that is deposited into onboard hoppers (Figure 2-1). While the ratio of water to sediment in the slurry mixture is controlled to maximize efficiency, hopper dredges typically entrain more than 80 percent water during operations. When the slurry of water and dredged material is emptied into a hopper, the heavier entrained material is allowed to settle and the water on top is decanted off. The decanted water is removed through a weir in the hopper and routed out through a pipe that extends 22 to 27 feet below the surface of the water to avoid creating a surface plume. When the hopper is filled, the pumps are disengaged, the dragarms are lifted off the bottom and the vessel travels under its own power to the in-water disposal site. The dredged material is discharged through the bottom of the ship by opening doors in the bottom of each hopper. Specific operational best management practices (BMPs) to protect biological and physical resources are described in Section 2.2.6.

The *Essayons* is 350 feet long, with a beam of 68 feet, a height of 126 feet, with a draft of 22 feet (light) and 27 feet (loaded). The *Essayons* has two 3,600 horsepower diesel propulsion engines and three 750 kilowatt ship service generator engines. While the *Essayons* can dredge to 80 feet with its two 28-inch diameter dragarms, the maximum dredge depth (including overdredge) for this project is 46 feet. All dredged material is pumped through the dragarms into the vessel's hopper using two 1650 horsepower pumps mounted to the dragarm and two 3,000 horsepower inboard pumps. The *Essayons* hopper can hold 6,000 cubic yards. During previous maintenance dredging, production rates ranged from a low of 5,000 cubic yards per day at Kalaeloa Barbers Point Harbor to a high of 14,000 cubic yards per day at Hilo Harbor (Holcroft 2014). Similar daily production is expected under the proposed action.

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In general, hydraulic dredges are best suited to dredging heavy sands in open areas away from marine structures; hopper dredges are not able to excavate rock, debris, or hard, compacted bottom material. During dredging, one or both dragarms are placed on the seabed and into the dredged material, the pumps are engaged, and the vessel moves slowly forward at a rate of 2-3 knots, sucking up sediment and unconsolidated rubble smaller than the 28-inch diameter dragarm. Dredged material is deposited into the aft of the hopper bins. If at any time the dragheads are to be raised above the seafloor, the pumps are first powered down to reduce suction velocities (see BMPs in Section 2.2.6). Based on production from the 1999 maintenance dredging action for Hawaii, it would take approximately 30 minutes to fill the hoppers with dredged material and entrained water, after which overflow of entrained water would be limited to the economic load determined by on-board computers as a minimization measure for turbidity (see BMPs in Section 2.2.6). The time to halt operations, stow the dragarms, steam to the Hilo ODMDS, open the hopper doors and release the sediment, and return to begin dredging again is approximately 90 minutes. The *Essayons* keeps moving while doors are opened during standard operations, which limits excessive mounding of the dredged material on the sea floor.

The *Essayons* would travel to the Hilo ODMDS at no more than 10 knots (see BMPs in Section 2.2.6). Based on the capacity and operational requirements, the *Essayons* could make approximately nine trips each day from the harbor to the Hilo ODMDS.

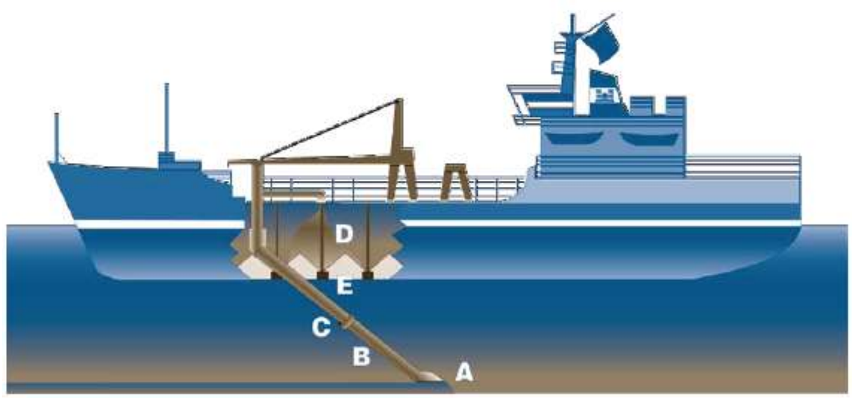

Figure 2-1. *Essayons* Hopper Dredge

Dragheads (A) with dragarms (B) extend from each side of the ship's hull. The dragheads are lowered to the channel bottom and slowly pulled over the area to be dredged. The submerged pumps (C) create suction in the dragarm and the silt or sand is drawn up through the arms and deposited in hopper bins (D) in the vessel's midsection. When the bins are full, the dredge sails to the designated disposal area and empties the dredged material through large hopper doors (E) in the bottom of the hull. Courtesy of http://www.nwp.usace.army.mil/Portals/24/docs/navigation/vessels/*Essayons*_brochure.pdf.

The *Essayons* would work 24-hours a day. During night dredging, per U.S. Coast Guard (USCG) requirements, the vessel would maintain the masthead light, stern light, and normal running lights on the working decks. The only other light is that emitted through cabin portholes (Holcroft 2014). The *Essayons* does not anchor during regular operations and would not be expected to anchor at any time during the proposed action unless required by an emergency situation (Holcroft 2014).

The *Essayons* employs a 32-foot support launch as part of its regular operations to do water quality sampling and endangered species monitoring and to shuttle crew to and from shore. The support launch would operate 2-4 hours per day, generally near the *Essayons* (Holcroft 2014).

2.2.3 Dredging Sound Production

Sounds can be described in terms of their intensity or loudness (decibels [dB]), pitch or frequency (Hertz [Hz] or kilohertz [kHz]), and duration (seconds or milliseconds). The proposed action would generate noise from four sources:

(1) The process of suction dredging,

(2) Vessel transit,

(3) Disposal of dredged material at the ODMDS, and

(4) Maintenance and shipboard operations.

Noise during Dredging. Noise produced during dredging is largely a function of the substrate being dredged (USACE 2012). During excavation, there would be regular intervals of continuous sound production as the dredge moves forward with the dragheads in contact with the bottom. Excavation of hard, cohesive and consolidated soils would require the dredger to apply greater force to dislodge or entrain the material. Dredging noise would stop when the dragheads are raised to allow the dredge to turn.

Depending on the type of material being excavated, a regular "rumbling sound" would be produced, possibly with irregular peak-pulses when pumping fragmented rock. This sound would be relatively low frequency when the ship is stationary with a fairly constant and continuous signal. For non-stationary equipment, this sound production would be cyclic rather than continuous. Sounds would also be produced by the dredge pumps both above and beneath the water. The *Essayons* would produce pump sounds intermittently during dredging, trailing, and self-discharge.

Underwater sounds from a hopper dredge similar in size to the *Essayons* (the *Stuyvesant*) were recorded in upper Mobile Bay, Alabama, in 2001 (USACE 2012). The pressure waveform (Figure 2-2) was a relatively continuous, uniform sound. The analyzed segment on Figure 2-2 was recorded as the hopper dredge passed in front of the listening vessel platform at a distance of 40 meters (131 feet). Sounds of the draghead scraping across the sandy substrate were discernible from the propeller noise of the ship. Most of the sound energy from the hopper dredge fell in the 70 to 1,000 Hz range with peak sound pressure levels (SPL) in the 120 to 140 dB root-mean-squared (rms) range (Figure 2-3).

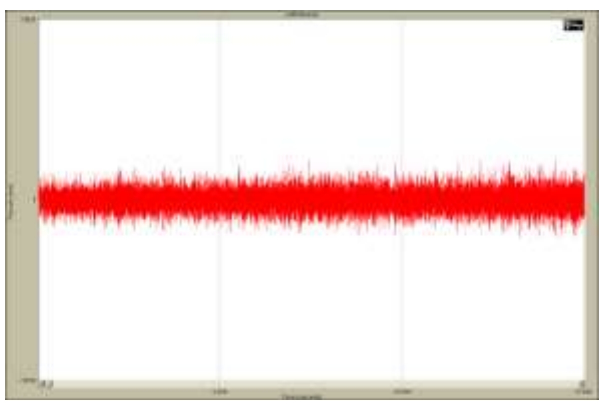

Figure 2-2. Pressure Waveform for a Recorded Segment of Hopper Dredge Sounds
(from USACE 2012)

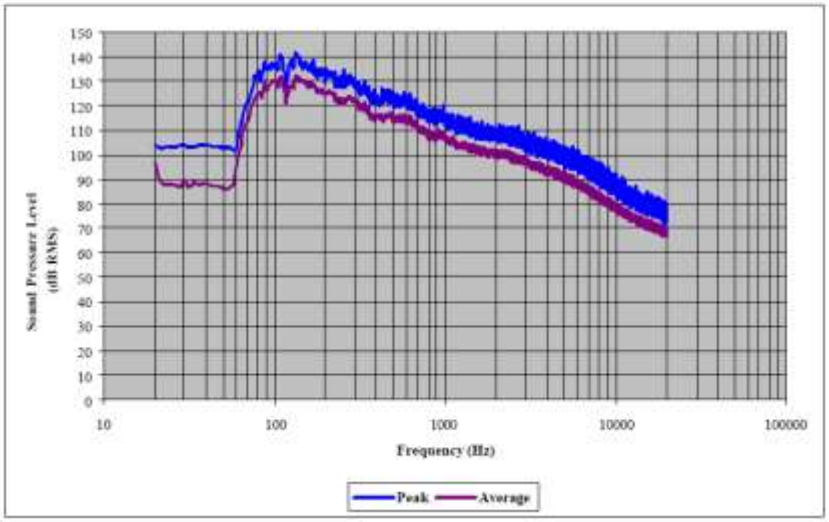

Figure 2-3. Sound Pressure Levels Produced by a Hopper Dredge in Mobile, Alabama at 40 Meters from the Dredge Plant
(USACE 2012)

USACE (2012) summarized hopper dredge sounds as follows:

- Peak SPLs ranged from 120 to 140 dB rms at 40 meters
- Average SPLs ranged from 110 to 130 dB rms at 40 meters
- Frequency range primarily from 70 to 1,000 Hz
- Average SPLs approximately 5 dB above background noise levels in Knik Arm (125 dB re 1 micropascal [μPa]) at 40 meters

Reine *et al.* (2014) characterized underwater sounds for three TSHDs during the removal of 3.1 million cubic yards of sand from an offshore borrow area and during offloading of the excavated sediment at the pump-out stations in an area in Virginia. Sounds were recorded simultaneously at two depths, 3 meters (10 feet) and 9.1 meters (30 feet) from the surface. SPLs for sediment removal, pump-out of material, and pump-out of clear water during pipe flushing were found to vary by vessel and were correlated to vessel size. That is, the highest SPLs were obtained for the largest dredge (*e.g.*, larger hopper volume and greater displacement). Attenuation to ambient noise levels depended on the specific sound source; for excavation attenuation was at 0.85 km (0.5 mile) when flushing pipes.

Robinson *et al.* (2011) reported that source levels at frequencies above 1 kHz had elevated levels of broadband sound from the aggregate extraction process. These sounds attenuated rapidly with distance. Source levels were dependent on extraction aggregate type; as expected, coarse gravel generated higher sound levels than sand. Aggregate pumped through pipes was a major source of elevated source levels at higher frequencies (Robinson *et al.* 2011).

In addition to the sound of substrate being removed, TSHDs propellers can produce sounds of high frequencies, particularly if there is any propeller cavitation. TSHDs work continuously during dredging, and sounds from TSHD vessels are reported to be louder than grab dredgers (Central Dredging Association 2011). Noise from the vessel during dredging would be relatively constant during dredging operations in the harbor, but would cease altogether when the vessel transits to the Hilo ODMDS.

Noise during Transit to ODMDS. Noise from the ship's engines is transferred through the ship's hull to the water, contributing to underwater sound levels. Overall noise levels are influenced by other factors, such as type of engine, specific configurations of winches, generators, and hydraulic equipment. Engines on large ships like the *Essayons* produce relatively strong continuous sounds of constant frequency and intensity.

Reine *et al.* (2014) measured SPLs from a TSHD during transit to the dredge disposal site (with the hopper empty) and also to the pump-out stations with hoppers fully loaded. Sounds emitted during transit produced the highest source level, whether the hopper was empty or full, compared with other stages of the dredge process; source levels ranged from 161.3 dB to 176.7 dB re 1 μPa-1meter rms. During transit with a full hopper, noise attenuated to ambient levels at 2.65 km (1.65 miles).

Robinson *et al.* (2011) reported that TSHDs in transit emit sound levels at frequencies below 500 Hz, which is comparable to sound levels reported for cargo ships travelling at similar speeds (between 8 and 16 knots). At frequencies above 1 kHz, source levels showed elevated levels of broadband sound from the aggregate extraction process; however these sounds attenuated rapidly with distance. A 5- to 10-dB range in broadband source level was found for ships depending on the transit conditions. For a given ship traveling at different speeds, cumulative noise was lowest at 8 knots, 65% reduction in operational speed.

- Cavitation Inception Speed occurs at around 10 knots for most merchant ships
- For the vast majority of ships, increased speed is directly correlated with increased noise. The exception is variable or controlled pitch props with fixed shafts.
- Any vessel speed reduction should consider cumulative noise, as a trade-off between source level reduction and increased time spent in a region.

Noise at the Hilo ODMDS. Disposal of dredged material would be slightly louder than transit alone, as the hopper doors may generate sound during opening and the material may produce sound as it moves through the hopper to the water column. The *Essayons* would be at the disposal site for a limited time, only long enough to empty the hopper.

Noise from Shipboard Operations and Maintenance. Noise is from operation and maintenance of shipboard equipment, such as cooling units, winches, and other machinery. Repairs such as rust chipping and hammering would increase noise levels intermittently, depending on the activities necessary to keep the vessel running efficiently. Normal degradation of pumps and other active or rotating machinery often produce increased vibration and noise levels as they wear. Source levels are reduced by damping or vibration isolation mounts and equipment isolation. BMPs for reducing noise related to ship machinery include establishing a routine inspection and maintenance program to identify and correct conditions that increase ship noise. This includes propeller inspection and cleaning, lubrication, and other general maintenance activities.

2.2.4 Benthic Disturbance

The *Essayons*' dragarms would physically contact all seafloor in the dredge footprint and remove the uppermost portions of unconsolidated seafloor habitat. The maximum extent of contact with the seafloor would be the entire dredge footprint. Areas with consolidated seafloor, which includes hardbottom, relic reef, and channel walls, would be avoided because the *Essayons* is not capable of removing consolidated seafloor. The *Essayons* would maintain a 20- to 30-foot buffer between the draghead and the boundary of an intentionally avoided area (see Section 2.2.6). The draghead itself moves forward and laterally along with the vessel; the draghead does not intentionally vibrate, although some vibration may be transferred from the vessel through the dragarm to the seafloor. The dragheads would be raised and lowered essentially vertically with respect to the seafloor, confining physical contact between the draghead and the seafloor to the draghead path.

2.2.5 Turbidity

Maintenance dredging would cause a temporary increase in turbidity in the harbor and entrance channel. The proposed action would cause turbidity in the area being dredged and at the Hilo ODMDS. Entrained water released through a decant pipe of the *Essayons* would likely contain suspended fine particles that could increase turbidity in the mid-level water column. Turbidity could be increased near the bottom in the area around the dredge as the dragarms and possibly the vessel propeller disturbed the substrate. At the Hilo ODMDS, release of the dredged material would cause a temporary increase in turbidity, although this effect is expected to be consistent with design specifications permitted at the disposal site.

Increased turbidity from return of entrained water. The primary source of turbidity in nearshore waters is the return of water during dredging (decanting). As sediment is sucked through the dragarms, entrained water fills up the hopper. As a necessary efficiency in the operation, much of this entrained water is returned to the harbor through a decant pipe connected to the bottom of the vessel (see Section 2.2.2). The discharge water would be controlled by a weir located at the bow of the hopper bin on the *Essayons*, which allows heavier sediment to fall to the bottom of the hopper, allowing less turbid water to flow over the weir. This water would be discharged 22 to 27 feet below the vessel, depending on the level of load in the hopper. The denser particulates settle inside the hopper. Smaller particles would be expected to have a longer residence time in the water column and would be less likely to settle in or adjacent to the dredged footprint. Tides and currents would disperse these particles over greater time and space. The intensity of turbidity from the overflow water can be partially modulated by the speed at which the pumps operate. Specifically, at slower pump speeds less water would be taken up at the dragheads and finer sediment would have more time to settle in the hopper before decanting. The ship's instrumentation contains a load meter graph that indicates when equilibrium of the dredged material coming in and out of the hopper is reached, allowing the operator to optimize sediment and water intake (Holcroft 2014). Additional water quality BMPs listed in Section 2.2.6 would be employed to minimize turbidity generated from this source.

Increased turbidity from dragarms and propeller wash. A TSHD operates like a giant vacuum cleaner, drawing virtually all of the disturbed sediment into the dragarms. The entire system is designed to optimize transfer of sediment from the seafloor into the hopper. Suction pumps are turned on after the dragheads contact the seafloor so that the disturbed sediment is directed into the hopper. Despite best efforts and design, some fine floccules at the leading edge of the dragarm may be transported by water movement out of range of the suction dredge, thereby increasing turbidity near the seafloor; propeller wash may unavoidably increase turbidity as the *Essayons* passes through shallow areas, regardless of the position of the dragheads. The duration of turbidity stressors is a function of particle size/density and water flow in the area.

Increased turbidity during placement of dredged material in the ODMDS. As described in section 2.2.2, the *Essayons* disposes of dredged material by opening the hopper doors to release sediment, which then drops to the ocean floor. Entrained water that was not decanted in the harbor could be released at the ODMDS. As the hopper doors are opened, denser material quickly sinks to the seafloor, while lighter and smaller particles remain suspended, increasing turbidity in the water column above the disposal site. A plume of fine sediment could develop during disposal, depending on the characteristics of the material being discharged, water currents, and other physical factors. The overall size of a plume could be modulated by slowing or stopping the ship's forward motion before opening the hopper doors, although operational efficiency is lost and dredged material could tend to mound up on the seafloor instead of spreading over the Hilo ODMDS. This source of turbidity would be relatively minor, and little can be done operationally to minimize the duration of the turbidity, which is dependent on the nature of the dredged material, as well as the winds and currents at the disposal site. The creation of turbidity plumes was considered during the design and permitting of the ODMDS to accept dredged material released by a TSHD. The proposed action would not cause any turbidity effects not already evaluated at the ODMDS. These effects are not considered further in this EA.

2.2.6 Best Management Practices

The proposed action incorporates BMPs implemented as part of normal operations of the *Essayons*, and BMPs previously developed by the USFWS, NOAA Fisheries, USEPA and USACE. Implementation of BMPs is understood to be secondary to safety concerns. Specific instances where safety concerns take precedence are noted under relevant BMPs. All workers associated with this project, irrespective of their employment arrangement or affiliation (*e.g.*, employee, contractor) will be fully briefed on these BMPs and required to adhere to them for the duration of their involvement in this project.

USACE is consulting with NOAA Fisheries and USFWS regarding the potential effects of the proposed action on protected species. The BMPs presented in this section be altered as a result of the outcomes of the consultations; however, the resulting BMPs would be similarly protective to those listed below. USACE would implement the final BMPs agreed upon between itself, NOAA Fisheries, and USFWS.

Endangered Species Observers.

1. The USACE will provide two full-time observers for the entire project action, with one observer always on duty during the entire dredging action. This is considered 100% observer monitoring.
2. Endangered species observers will;
    a. Conduct visual sweeps for the presence of marine mammals and sea turtles during dredging, transits and ocean disposal,
    b. Visually monitor dredge material into the hopper and at the overflow screens, and
    c. Ensure that all BMPs are followed.
3. At the start of operations, and whenever there is new crew, the observers shall instruct all *Essayons* personnel associated with the project of the potential presence of sea turtles, dolphins and whales in the area, and the need to avoid collisions with and harming these animals.
4. Observers will be required to complete all appropriate forms as directed by the USACE, including Endangered Species Act (ESA) species sightings, dredge material monitoring forms, and any ESA-related incident forms (*e.g.*, vessel strike, sea turtle take).
5. Observers' responsibilities are provided in the subsequent BMP categories. While monitoring of dredge material for sea turtle entrainment is the highest priority, other prioritization of responsibilities and time dedicated to each activity will be determined in consultation with NOAA Fisheries and during observer training.
6. Monitoring Reports: The results of monitoring shall be recorded on the appropriate monitoring sheets, with daily and weekly summary sheets. In addition, there will be a post dredging summary sheet for each harbor. Monitoring sheets will be completed regardless of whether any observations or takes of ESA species occur. NOAA Fisheries will approve monitoring and incidental take forms provided by the USACE as part of any Incidental Take Permit (ITP). Any specimens taken under the ITP shall be photographed with a digital camera, with photographs attached to respective reports. Documentation associated with the incidental take reports shall be submitted to the USACE within 24-hours of the take. All monitoring data will be archived by the U.S. Army Engineer Research and Development Center (USACE ERDC) as well as provided to NOAA Fisheries.
7. The endangered species observer will place all specimens or specimen parts taken under the ITP in a heavy duty garbage bag in a large cooler on ice and contact the specific island's stranding coordinator to arrange the transfer of the specimen off the vessel. The observer will place an immediate call to the stranding coordinator upon the retrieval of a live sea turtle. The stranding

coordinator's contact information and other handling requirements will be provided by NOAA Fisheries.

Benthic Impacts and Disturbance BMPs.

1. While transiting to the ODMDS, the *Essayons* will remain in the marked channel until passing the outer buoy to prevent any accidental release of material from the scow/hopper that might settle on adjacent reef habitats.
2. Measures to reduce potential effects on essential fish habitat (EFH), including designation of avoidance areas for living coral, will be implemented pending completion of consultation with NOAA Fisheries.
3. All efforts will be made to time the dredging operations to avoid coral spawning season (Mid-May through the end of August).

Water Quality BMPs.

The *Essayons*' hopper dredge technology and BMPs will be employed to prevent excess turbidity. Due to the differences in the composition of the dredged material, ocean conditions, proximity to sensitive habitats, and other environmental factors, the *Essayons*' crew will draw on their dredging experience in determining the best course of action from the suite of BMPs provided below to minimize turbidity and associated impacts on habitat and biological resources.

1. A Water Quality Monitoring Plan has been prepared as part of this action. Turbidity and dissolved oxygen will be monitored in accordance with the plan by the dredge crew and the dredge operations will be adjusted accordingly to minimize the effects of turbidity on the surrounding area.
2. Turbidity will be monitored by a support boat during active dredging as indicated in the Water Quality Monitoring Plan to determine if there is an appreciable increase in turbidity. Sampling locations will be determined with an emphasis on monitoring the harbor entrances which are adjacent to coral reef and seagrass beds outside of the harbor. For safety reasons, the support vessel must be 300 yards away from the dredge while operating, and shall operate only during daylight hours.
3. The draghead will be placed directly into the dredge material prior to powering up the pumps in order to minimize the mixing zone of dredged material in the surrounding water.
4. Depending on the density of the dredged material, the *Essayons* will adjust its speed to reduce horizontal speed of the suction draghead moving through the dredge material, especially in areas close to the harbor entrance and adjacent to the large designated reef avoidance area in the entrance of Nawiliwili Harbor.
5. The *Essayons* will plan its dredge activities in order to minimize overflow or return effluent back into the surrounding waters near the harbor entrance
6. Some turbidity is inevitable during dredging. Where turbidity becomes excessive, as determined in the Water Quality Monitoring Plan, the *Essayons* will employ the following suite of corrective actions until turbidity is diminished to acceptable levels;
    a. Employ anti-turbidity valves within the hopper to slow the entrainment of air and increase laminar flow, minimizing mixing and increasing the settling rate of the sediment, allowing for the return of cleaner overflow water.
    b. Adjust pump speed to slow the flow rate of the water-dredged material slurry into the hopper, providing more time for the sediment to fall out of suspension, allowing for the return of cleaner overflow water.

   c. Reduce the total overflow time to less than the economic load in areas of fine silt and clay sediments, where corrective actions 6a and 6b prove less effective.
   d. Reposition the *Essayons* to a new area within the harbor to allow for turbidity to naturally dissipate through current action and settlement of fine particles.
   e. Where repositioning is not an option, the *Essayons* will stop dredging and transit to the ODMDS, allowing for natural dissipation of turbidity.
7. *Essayons* staff will inspect all heavy equipment for oil leaks on a daily basis. 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.
8. A contingency plan to control toxic materials will be maintained on board the *Essayons*.
9. A Spill and Debris Prevention Plan will be maintained on board the *Essayons*, and the *Essayons* will store and have readily available appropriate materials to contain and clean potential spills.

***Vessel Strikes BMPs*.**

The *Essayons* is a large capacity dredge, which allows for less traffic and fewer dumps, thereby requiring fewer trips to the disposal site, diminishing the risk of vessel strikes while in transit. In addition, the following BMPs will serve to limit vessel strikes where possible.

1. Transit speed to and from the ODMDS and between harbors will be no greater than 10 knots.
2. The *Essayons* will communicate with the harbor masters and other vessels operating within the harbor to relay or receive the location and other relevant information for any ESA listed marine mammals entering or occurring in the harbor during operations, and will abide by harbor master instructions, including the possibility of reducing vessel speed or halting vessel movement until the animal leaves the vicinity.
3. During daylight hours, the observer shall have access to the bridge and check for the presence of endangered species, especially humpback whale mothers and calves. Observers will scan with binoculars for whales and monk seals to ensure avoidance measures, as appropriate, are performed. Observers will also scan for and report sea turtles for monitoring purposes, which will provide information on the effectiveness of the sea turtle entrainment mitigation measures.
4. Observer periods.
   a. While in the harbor action area, observation for marine mammals shall take place before dredging resumes, following any break of more than one half hour.[1]
   b. Prior to exiting the harbor entrance and into the transit action area, the ship will transit at the slowest possible safe speed to allow the on-duty observer to perform a scan sweep for ESA-listed marine mammals, allowing time for the captain to note location of whales, thereby mitigating any ship strikes upon leaving the harbor.
   c. During daylight transits to the ODMDS, observers shall maintain a continuous watch for the presence monk seals and whales.
5. During night transits to the ODMDS, the observer shall scan the waters as may be practical, however the *Essayons* will not employ spotlights as part of their monitoring effort, due to safety concerns for night blindness in unlit areas of the water.

[1] *Essayons* staff (Holcroft 2014) noted that the primary ESA concern during active dredging operations is for sea turtles resting on the seafloor within the dredge footprint, that do not flee an oncoming draghead. These sea turtles would not be seen by observers. Sea turtles occurring at the surface (*i.e.*, the ones visible to observers), as well as those actively foraging are generally not in danger of entrainment or vessel strike and could swim safely away from the operation area, as the dredge operating speed is 1-3 knots (D. Dickerson, pers. comm.).

6. The start of dredging shall be postponed when marine mammals are within 50 yards of the vessel with the exception of humpback whales (100 yards). Once the species leaves the area, dredging can commence.
7. No one associated with the dredging operation shall attempt to feed, touch, ride, or otherwise intentionally interact with any ESA-listed marine species.
8. To the extent possible, when piloting vessels, vessel operators shall adjust speed and/or alter course to remain at least 100 yards from whales, and at least 50 yards from other marine mammals, and will not pilot the vessel as to cause another vessel or object to approach within 100 yards.
9. The *Essayons* will adjust the release of dredged material at ODMDS to ensure marine mammals are outside of those ranges during dumping operations.
10. If, despite efforts to maintain the distances and speeds described above, a marine mammal approaches the vessel, and only if the safety of the vessel, crew, and adjacent habitat is assured, put the engine in neutral until humpback whales are at least 90 meters (100 yards) away and at least 45 meters (50 yards) away for or for other species of whales, dolphins, and monk seals, and then slowly (under 5 knots) move away to the prescribed distance.
11. Marine mammals shall not be encircled or trapped between multiple vessels or between vessels and the shore.

Sea Turtle Entrainment Protection BMPs.

In addition to the above observer and vessel strike and entanglement BMPs, the following BMPs are specifically designed to minimize sea turtle entrainment into the hopper dragarm.

1. The *Essayons* shall operate the dredge to minimize the possibility of taking sea turtles and to comply with the requirements stated in the Incidental Take Statement provided by NOAA Fisheries in their Biological Opinion.
2. The *Essayons* will attach "tickler chains" (Figure 2-4) to each dragarm, which act in part to disturb sea turtles prior to coming in contact with the operating draghead, allowing them to swim away to safety. [2]
3. The Essayons will have on board dragheads with fixed-position sea turtle deflectors available for use as an alternative protection to tickler chains if the tickler chains are deemed ineffective.
4. Tickler chains and sea turtle deflector-equipped dragheads shall be maintained in operational condition for the entire dredging operation.
5. The draghead will be placed firmly on the bottom prior to powering up the pumps to the full power, in order to minimize the potential of entraining a sea turtle resting on the sea floor.
6. During turning operations, moving to a new dredge location, or at the end of a load cycle (*i.e.*, when hopper is full and ready to transit to ODMDS), the *Essayons* will reduce the dragarm pumps from a maximum speed of 7,000 revolutions per minute (RPMs) (equivalent to 27 feet per second [fps] within the dragarm) to its idle speed of 4,700 RPMs (approximately 18 fps) prior to lifting the dragheads off the seafloor. Pumps shall remain at idle speed until the draghead is at mid-water, where the suction velocity can be increased just long enough to clear the lines, approximately 5-10 seconds, and after which the pumps will return to idle speed. Pumping water through the dragheads shall cease while maneuvering or during travel to/from the disposal area.
7. If a dragarm becomes clogged, as noted by increased pump RPMs or decreased flow rate, the draghead will not be raised off the bottom to increase suction velocity in order to clear the

[2] The *Essayons* has expressed concerns regarding the attachment of a sea turtle deflector to the dragarm as has been done for harbor maintenance dredging projects on the U.S. East Coast and Gulf of Mexico. These devices create substantial torque, increasing the possibility of a catastrophic failure of the *Essayons'* dragarm. A sea turtle deflector will be available on board as a measure of last resort if the tickler chains are determined to be ineffective.

obstruction. As with BMP #6 above, the pump will be reduced to idle speed, the dragarm will be raised to mid-water and powered up to full speed long enough to clear the obstruction. After which, the pump will be powered down to idle speed until the draghead is placed firmly on the sea bottom, as described in BMP #5 above.

8. Dredging speeds shall not exceed 3.5 knots, allowing sea turtles to swim away from the draghead.

Sea Turtle Monitoring BMPs.

1. The *Essayons* will attach an overflow screen at the weirs to allow for examination of dredge material. Safe access shall be provided to allow the observer to inspect for sea turtles, sea turtle parts or damage (See Figure 2-5). The dredge will provide suitable illumination to allow the observer to safely monitor take throughout each cycle during non-daylight hours.
2. The overflow screens shall be maintained in operational condition for the entire dredging operation.
3. After the completion of a dredge cycle, the observer shall thoroughly monitor the overflow screens for sea turtles and/or sea turtle parts on every load.
4. The *Essayons* will carry out all lock-out tag-out procedures during monitoring activities to ensure complete safety for the endangered species observer.
5. Upon completion of each load cycle, dragheads shall be examined by the observer after the draghead is lifted from the sea surface and is placed on the saddle during the transit to the ODMDS in order to assure that sea turtles that may be trapped within draghead are not lost and unaccounted for. Observers shall physically inspect dragheads for threatened and endangered species take.
6. All sea turtle takes shall be immediately reported to the Environmental Coordinator, who will relay this information to NOAA Fisheries Pacific Islands Regional Office (PIRO).
7. The endangered species observer will place all specimens or specimen parts taken under the ITP in a heavy duty garbage bag in a large cooler on ice and contact the specific island's stranding coordinator to arrange the transfer of the specimen off the vessel. The observer will place an immediate call to the stranding coordinator upon the retrieval of a live sea turtle. The stranding coordinator's contact information and other handling requirements will be provided by NOAA Fisheries.
8. The observer will monitor for sea turtles on the water's surface whenever they are scanning for marine mammals, as well as during active dredging to the extent their other duties allow. This will provide an understanding of the presence or absence of sea turtles in the dredge area, which will be useful in general understanding of sea turtle behavior around the dredge, post-processing of the data acquired to assess the effectiveness of the mitigation measures, and to correlate presence to the take data.

Alien and Invasive Species BMPs.

1. The *Essayons* has a ballast water control plan to minimize the potential for spread of non-native species. The *Essayons* utilizes potable (fresh) water in its ballast tanks, which are not normally discharged during the entire dredging action, significantly reducing the potential of transporting alien and invasive marine species between ports.
2. The *Essayons* will initiate several cycles of rinsing the hopper and dragarms before entering Hawaii state waters and before moving from one harbor to the next.
3. The *Essayons* has regular USCG inspection of its tanks to minimize potential for the spread of alien and invasive marine species. These inspections will be done prior to the *Essayons* entering the first Hawaii harbor from its homeport in Portland, Oregon.
4. Dragarm and draghead inspections will be completed between each of the islands.

5. The *Essayons* will not require ballast water, except possibly during ocean transit from Portland, Oregon. As required by USCG, ballast water will be released prior to entering Hawaiian waters.
6. Honolulu Harbor will be dredged last due to the harbor having substantially more invasive species compared to the other harbors. This will limit the potential of the *Essayons* acting as a vector for the transmission of invasive species from Honolulu and the other harbors.

Additional BMPs and avoidance measures may be prepared as part of consultation with NOAA Fisheries in accordance with the preparation of the Section 7 of the ESA ITP, including the *Essayons* accommodating competent observers, as required. If required, NOAA Fisheries and the USACE will coordinate to determine protocols for observers and roles, if any, of *Essayons* personnel in assisting observers in addition to the BMPs provided above.

2.2.7 Dredge Material Observation Mechanisms and Methodologies

As the *Essayons* was originally not equipped to provide for 100% observation of the dredge material as is required to fulfill the protocol for a sea turtle ITP for USACE hopper dredge projects in the Atlantic and Gulf of Mexico, an alternative method was proposed. The *Essayons* is equipped with an 8.6 cubic yard sample basket, originally designed to sample for fish and crab. Although not designed for this purpose, the sample basket was made available for use by observers to monitor potential entrainment of ESA listed species during active dredging. The sample basket is hydraulically operated by the observer or deckhand, diverting the dredge slurry through a 28-inch pipe to the sampler basket, where the observer would be able to sort through the material for turtles or turtle parts. An analysis of this method by the USACE determined that, despite significant effort by the observer, it would allow for no more than 1% of the dredge material to be checked, which was determined to be insufficient to interpret the results for potential takes of turtles or other protected species. For this reason, this observing method was eliminated from consideration.

Because the project start date was delayed for one year, the USACE was able to investigate, design and retrofit an alternative mechanism that allows for observation of a greater percentage of the dredge material. East Coast and Gulf of Mexico hopper dredges are equipped with hopper inflow and overflow screens, which, in addition to monitoring dragheads after they have been raised, provides 100% monitoring of dredge material, and an accounting of the vast majority of sea turtles taken. The USACE investigated whether these screens could be retrofitted on the *Essayons* for the proposed action. The USACE determined that the extensive modifications required to install hopper inflow screens on either the forward or aft hopper inflows was not feasible for this action, due to time constraints during the *Essayons* 2015-2016 scheduled dry-dock period. The USACE did determine that overflow screens on the weirs could be retrofitted for this action and designs and fabrication are underway to have these screens installed prior to the proposed start date.

As described in the BMPs for observer actions, observers will be providing 24-hour monitoring of the dredge material within the hopper at the overflow screens (Figure 2-4), and inspect dragheads each time dredging stops and they are raised and stowed at the surface (*i.e.*, during transits to the ODMDS or moving to a new dredging location within the harbor). With the exception of observing at the inflow screens, this approximates the standard practice for hopper dredge observers on the East Coast and Gulf of Mexico. Direct counts of sea turtles taken in all Atlantic and Gulf of Mexico hopper dredge projects (post implementation of the suite of sea turtle mitigation measures and 100% observer requirements) from 1995 to 2013 are presented in Table 2-2. These data provide an estimate of the percentage of coverage that the proposed action can provide. Analysis of turtle take data on over 500 turtle specimens over 19 years demonstrates 20.8% of takes have been recovered from overflow screens and 19.8% from inside the draghead (D. Dickerson, pers. comm.). As inflow screens will not be employed, and therefore will not reduce the total number of turtles entering the hopper, it should be expected that a higher percentage of taken turtles will reach the overflow weir. There is, however, no data or verifiable way to estimate the increased percentage. Nevertheless, monitoring the overflow screens and inside the draghead should collectively represent, at a minimum, a 40% sampling effort.

Table 2-2. Observed Location of Sea Turtle Take from Atlantic Hopper Dredge Projects, 1995-2013

Location	Number of Turtles	Percentage	Available for this Project
Inflow Screening	300	59.9	No
Overflow weir screening	104	20.8	Yes
Inside draghead	97	19.3	Yes

Source data: USACE Sea Turtle Dredging Data Warehouse, USACE ERDC 2015

Figure 2-4. Photo of Observer Checking the Overflow Screen (Courtesy USACE ERDC)

Figure 2-5 *Essayons* with Recently Fabricated Dragarm Tickler Chains and Draghead Turtle Deflector.

Note: The turtle deflector is proposed to be employed only as a back-up option if the tickler chains are deemed ineffective.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

In this section, the baseline condition of each potentially affected resource is described and the potential impacts of the no action alternative and the proposed action are analyzed.

The affected environment is the living and nonliving components of Hilo Harbor, the transit corridor to the Hilo ODMDS, and the Hilo ODMDS itself. Biological resources evaluated are Benthic Habitats, Seagrasses, and Marine Invertebrates (Section 3.1), Fish (Section 3.2), Sea Turtles (Section 3.3), Birds (Section 3.4), and Marine Mammals (Section 3.5). Nonliving resources evaluated are water quality (Section 3.6), Cultural and Historic Resources (Section 3.7), Socioeconomics and Environmental Justice (Section 3.8), Transportation (Section 3.9), and Hazardous Substances (Section 3.10). Resources not evaluated in detail because there is no nexus between the proposed action and the resource are aesthetics and visual resources, land use, air quality, noise, and utilities and infrastructure (Section 3.11). Effects conclusions are provided in Section 3.12.

Environmental impacts, also called environmental consequences, are characterized by duration (long-term or short-term), severity (none, negligible, minor, moderate, or major), quality (beneficial or adverse), causation (direct or indirect), and significance (intensity and context). Cumulative impacts are evaluated in Section 4.0.

3.1 Benthic Habitats, Seagrasses, and Marine Invertebrates

The USACE provided funds to the USFWS to conduct a Marine Habitat Characterization in Hilo Harbor in November 2013. The survey provided data to characterize the habitat and biological resources in the proposed project area (USFWS 2014). The USACE relied on this information to exclude sensitive habitat from the project area and to focus the analysis of this EA on relevant benthic habitats and biological resources.

3.1.1 Affected Environment

Almost 97% of the project area is characterized as unconsolidated sediment, largely mud. The only hardbottom habitat in the project area is a 0.42-acre patch of pavement with sand channels (2.2% of the project area), 0.09 acre of aggregate reef (0.5% of the project area), and a 0.02 acre area of rock/boulder (0.1% of the project area) (USFWS 2014). Several areas along southern edge of DMMU H3 and H4 that are dominated by coral would be excluded from the project area to avoid directly affecting coral habitat (Figure 1-2).

No seagrasses were reported in the project area (USFWS 2014). Marine invertebrates observed in the aggregate reef habitat during the 2013 survey include Porifera (sponges), Cnidaria (corals and anemones), Annelida (segmented worms), Mollusca (snails and bivalves), Echinodermata (urchins, sea stars, and sea cucumbers), and Chordata (sea squirts). None of these invertebrate phyla were observed in the unconsolidated sediment; the survey reported only a single observation an unidentified macroinvertebrate (USFWS 2014).

Corals are absent from most of the project area, except for limited coverage (1 to 10%) in the pavement area of the entrance channel. Corals in this area are apparently able to withstand the high ambient turbidity of Hilo Harbor caused by terrigenous runoff and propeller wash from vessels entering and leaving the harbor (see Section 3.6 for a discussion of water quality). No federally-listed endangered or threatened marine invertebrates occur in Hawaii.

3.1.2 Environmental Consequences

3.1.2.1 No Action Alternative

Under the No Action Alternative, the *Essayons* would not dredge the project area in 2016 and/or 2018. To maintain vessel access and navigational safety, the USACE may dredge the area using other equipment in the future. During the interval before dredging, existing conditions would prevail. The underlying substrate would not change, but epibenthic invertebrates could continue to grow where suitable habitat exists. Sediment accumulation would continue, further shoaling the harbor. The No Action Alternative would have no direct or indirect impact on benthic habitat, benthic algae, or marine invertebrates.

3.1.2.2 Proposed Action

Direct Physical Disturbance. The proposed action would directly affect benthic habitat and likely cause mortality of non-motile invertebrates in the path of the dragheads. An estimated maximum of 233,171 cubic yards of benthic substrate would be affected (Table 2-1). The vast majority of the area (more than 97%) is unconsolidated mud where few or no biological resources were identified during surveys (USFWS 2014). The area of hardbottom identified as important to coral was eliminated from the project area, and would not be subject to direct contact with the dragarm. Benthic habitat would not be affected along the transit route because the water is deep enough to preclude disturbance by propeller wash and no part of the vessel would contact the seafloor. Benthic infauna are expected to recolonize the mud and sand substrate in the project area, although recovery could take more than 3 years, based on studies of dredging effects in other regions (Byrnes *et al.* 2004, Peterson and Bishop 2005, USACE 2001, Lindholm *et al.* 2011). The deep water channels of a commercial harbor are necessarily dominated by heavy vessel traffic and other features of industrial waters, making the area of limited value as benthic habitat regardless of dredging activity.

Turbidity and Light Penetration. Indirect effects of the proposed action include increased turbidity, reduction of light penetration, decline in primary productivity due to decreased photosynthesis by phytoplankton, and deposition of a thin layer of fine sediments in the immediate area (see Section 2.2.5). Any appreciable turbidity increase may also cause clogging of the feeding apparatuses of filter feeders. Ambient turbidity in the project area is already considered high enough to constitute water quality impairment (see Section 3.6). Turbid conditions are maintained by a combination of sediment-laden stream discharge and frequent passage of large vessel that resuspend bottom sediment. Turbidity and sedimentation would be likely to extend beyond the immediate dredge footprint, but the affected area would be determined by the concentration of fine sediments, local water motion, wind speed and direction, and other physical conditions that are not subject to prediction. Turbidity and sedimentation could reach the coral communities in DMMU H3 and H4 (Figure 1-2). Marine invertebrates could react to deposition of sediments by moving to less-affected areas, producing mucus to rid the body of sediment, or entering a quiescent state until the sediment is removed by water currents. If burial were complete, some individual could suffer permanent injury, although this outcome is considered unlikely because the project area is known to experience high turbidity on a regular basis. Numerous BMPs incorporated into the proposed action would minimize project-related turbidity (see Section 2.2.6). Specifically, horizontal speed of the suction draghead would be reduced and overflow of entrained water from the *Essayons* would be limited in the entrance channel and adjacent to the large avoidance areas in Hilo Harbor (see Figure 1-2) if turbidity becomes excessive. Other corrective actions to address increased turbidity are outlined in the Water Quality Management Plan for this project. Effects of turbidity on marine invertebrates would be temporary; water clarity would return to ambient levels within days to weeks after dredging.

While some marine invertebrates may detect underwater sound (Mooney *et al.* 2010, Radford *et al.* 2008, Simpson *et al.* 2011, Vermeij *et al.* 2010), most species are not thought to have sensory organs that respond to anthropogenic noise. No data are available to support analyses of impacts of noise on coral or other marine invertebrates present in the project area. If noise associated with the proposed action were detected by marine invertebrates and could be discerned against the background noise environment, the effect on a given species could be adverse, neutral, or beneficial. The effect of noise on benthic invertebrates is not expected to rise to the level of significance.

Direct effects on benthic habitat, benthic algae, and marine invertebrates in the dredged area would be permanent. Because the area to be dredged supports few living resources, and has little habitat value, effects of the proposed action on benthic habitats, benthic algae, and marine invertebrates would be less than significant. Indirect effects on marine invertebrates mediated through changes to water quality (turbidity) would be localized, short-term, reversible, and moderate.

3.2 Fish

3.2.1 Affected Environment

More than 566 species of reef and shore fishes are known to occur in the nearshore waters of the Hawaiian Archipelago; 24% of these species are endemic to the Hawaiian Islands (Randall 1998). Little information is available on the abundance or diversity of fishes in Hilo Harbor. The USFWS survey did not include observations of fishes. No fishes in Hawaii have been listed under the ESA.

No records of recreational or commercial catches are available, although commercial harbors in general are rarely used by fishermen because of the danger of large vessels, the poor water quality, and restrictions on access due to security concerns. The presence of EFH in the project area is discussed in a separate Essential Fish Habitat Assessment (EFHA) (Tetra Tech 2015a).

3.2.2 Environmental Consequences

3.2.2.1 No Action Alternative

Under the No Action Alternative, the *Essayons* would not dredge the project area in 2016 and/or 2018. To maintain vessel access and navigational safety, the USACE may dredge the area using other equipment in the future. During the interval before dredging occurred, existing conditions would prevail. The underlying conditions that make habitat suitable for various fish species would not change; resident and transient fishes would continue to use the project area as they currently do. The No Action Alternative would have no direct or indirect impact on fishes.

3.2.2.2 Proposed Action

Unlike algae and sessile invertebrates, most fish would be expected to move away from the approaching dragarm and thus escape direct injury during dredging. Some slower-moving individuals could be entrained as the sediments and water are sucked into the hopper, resulting in severe injury or mortality. Fish that are displaced by the approaching dredge could forego foraging in the project area for a short time, but could return to the dredged area as soon as the vessel moved away and turbidity decreased to a level tolerable to the fish. Demersal fish that remained in the area adjacent to the dragarm could experience increased turbidity and sedimentation if the *Essayons* raised a cloud of fine silts. Any appreciable turbidity increase may also clogging the gills of fish. Fish that prey on benthic invertebrates may benefit from enhanced foraging opportunities after the dredge passed, as injured or uncovered invertebrates could be more easily captured in the turbid waters. In the dredged area, overall benthic invertebrate density would likely decrease following dredging, and remain low until, invertebrates recolonized the dredged area. None of the fishes in Hilo Harbor are restricted to that location, and fish have access to vast areas of foraging habitat in adjacent areas.

The BMPs designed to reduce impacts on water quality (see Section 2.2.6) would minimize turbidity levels to the extent practicable. The BMPs incorporated into the proposed action represent a strategic tradeoff between minimizing the duration of dredging and minimizing instantaneous turbidity while extending the overall duration of dredging. Previous USACE experience suggests that high levels of turbidity over a short period of time may be less injurious to marine organisms than lower turbidity over a longer period of time, and the concentration of suspended sediments in short-duration experiments required to result in mortality in fish is hundreds to thousands of times higher than that recorded during dredging operations (Rich 2010). The current 26-day dredging period is expected to have less than significant adverse effects on fishes. The proposed action would have moderate, localized, temporary adverse effects on resident demersal fishes. Impacts would be reversible for most individuals, and affect only the individuals near the dredge or sediment plume. No population-level effects would occur.

3.3 Sea Turtles

3.3.1 Affected Environment

Five species of sea turtle occur in the Hawaiian archipelago. The green and hawksbill sea turtles are permanent residents of the Hawaiian Islands; nesting and foraging occurs near the project area. These two species are likely to occur in Hilo Harbor and be exposed to stressors associated with the proposed action. The Biological Assessment (BA) currently under review by the Services determined that the proposed action may affect and is likely to adversely affect these two sea turtle species by entraining individuals into the dragarm during active dredging. The description, effects analyses, and conclusions of the BA are summarized below.

Three sea turtle species (leatherback, loggerhead, and olive ridley sea turtle) are primarily pelagic and considered only transient visitors to the project area; few recorded observations have been reported within 25 nm of the islands. The BA determined that the proposed action would have no effect on these three sea turtles; they are not considered further in this EA.

Green Sea Turtle. The green sea turtle (*Chelonia mydas*) accounts for more than 98% of all sea turtles in Hawaii (Chaloupka *et al.* 2008). The Hawaiian population is federally listed as threatened. The Hawaiian population is composed of a single genetic stock (Dutton *et al.* 2008), with individuals spending most of their lives in the Hawaii ecoregion. This population appears to have increased gradually over the past 30 years, with near capacity nesting at French Frigate Shoals (Balazs and Chaloupka 2006; Chaloupka *et al.* 2008). NOAA Fisheries and the USFWS recently proposed to classify the green sea turtle into eleven distinct population segments (DPS), including a Hawaii DPS (80 Federal Register 15271). No critical habitat has been designated for the green sea turtle in Hawaii.

During the 2013 USFWS survey, no sea turtles were observed in the project area (USFWS 2014). The project area (and the rest of Hilo Harbor) offers little algae and no seagrass foraging habitat for the green sea turtle. Green sea turtles have been regularly observed in the harbor outside of the dredge area (Kelly 2013). Based on habitat preference, the green sea turtle is likely to occur near the outer entrance to the harbor and in the nearshore waters of the transit corridor. The species is less likely to occur in deeper water, including around the Hilo ODMDS.

The green sea turtle seems to prefer shallow waters, usually less than 100 fathoms (shoreward of the 600-foot depth); it hauls out to bask on sandy beaches throughout the main Hawaiian Islands (Parker and Balazs 2011). The green sea turtle is herbivorous, foraging on a variety of macroalgae and seagrass. Red algae is a dietary staple, with the introduced algae *Acanthophora spicifera*, *Hypnea musciformis*, and *Gracilaria salicornia* making up 44.1 percent of all stomach contents (Arthur and Balazs 2008). Seagrasses, sponges, crustaceans, and other invertebrates are also occasionally eaten (Russell *et al.* 2011).

The ears and auditory system of sea turtles have traditionally been considered to be adapted to hearing in water but not in air (Lenhardt 1982, Lenhardt *et al.* 1983). Sea turtles do not have external ears (pinnae) or ear canals to channel sound to the middle ear, nor do they have a specialized eardrum. Rather, sound is conducted through the shell and bone to the inner ear (Lenhardt *et al.* 1983). Unlike mammals, the cochlea of the sea turtle is not elongated and coiled and likely does not respond well to high frequencies, a hypothesis supported by the limited amount of research on sea turtle auditory sensitivity (Bartol and Bartol 2011; Ridgway *et al.* 1969). The role of underwater low-frequency hearing in sea turtles is unclear. Investigations suggest that sea turtle auditory sensitivity is limited to low-frequency bandwidths, such as the sounds of waves breaking on a beach. Sea turtles may use acoustic signals from their environment as guideposts during migration and as cues to identify their natal beaches (Lenhardt *et al.* 1983). Sea turtles are low-frequency hearing specialists, typically hearing frequencies from 30 to 2,000 Hz, with a range of maximum sensitivity between 100 and 800 Hz (Bartol and Ketten 2006; Bartol *et al.* 1999; Lenhardt 2002; Lenhardt 1994; Martin *et al.* 2012; Ridgway *et al.* 1969). Hearing below 80 Hz is less sensitive but still potentially usable (Lenhardt 1994). Greatest sensitivities are 300 to 400 Hz for the green sea turtle (Ridgway *et al.* 1969) Most sea turtles are reported to hear a limited range of low-frequency sounds that include typical anthropogenic noises such as vessel engines, drilling, low-frequency sonar, and pile driving (Dow Piniak *et al.* 2012). Juvenile and sub-adult green turtles detect sounds from 100 to 500 Hz underwater, with maximum sensitivity at 200 and 400 Hz (Bartol and Ketten 2006). Auditory brainstem response recordings on green turtles showed peak response at 300 Hz (Yudhana *et al.* 2010). Exposure threshold for behavioral disturbance for sea turtles has been set at 160-dB, while the injury and hearing loss thresholds is set at the 180-dB (U.S. Department of the Navy 2007; NOAA Fisheries 2002). Behavioral disturbance includes rising and remaining at the surface until the sound dissipated or leaving the area (Lenhardt 1994). Turtles are also known to become habituated to a steady noise, even at high levels.

Hawksbill Sea Turtle. The hawksbill sea turtle is the most coastal of the marine turtles, with juveniles and adults preferring coral reef habitats (NOAA Fisheries 2010a). Hawksbill sea turtles are the second most common species in the waters of the Hawaiian Islands, as reflected by the stranding records, yet they are far less abundant than green sea turtles (Chaloupka *et al.* 2008; Seitz *et al.* 2012). The lack of hawksbill sightings during aerial and shipboard surveys likely reflects the species' small size and difficulty in identifying from a distance. The hawksbill is federally listed as endangered throughout its range; no critical habitat has been designated in Hawaii.

The hawksbill remains in the oceanic environment until reaching a carapace length of approximately 20 to 30 centimeters, interpreted as 7 to 10 years, and then recruits into neritic habitats and transition from a pelagic to a benthic diet (NOAA Fisheries and USFWS 2013). Reefs provide shelter and food for resting and foraging hawksbills, and individuals are known to visit the same resting spot repeatedly. The hawksbill is found around rocky outcrops and high-energy shoals—optimum sites for sponge growth—and mangrove-lined bays and estuaries (NOAA Fisheries 2010a). While home range appears to be less than 2 km^2 in Hawaii (Parker *et al.* 2009), females nesting on Hawaii Island and Maui have been tracked to feeding grounds on Oahu, Molokai, Maui and the Big Island (Seitz *et al.* 2012; Ligon and Bernard 2000; Parker *et al.* 2009). Unlike other sea turtles, hawksbills are not generally deep divers, which may be a reflection of the shallow depths of their primary food, sponges and macroalgae (NOAA Fisheries and USFWS 2013). Coral reefs and hardbottom areas are their preferred habitats, which are seldom found in waters deeper than the shelf break.

No hawksbill sea turtles were reported during the 2013 USFWS survey of Hilo Harbor (USFWS 2014). No other published reports of hawksbills in Hilo Harbor, the transit corridor, or the Hilo ODMDS were found. Foraging grounds have been identified north of Hilo along the Hamakua coast, and this species nests on beaches predominantly along the southern Kau coast of the Big Island (Seitz *et al.* 2012). The relatively small hawksbill population appears to be concentrated around Hawaii Island and Maui. The *Essayons* could encounter a hawksbill turtle during the proposed action.

Little auditory research has been done on the hawksbill sea turtle. The information above on the green sea turtle is assumed applicable to the hawksbill.

3.3.2 Environmental Consequences

3.3.2.1 No Action Alternative

Under the No Action Alternative, the *Essayons* would not dredge the project area in 2016 and/or 2018. However, to maintain vessel access and navigational safety, the USACE may dredge the area using other equipment in the future. During the interval before dredging, existing conditions would prevail. Sea turtles would continue to transit through Hilo Harbor as they do now, and would not experience any measurable change in habitat value. The No Action Alternative would have no direct or indirect impact on sea turtles.

3.3.2.2 Proposed Action

During informal consultations with NOAA Fisheries, four potential stressors on sea turtles were associated with the proposed action: noise, benthic disturbance, impacts from turbidity and water quality, and ship strikes and entrainment.

Noise. Sea turtles have maximum sensitivity to noise in the same frequencies that are produced by a TSHD. Nevertheless, even in the area of greatest sensitivity, the physiology of sea turtles makes them less at risk to adverse impacts from noise than marine mammals (Lenhardt et al. 1983; 1985). While the 166 dB isopleth represents our best understanding of the threshold at which sea turtles exhibit behavioral responses to seismic airguns, NOAA has set the exposure threshold for disturbance at 160 dB and for injury and hearing loss at 180 dB. Based on recorded noise production for TSHD (USACE 2012, Figure 2-3), the peak source level noise is calculated at 164 dB and falls below the disturbance threshold within 2 meters of the source noise. Noise production is expected to never reach the injury level of 180 dB. Green and hawksbill sea turtles immediately adjacent to the noise source may experience temporary, mild behavioral effects, and would be able to swim beyond this range or to the surface (Lenhardt 1994) within a few seconds to minimize the potential for further disturbance. Therefore, direct effects of noise may affect but are not likely to adversely affect green and hawksbill sea turtle species, while no effects from noise are expected to leatherback, olive ridley or loggerhead sea turtles. As noted in the analysis for ship strikes and entrainment (below), vessel noise may cause any unseen turtle (on or near the harbor bottom) in close proximity to the dredging action to swim away, reducing the risk of this threat.

Benthic Disturbance. Benthic disturbance in the dredged area may indirectly reduce foraging opportunities for sea turtles in the project area either by removing or burying food items. Foraging habitat in the project area is already poor, limited to a small area of macroalgae near the entrance channel. No seagrass occur in the project area, and all coral reef, large colonies, and hardbottom habitat have been excluded from the dredge footprint (Figure 1-2). Sponges were observed along the southern edge of the dredge area in DMMUs 3 and 4, mostly associated with the hardbottom area excluded from the dredge footprint to protect coral (USFWS 2014). Removal of the small areas of sponges outside the excluded area could constitute a minor loss of a forage resource for the hawksbill turtle. No sponges were observed in the unconsolidated mud that makes up 97% of the project area. The scarcity of suitable habitat and forage for both green and hawksbill sea turtles makes direct impacts on sea turtles from benthic disturbance less than significant.

Water Quality and Turbidity. Turbidity could reduce the ability of sea turtles to locate algal food sources. However, the project area provides poor foraging habitat with very small areas of algal growth suitable for sea turtles. Moreover, ambient water clarity is low because of high sediment loads in stream discharge and continuous resuspension of bottom sediment by vessels transiting the entrance channel. Any change in foraging opportunity related to turbidity increases during dredging would be temporary and within the range of normal variability in foraging. Sea turtles are mobile and can forage in more suitable habitats if turbidity presents an obstacle in Hilo Harbor. For these reasons, the proposed action would not have a significant effect on sea turtle access to forage or on overall nutritional condition.

Ship Strikes and Entrainment. During informal consultation, NOAA Fisheries raised concern about the potential entrainment of sea turtles by the dredge, based on the following factors:

- Hopper dredges are known to entrain sea turtles during East Coast dredging operations;
- Sea turtles could be in the project area;
- Sea turtles on the sea floor would not be visible to observers or *Essayons* crew, and could be at risk of entrainment; and
- Potential for a sea turtle take could not be entirely eliminated by BMPs.

These factors reduce the probability of a sea turtle take:

- Sea turtles would be unlikely to be in the immediate project area because habitat is unsuitable;
- Sea turtles swimming at the surface or in mid-water near the *Essayons* would not be at risk of entrainment;
- Noise produced by the dredge could cause sea turtles in the area to swim away;
- BMPs incorporated into the proposed action, including the attachment of tickle chains and turtle deflectors on the dragarm and draghead, respectively, and using pumps only when dragarms are on the seafloor, are highly effective at reducing the potential for sea turtle entrainment.

The *Essayons* has been in operation since 1983 and has not entrained sea turtles during any dredging operations in Hawaii or the Pacific Northwest (Holcroft 2014). Concern for entrainment arises based on experiences of dredge operators in the Southeast Region, where a much greater sea turtle population increases the risk of entrainment. Entrainment of sea turtles through the dragarm and into the hopper is most likely fatal and the USACE has an active research program working with all stakeholders to develop methods to reduce impacts to sea turtles during hopper dredging (Baird and Associates 2004). During Section 7 consultations with NOAA Fisheries, a suite of vessel retrofits and operational BMPs were developed to best address the specific marine environment and vessel design. Specifically, a hopper overflow screen (Figure 2-4) and tickler chains and a fixed position turtle deflector (Figure 2-5) were fabricated for this action. The overflow screen will allow observers to document and report any take of sea turtles to NOAA Fisheries as required as part of an ITP. Observers would monitor the influx of dredged material into the hopper to assess potential entrainment of sea turtles as described in Section 2.2.7. The observer would check for sea turtles, sea turtle parts, or any other notable item. Any sea turtle parts would be bagged, tagged, and stored in a freezer for subsequent transfer to NOAA Fisheries. Observers will monitor dredge material during every load. On completion of each load cycle, dragheads would be monitored as they are lifted from the sea surface and placed on the saddle to assure that sea turtles that may be trapped in the dragheads are not lost and un-accounted for. Observers will physically inspect dragheads for threatened and endangered species take. The USACE would report any sea turtle take as required by the ESA. The tickler chains will be attached to the leading edge of the dragarm and will drag along the seafloor in front of the draghead. Any sea turtle in the draghead's path will be brushed with the tickler chains, providing enough time to swim away from the draghead. If the tickler chains are determined to be ineffective, the *Essayons* will use dragheads with fixed position turtle deflectors, as is required in Atlantic and Gulf of Mexico hopper dredging. Despite the small possibility that a sea turtle would be entrained, the USACE has requested an ITP for green and hawksbill sea turtles to ensure that the proposed action can be implemented without delays or cost overruns caused by an unexpected take.

The threat of a ship strike would be greatest during transits to and from the Hilo ODMDS, especially as the *Essayons* left the harbor and entered the shallow, nearshore portion of the transit corridor. Competent observers would scan the harbor entrance and the transit area before the vessel left the harbor; the *Essayons* would transit to the ODMDS at speeds up to 10 knots. Sea turtles surface only briefly a couple of times per hour. After the *Essayons* passed the entrance channel, it would be difficult for the 350-foot vessel travelling at 10 knots to avoid a sea turtle that suddenly appeared in its path. Sea turtles face the same threat from the cargo vessels, fuel barges, cruise ships, and military vessels of similar size that regularly operate in the island's nearshore waters. As sea turtles occur predominantly below the water, only surfacing briefly, altering course in an attempt at avoidance during transit is believed to be counterproductive, and is not protocol for East Coast and Gulf of Mexico hopper dredges (D. Dickerson, pers. comm.).

The *Essayons* would make approximately 234 round trips to the Hilo ODMDS over 26 days, representing a measurable increase in vessel traffic. BMPs requiring trained observers onboard the *Essayons* would minimize the potential for vessel strikes (see Section 2.2.6). Based on sea turtle stranding data, 4 to 5 mortalities are attributed to ship strikes every year throughout the Hawaiian archipelago. As the green sea turtle population continues to increase in Hawaii to the point of being considered for delisting, the small potential for ship strikes is considered a minor impact. The *Essayons* could encounter the hawksbill sea turtle in the harbor and nearshore transit corridor. Hawksbills are most likely to occur in the hardbottom area at the edge of the dredge footprint, where the *Essayons* would be moving very slowly while dredging. Onboard observers would alert the vessel operator to any sea turtles detected in the vicinity so that avoidance measures could be taken. The minimal area of overlap with suitable hawksbill foraging habitat and the implementation of protective BMPs reduce the potential adverse impacts on the hawksbill to less than significant levels.

Direct impacts to sea turtles could result from entrainment or collision with the *Essayons*. The short duration of the project, the BMPs to minimize entrainment and ship strikes, and the baseline trend toward increasing in sea turtle abundance in the project area would reduce impacts to sea turtles from the proposed action to less than significant levels.

3.4 Birds

3.4.1 Affected Environment

Because the project area is almost entirely restricted to open water, birds are likely to be relatively uncommon and limited to species associated with nearshore habitats, ocean embayments, and the open sea. Only species acclimated or habituated to human disturbance, such as common species of seabirds, shorebirds, waders, and water birds, would tolerate the busy commercial conditions of Hilo Harbor and the activity of the *Essayons* and its support vessel. All native Hawaiian bird species are protected under the Migratory Bird Treaty Act (MBTA), which provides protection for active nests, eggs, and young.

Potential adverse effects on the five federally listed bird species that may occur in the project area were evaluated in the BA (Table 3-1; Tetra Tech 2015b). Brief descriptions of these species and effect determinations are summarized below. None of the ESA-listed birds has more than a limited potential to be exposed to the proposed action. No designated critical habitat for bird species exists within the project's ROI.

Table 3-1. ESA-Listed Birds in the Region of Influence

Common Name	Scientific Name	Listing Status
Hawaiian Coot	*Fulica americana alai*	Endangered
Hawaiian Dark-Rumped Petrel	*Pterodroma phaeopygia sandwichensis*	Endangered
Hawaiian Duck	*Anas wyvilliana*	Endangered
Hawaiian Stilt	*Himantopus mexicanus knudseni*	Endangered
Newell's Shearwater	*Puffinus newelli*	Threatened

Source: Tetra Tech 2015b

Hawaiian Coot. The Hawaiian coot occurs on and near water bodies on Hawaii Island, concentrated in four ponds, including Waiakea and Loko Waka Ponds in Hilo (Birding Hawaii 2003, USFWS 2005, and Hawaii Audubon Society 2014)..The Hawaiian coot has been reported to occur on virtually all types of water bodies, including estuaries, marshes, and golf course wetlands, but is most common on the coastal plain (USFWS 2005). Breeding sites are characterized by robust emergent plants interspersed with open, fresh, or brackish water, which is usually less than 3.2 feet (1 meter) deep. Its current range overlaps with Hilo Harbor, but the highly degraded commercial harbor provides habitat of limited suitability and is unlikely to be visited by the Hawaiian coot (Rounds 2014). The species has not been reported in the project area.

Hawaiian Dark-Rumped Petrel. The Hawaiian dark-rumped petrel breeds on Mauna Kea and Mauna Loa and the fledging season is from mid-September to mid-December (Ainley *et al.* 1997; Simons and Hodges 1998). It usually forages in mixed flocks, typically over schools of predatory fish (Mitchell *et al.* 2005), feeding almost exclusively at night along the water surface. Like other night-foraging seabirds, it is attracted to urban lighting and is susceptible to collisions with human structures (Reed *et al.* 1985). The current range of this petrel overlaps with Hilo Harbor, but the project area provides virtually no suitable habitat (Rounds 2014). Fledging season, when the young birds are most vulnerable, is between mid-September and mid-December (personal communication with USFWS, 13 August 2014), which does not overlap with the timing of this project. The Hawaiian dark-rumped petrel has not been reported in the project area, but some individuals could cross the area while moving between nesting and foraging grounds.

Hawaiian Duck. About 2,000 Hawaiian ducks are thought to remain, with 200 on Hawaii Island, although some may be mallard hybrids (USFWS 2005). The species inhabits wetlands, including coastal ponds, lakes, swamps, flooded grasslands, mountain streams, anthropogenic waterbodies, and occasionally boggy forests (Todd 1996). Its current range overlaps with Hilo Harbor, but the project area provides habitat of limited suitability (Rounds 2014). The Hawaiian duck does not typically co-occur with the mallard (Birding Hawaii 2003; Hawaii Audubon Society 2014). The Hawaiian duck is known to occur north of Hilo Harbor along the Hamakua Coast (Pyle and Pyle 2009).

Hawaiian Stilt. On Hawaii Island, the Hawaiian stilt is mostly restricted to the north and west coasts but also occurs north of Hilo (USFWS 2005). This species is limited to areas with shallow water and open cover (USFWS 2012). The current range overlaps with Hilo Harbor, but habitat in the project area if of limited suitability (Rounds 2014). The Hawaiian stilt has not been reported in the project area, although a population occurs in several ponded and wetland areas 5 miles north of the project area along the Hamakua Coast. No discrete population has been identified near Hilo Harbor despite the availability of fishponds and agricultural wetlands in the vicinity.

Newell's Shearwater. The Newell's shearwater nests principally in the mountains of Kauai (Kauai Endangered Seabird Recovery Project 2014) and forages hundreds of miles offshore (Mitchell *et al.* 2005). Its current range overlaps with the harbor, but the project area provides virtually no suitable habitat (Rounds 2014). The breeding season, when adults are foraging at sea and returning to their nest at night to care for the chick, occurs from April through early November, which is predominately outside the window of this action (personal communication with USFWS, 13 August 2014). The species has not been reported in the project area.

3.4.2 Environmental Consequences

3.4.2.1 No Action Alternative

Under the No Action Alternative, the *Essayons* would not dredge the project area in 2016 and/or 2018. However, to maintain vessel access and navigational safety, the USACE may dredge the area using other equipment in the future. During the interval before dredging, existing conditions would prevail. Birds would continue to travel through Hilo Harbor as they do now, and would not experience any measurable change in habitat value. The No Action Alternative would have no direct or indirect impact on birds.

3.4.2.2 Proposed Action

Direct effects of the proposed action on birds would be limited to disturbance or displacement from the area due to noise, vessel movement, and human activity. The project area does not provide suitable habitat for any ESA-listed species, and non-listed species would be expected to react to the *Essayons* as to any other large, slow-moving vessel. Seabirds are adept at detecting and avoiding vessels or using them as perches, neither of which constitutes an adverse impact to the birds. The listed seabird species are also unlikely to forage within the harbors or transit corridors during the period of the proposed action (February – April). The proposed action would not affect any nesting or roosting habitat. Observers onboard the *Essayons* would monitor the project area for all ESA-protected species (see Section 2.2.6), further minimizing the potential for adverse impact on these birds.

While minimal, artificial lighting on the *Essayons* associated with nocturnal work could affect ESA-listed and non-listed seabirds by attracting individuals to the vessel. Potential exposure of these species to the proposed action is low because (1) the *Essayons* would not be present during fledging periods of ESA-protected birds, (2) these species have not been reported in the project area, (3) the project area does not provide suitable habitat for these species, and (4) the *Essayons* would contribute a negligible amount of additional artificial lighting to the project area. The commercial harbor where dredging would occur is already artificially lit at night, rendering the effects of lighting associated with the proposed action negligible.

Effects on birds that forage at the Hilo ODMDS would be limited to temporary disturbance of prey species during disposal activities. Disturbance from the dredge and the sediment plume created by disposal could alter the distribution of prey in the immediate area. The sediment plume could temporarily increase water turbidity and reduce visibility for foraging seabirds. Conversely, injured or dead fish released with the dredged material could provide a feeding boon to seabirds, as is commonly observed when bycatch is released to the water surrounding a fishing vessel. Direct effects on birds at the Hilo ODMDS would be localized, short-term, and minor; effects could be adverse or beneficial, depending on the species of bird foraging at the ODMDS and the prey value associated with each disposal event. On balance, effects would not rise to the level of significance. The BA determined that the proposed action would have no effect on any ESA-listed bird species.

3.5 Marine Mammals

3.5.1 Affected Environment

All marine mammals are protected under the Marine Mammal Protection Act (MMPA), and several are also listed under the ESA, which provides extra protection. Potential adverse effects on federally endangered marine mammals that may occur in the project area (Table 3-2) were evaluated in the BA (Tetra Tech 2015b). Brief descriptions of these species and effect determinations are summarized below. The proposed action was determined not likely to adversely affect any ESA-listed marine mammal species.

Table 3-2. ESA-Listed Endangered Marine Mammals in the Region of Influence

Common Name	Scientific Name
Hawaiian monk seal	*Neomonachus schauinslandi*
Humpback whale	*Megaptera novaeangliae*
Sperm whale	*Physeter macrocephalus*
False killer whale, Main Hawaiian Islands Insular stock	*Pseudorca crassidens*
Blue whale	*Balaenoptera musculus*
Sei whale	*Balaenoptera borealis*
Fin whale	*Balaenoptera physalus*
North Pacific right whale	*Eubalaena japonica*

Source: Tetra Tech 2015b

Hawaiian Monk Seal. With an estimated population of approximately 1,200 individuals, the endemic Hawaiian monk seal is one of the rarest marine mammals in the world. Its overall population declines by approximately 4% a year (NOAA Fisheries 2012, 2014b), especially due to mortality of pups and juveniles (NOAA Fisheries 2007). The population on the main Hawaiian Islands, however, has been increasing in recent years (NOAA Fisheries 2012). Births have been documented on most of the major islands (Hawaii Wildlife Fund 2005, Gilmartin and Forcada 2009, NOAA Fisheries 2007, 2009). The minimum abundance estimate for the main Hawaiian Islands in 2010 was 153 seals (NOAA Fisheries 2012). Hawaiian monk seals haul out on sandy beaches and can occur year-round at any suitable shore. Mothers typically come onshore to give birth and rear their pups in early spring, although births may occur year-round.

Critical habitat for the Hawaiian monk seal is currently designated around the Northwest Hawaiian Islands (NOAA Fisheries 1988). On August 21, 2015, NOAA published a final rule to expand critical habitat for the Hawaiian monk seal to include nearly all coastlines of the main Hawaiian Islands, and marine waters to the 500-meter depth contour (80 Federal Register 50925). Commercial harbors, including the project area, are excluded from the proposed critical habitat, as is the Hilo ODMDS.

Most encounters with monk seals in the main Hawaiian Islands involve solitary individuals, though a mother and pup could also be encountered (NOAA Fisheries 2014c). The monk seal is expected to occur in all portions of the project area, including Hilo Harbor entrance, the transit corridor, and possibly, although unlikely, at the Hilo ODMDS. This seal appears to be intolerant of human presence; seals tend to frequent remote areas where human presence is limited (NOAA Fisheries 2010b, 2012). Potential close encounters are most likely in the harbor and the harbor entrance where confined space may make it more difficult for the seals and the *Essayons* to avoid each other.

The Hawaiian monk seal has a somewhat narrower hearing range and relatively low upper hearing limit compared with other pinnipeds. NOAA reports the hearing range for phocids as 75 to 100 kHz (NOAA Fisheries 2013a).

Humpback Whale. The humpback whale is the best-known of all rorqual whales (whales with longitudinal throat folds). The humpback whale is listed as endangered throughout its range, although the North Pacific population, which includes humpbacks that winter in Hawaii, is currently under review for delisting (NOAA Fisheries 2014d, 2014c). No critical habitat is designated for this species. Approximately two-thirds of the North Pacific humpback whale population migrates to Hawaii in winter to breed, calve, and nurse (NOAA Fisheries 2003). The population of humpback whales that winters in Hawaii is likely more than 10,000 animals (NOAA Fisheries 2014d).

Humpback whales occur throughout the Hawaiian Islands from September through June (Clark and Tyack 1998), with the areas of highest concentration southwest of Molokai in the waters known as Penguin Bank and in the four-island area between Molokai, Maui, Kahoolawe, and Lanai (NOAA Hawaiian Islands Humpback Whale National Marine Sanctuary 2000). Peak abundance is between late February and early April (Mobley *et al.* 2000; Carretta *et al.* 2010).

Humpback whales seem to prefer shallow waters during the breeding season (Baker and Herman 1981; Mobley *et al.* 1999, 2001; Mobley 2005), especially females with calves (Smultea 1994). Calves surface to breathe more frequently than their mothers, especially during rest and slow travel (Cartwright and Sullivan 2009), leaving them alone at the surface and more vulnerable to boat strikes (Würsig *et al.* 1984; Dolphin 1987; Guzman *et al.* 2012; Stack *et al.* 2013). Increasing vessel speeds increases the likelihood of vessel strikes to whales. Injuries to whales occur rarely at speeds below 10 knots (Laist *et al.* 2001). Larger vessels traveling at 14 knots or faster cause the most severe and lethal injuries (Laist *et al.* 2001). Throughout the waters of the Pacific coast, one humpback whale is killed approximately every other year by a ship strike (Barlow 1997).

Data on hearing sensitivity of humpback whales is lacking, but studies show they most likely have excellent low frequency hearing. Humpback whales are reported to produce frequencies between 25 Hz to 10 kHz and may have sensitivity to frequencies between 40 Hz to 16 kHz (Au *et al.* 2000). It is often assumed that mammals can hear in the ranges of sounds they produce. Numerous papers have documented the response of humpback whales to noise. Results are variable and depend on many factors including sound source, group size, group composition, behavior of the whales at the time of exposure, and ambient conditions (Herman *et al.* 1980, Watkins 1981, Krieger and Wing 1986, Glockner-Ferrari and Ferrari 1985, 1990). Humpback whales may change their behavior in response to noise, or avoid or leave an area (Jurasz and Jurasz 1979, Dean *et al.* 1985, Glockner-Ferrari and Ferrari 1985, 1990; Salden 1988). Humpback whales may become habituated to vessel noise (Watkins 1986). The humpback whale is expected to occur in all portions of the project area.

Sperm Whale. The sperm whale is the largest toothed whale species and is listed as endangered throughout its range. It is widely distributed throughout the Hawaiian Islands year-round (Rice 1960, Shallenberger 1981, Lee 1993, Mobley *et al.* 2000). The Hawaiian stock of sperm whales numbered about 6,919 in 2006 (coefficient of variation = 0.81) (Barlow 2006). Data are insufficient to determine population trends (NOAA Fisheries 2013b). No critical habitat has been designated for this species.

The sperm whale is uncommon in waters less than 984 feet (300 meters) deep (NOAA Fisheries 2013b). Although its range overlaps the project area, it is not expected to enter the relatively shallow waters of the harbor. It may occur in the transit corridor or in deeper waters near the Hilo ODMDS. The *Essayons* could encounter a solitary individual or a group.

The sperm whale is a highly social animal and often occurs in groups of 20 to 40 individuals (Rice 1989). The sperm whale can dive to more than 6,500 feet and remain submerged for more than 60 minutes (Watkins *et al.* 2002). A male sperm whale spends up to 80% of daylight hours underwater (Jaquet *et al.* 2000). In contrast, a female spends one to five hours at the surface daily without foraging (Amano and Yoshioka 2003). Their average swimming speed is about 1.5 miles per hour. Sperm whales spend extended periods of time "rafting" at the surface to restore oxygen levels in their tissues after deep dives (Jaquet and Whitehead 1996; Watkins *et al.* 1999). When at or near the water surface, sperm whales are susceptible to injury by ship strikes (Douglas *et al.* 2008, Jensen and Silber 2004).

The anatomy of the sperm whale's inner and middle ear indicates it is sensitive to high-frequency to ultrasonic-frequency sounds. It may also have better low-frequency hearing than other toothed whales, although not as low as many baleen whales (Ketten 1992). More recently, NOAA has listed the hearing range for the sperm whale as potentially a mid-frequency hearing cetacean from 150 Hz to 160 kHz (NOAA Fisheries 2013a).

False Killer Whale. The false killer whale is an active, fast-moving delphinid. The false killer whale ranges widely, but only the Main Hawaiian Islands Insular population is listed as endangered under the ESA. Satellite-tracked individuals around the Hawaiian Islands indicate that individual false killer whales can make extensive movements among different islands and also sometimes move from island coast to as far as 96 km offshore (Baird *et al.* 2008). Animals seen within 40 km of the main Hawaiian Islands between Hawaii Island and Oahu are considered to belong to the main Hawaiian Islands Insular stock, with a population estimate of 151 individuals (NOAA Fisheries 2013c). Critical habitat has not been designated for this species.

The false killer whale prefers deeper waters (at least 3,300 feet [1,000 meters]), but it has been tagged and tracked in near shore Hawaiian waters, including outside of harbors (Baird 2014). It is an active fast-moving dolphin that occasionally rides bow waves of vessels (Baird 2009a). The false killer whale is extremely social. Group sizes of 10 to 60 are most commonly observed, although larger groups with up to 300 individuals have been reported (Baird 2009b, Brown *et al.* 1966). It is unlikely to enter the harbor, but could be encountered in the transit corridor or at the Hilo ODMDS. Encounters would likely be with multiple animals because solitary members of this species are uncommon.

The dominant frequencies of false killer whale whistles are 4 to 9.5 kHz; those of their clicks are 25 to 30 kHz and 95 to 130 kHz (Thomas *et al.* 1990; Thomson and Richardson 1995). The source level is 220 to 228 dB re 1 μPa-1 meter (Ketten 1998). The range of best hearing sensitivity measured for a false killer whale occurs around 16 to 64 kHz (Thomas *et al.* 1988, 1990). NOAA Fisheries (2013a) includes this species, along with all dolphins and toothed whales, as potentially a mid-frequency hearing cetacean from 150 Hz to 160 kHz.

Blue Whale. Blue whale abundance worldwide has slowly been rising over the past few decades, and the global population is currently estimated at 8,000 to 9,000 (Jefferson *et al.* 2008). Data are insufficient to estimate the size of the Hawaiian stock. The blue whale is primarily pelagic, but sometimes ventures near the coast and over the continental shelf. Only four documented sightings of the blue whale in the Hawaiian Islands occurred between 1994 and 2009 (NOAA Fisheries 2011). Before this, there was one recorded sighting 400 km northeast of Hawaii in January 1964 (NOAA Fisheries 1998). Blue whales spend more than 94% of their time below the water's surface, so sightings are rare. Blue whales are known to occur within several kilometers of Oahu during summer and winter from their recorded calls (Northrop *et al.* 1971, Thompson and Friedl 1982, McDonald and Fox 1999, NOAA Fisheries 1998). The *Essayons* would not be expected to encounter a blue whale in the project area.

Fin Whale. The fin whale occurs in all major oceans in both the Northern and Southern hemispheres, but is seldom seen in tropical waters (Reeves *et al.* 2002). It typically migrates to lower latitudes every other year, though the location of breeding and calving grounds remains unknown. The fin whale is most typically seen in pelagic regions (Jefferson *et al.* 2008). The fin whale has few specific habitat requirements but follows prey where it occurs, typically off the continental shelf (Azzellino *et al.* 2008). The fin whale is considered rare in Hawaiian waters (Carretta *et al.* 2010, Shallenberger 1981). Five sightings were made in offshore waters during a 2002 survey of waters in the Hawaiian Exclusive Economic Zone, and a single sighting was made during aerial surveys from 1993 to 1998 (Barlow *et al.* 2006, Carretta *et al.* 2010, Mobley *et al.* 2000, Mobley *et al.* 1996). Based on sighting data and acoustic recordings, fin whales primarily occur in Hawaiian waters in fall and winter (Barlow *et al.* 2006, Barlow *et al.* 2008, Barlow *et al.* 2004, Thompson and Friedl 1982, Northrop *et al.* 1971, McDonald and Fox 1999), most likely seaward of the 100-meter isobath. The *Essayons* could encounter solitary or small groups of fin whales in the transit corridor or at the Hilo ODMDS.

The fin whale is one of the fastest cetaceans, capable of attaining speeds of 25 miles (37 km) per hour (Jefferson *et al.* 2008, Marini *et al.* 1996). Despite its speed, the fin whale is the most commonly struck of the larger baleen whales, suffering injury and mortality from ship strikes throughout its range (Laist *et al.* 2001, Jensen and Silber 2004, Douglas *et al.* 2008).

NOAA recently extended slightly the estimated upper end of the hearing range for low-frequency hearing cetaceans including the fin whale from 22 to 30 kHz (NOAA Fisheries 2013a).

Sei Whale. The sei whale occurs in deep oceanic waters of the temperate zones. It appears to prefer regions of steep bathymetric relief, such as the continental shelf break, canyons, or basins situated between banks and ledges (Horwood 2009). The best population estimate for the Hawaiian stock is 77 individuals (coefficient of variation = 1.06); however, this summer/fall estimate may be an underestimate, as most individuals are expected to be feeding at higher latitudes that time of year (Carretta *et al.* 2010). No sei whales were sighted during aerial surveys done within 25 nm (46 km) of the main Hawaiian Islands from 1993 to 1998 (Mobley *et al.* 2000). Secondary occurrence is expected in deep waters on the north side of the islands only. This pattern was based on sightings made during the NOAA Fisheries –Southwest Fisheries Science Center shipboard survey assessment of Hawaiian cetaceans (Barlow *et al.* 2004). In 2007, there were two sei whale sightings north of Oahu during a short survey in November, including one sighting of three subadults (Smultea *et al.* 2010). Sei whales could occur in the transit corridor and near the Hilo ODMDS. The *Essayons* could encounter a solitary individual or a small group of adults or juveniles. Like all baleen whales, the sei whale feeds at the surface and is vulnerable to ship strikes.

Sei whale vocalizations have been recorded on only a few occasions. NOAA recently extended slightly the estimated upper end of the hearing range for low-frequency hearing cetaceans including the sei whale from 22 to 30 kHz (NOAA Fisheries 2013a).

North Pacific Right Whale. The eastern North Pacific population of North Pacific right whale numbers only in the tens of animals (Shelden and Clapham 2006). Not much is known of the behavior of this species, a result largely of its rarity. It feeds at the surface and throughout the water column, moving at slow speeds through patches of zooplankton with an open mouth for long periods (4 to 6 minutes) (Gregr and Coyle 2009). Two sightings of the North Pacific right whale have been documented from the Hawaiian Islands. One occurred in 1979 (Herman *et al.* 1980, Rowntree *et al.* 1980) and the second was off the coast of Maui in April 1996 (Salden and Mickelsen 1999). The rarity of these sightings suggests that these were chance occurrences and are not typical of right whale distribution in the Pacific (Salden and Mickelsen 1999). Critical habitat for this species has not been designated in Hawaii. Due to the North Pacific right whale’s rarity, it is unlikely the *Essayons* would encounter one in the project area.

Noise. Noise from the *Essayons* is described in Section 2.2.3. Underwater noise can affect marine mammals by causing temporary threshold shifts (TTS) or permanent threshold shifts (PTS). TTS is a temporary reduction in hearing sensitivity caused by exposure to intense sound, as a function of duration and intensity of the sound. At very high decibel levels or after prolonged exposure to noise, permanent hearing damage or PTS may occur.

Noise can affect marine mammal behavior, cause physiological shifts (TTS or PTS), or mask sounds important to the animal such as conspecific calls. Masking can render certain frequency bandwidths inaudible and make it impossible for the animal to detect low intensity sounds.

Hydraulic dredges can produce underwater noise that is continuous and of high enough intensity to affect marine life adversely in some scenarios. Effects on marine mammals exposed to continuous sounds vary with the frequency, intensity and duration of the sound source, and the hearing characteristics of the exposed animal. The effects of underwater noise on marine mammals varies among species, depending on the hearing thresholds, reproductive or age class, ambient conditions, and other factors.

Impacts on marine mammals are defined under the MMPA such that a take by harassment might occur either by Level A or Level B harassment. Harassment is defined as "any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment) or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption to behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment)." These categories carry over for acoustic impacts and their related thresholds.

The NOAA Fisheries standard for acoustic impacts relies on generic sound exposure thresholds to determine when noise could result in effects that constitute a take by harassment. NOAA Fisheries is in the process of developing new science-based thresholds to improve and replace the current generic exposure thresholds (Southall *et al.* 2007, Ellison *et al.* 2012, NOAA Fisheries 2013a). The current acoustic threshold for Level B harassment (behavioral take for TTS for non-impulse continuous noise (*e.g.*, ship noise and most dredging) is 120 dB re 1 µPa-1m rms. For Level A harassment (PTS), it is 180 dB re 1 µPa-1m rms for cetaceans (whales, dolphins, and porpoises) and 190 dB re 1 µPa-1m rms for pinnipeds (seals and sea lions).

Baseline or ambient noise levels in harbor areas are the sum of sounds associated with recreational and commercial vessels, other anthropogenic noises such as vehicular traffic and construction, biological resources in the area such as snapping shrimp and humpback song, and natural environmental sounds from waves, tidal action, currents, and wind (Richardson *et al.* 1995). No baseline noise levels for Hilo Harbor are available. Baseline noise levels measured in other harbors are 95 to 120 dB re 1µPa-1m rms (USACE 2013).

Based on the known acoustic signature of TSHDs such as the *Essayons*, the acoustically-affected area is generally considered to have a radius of 1.5 km (0.93 mile) around the vessel. A TSHD pressure waveform produces a relatively continuous, uniform sound (see Figure 2-1) that is expected to be audible to marine mammals in the project area. Most of the sound energy produced from the TSHD fell within the 70 to 1,000 Hz range. Peak pressure levels were in the 120 to 140 dB rms range.

3.5.2 Environmental Consequences

3.5.2.1 No Action Alternative

Under the No Action Alternative, the *Essayons* would not dredge the project area in 2016 and/or 2018. However, to maintain vessel access and navigational safety, the USACE may dredge the area using other equipment in the future. During the interval before dredging, existing conditions would prevail. Marine mammals would continue to use Hilo Harbor as they do now, and would not experience any measurable change in habitat value. Acoustic stressors would neither increase nor decrease under the No Action Alternative. The No Action Alternative would have no effects on marine mammals.

3.5.2.2 Proposed Action

Potential impacts of benthic disturbance, turbidity and water quality, and ship strikes on marine mammals are evaluated below, focused on the two species most likely to occur in the project area: the Hawaiian monk seal and the humpback whale. No direct effects on marine mammals are anticipated in Hilo Harbor due to the limited occurrence of these species in the harbor, the operational characteristics of the *Essayons*, and the extensive BMPs implemented to minimize adverse impacts on marine mammals.

Benthic Disturbance. The Hawaiian monk seal feeds on benthic invertebrates in Hawaii, but is not expected to forage in the muddy and relatively shallow waters of the harbor and entrance channel. More productive foraging habitat is abundant nearby, making it highly unlikely that a Hawaiian monk seal would choose the harbor as a foraging ground. If Hawaiian monk seals were to enter the harbor area, observers on the *Essayons* would alert the vessel operator so that the animal could be avoided (see BMPs in Section 2.2.6). The humpback whale does not forage in Hawaii and is not expected to enter the harbor project area.

The slight deepening of the harbors and entrance channels that would result from dredging and the slight seafloor alteration due to depositing material at the ODMDS would not make these areas more or less attractive to marine mammals and would have no appreciable effect on foraging of any species of marine mammal. For these reasons, benthic disturbance would have a negligible, direct, temporary effect on marine mammals. The effect would not be significant.

Turbidity and Water Quality. The only effect on water quality would be a localized temporary increase in turbidity. Harbors are generally not well suited for marine mammals because of degraded habitat, high levels of vessel traffic, and other human activity.

Turbidity near the entrance channel and at the ODMDS could indirectly increase the risk of ship strikes by reducing the animal's ability to see the *Essayons* (or other vessel). Increased turbidity would be localized and temporary, as sediments would settle and water quality would return to its pre-dredging state after dredging was completed. The *Essayons* is restricted by law from approaching within 91 meters (100 yards) of a humpback whale and 45 meters (50 yards) of other marine mammals. These marine mammals would not be likely to approach the vessel, especially in areas of increased turbidity. Therefore, increased turbidity would have a negligible, direct, temporary effect on marine mammals that would be less than significant effect.

Ship Strikes. The greatest potential of the proposed action to cause an adverse effect on a marine mammal would be a vessel strike, although even that potential would be extremely low. The *Essayons* could strike a marine mammal in any location of the project area, but the likelihood would be less in the harbor. The probability of a vessel strike is a function of multiple factors including vessel speed, the density of marine mammals in the area, visibility, and species-specific behaviors that put the animal in contact range. The likelihood of a strike would be influenced by the type of operation the *Essayons* would be conducting (dredging, transiting to the ODMDS, or disposing dredged materials) because of the differences in vessel speed and occurrence of species in each location.

While dredging in Hilo Harbor, the only marine mammal the *Essayons* would be expected to encounter is the Hawaiian monk seal. Observers onboard the dredge would be required to notify the operator if a monk seal or any other marine mammal was observed, but the small size and agility of the seal could make it relatively difficult to detect. Other vessel operators are also required to report the presence of marine mammals in the harbor so that the harbor master can relay the information to all vessels. The *Essayons* would be alert to such incoming news from the harbor master. Once a marine mammal were reported in the harbor, the *Essayons* would implement other BMPs to reduce the likelihood of vessel strike (see Section 2.2.6). The Hawaiian monk seal is highly mobile and agile and could easily avoid a collision with the *Essayons*, which travels at slow speeds while dredging. For these reasons, the effect of ship strikes on marine mammals in the harbor project area would be less than significant.

As the *Essayons* left the harbor and transited to the Hilo ODMDS, the probability of contact with larger marine mammals would increase because these animals would be more likely to be encountered in open waters and the vessel would be moving faster than in the harbor. Conversely, the likelihood of the *Essayons* striking a Hawaiian monk seal would decrease because the seal could easily evade the vessel (NOAA Fisheries 2008). The *Essayons* would make approximately 234 round trips to the Hilo ODMDS over 26 days, representing a measurable increase in vessel traffic.

The *Essayons* would travel at 10 knots during transit to and from the ODMDS and between harbors. This speed has been designated in other areas (78 FR 73726) to increase the distance that a whale is first sighted and evasive actions can be executed (Gende et al. 2011) and reduce the potential that a ship strike would be lethal (Laist et al. 2001). This speed is within the range found to be relatively protective of marine mammals in reducing the likelihood of ship strikes, and in particular the potential mortality from a ship strike. Additional BMPs are incorporated into the proposed action to minimize the potential for vessel strikes (see Section 2.2.6).

Direct adverse effects of the proposed action on marine mammals could result from ship strikes; however, the implementation of numerous BMPs and the low densities of most marine mammals in the project area minimize the potential for adverse effects, so effects would be less than significant.

***Noise*.** The animals most likely to be affected by any project generated noise would be humpback whales and Hawaiian monk seals because of their potential proximity to the noise from dredging. The noise source most likely to reach marine mammals beyond the avoidance area imposed by the BMPs is noise from dredging excavation. Other noises produced by the *Essayons* are considered to fall within the range of normal variability of ambient noise conditions, to be transient, or to attenuate so rapidly with distance as to be negligible.

Marine mammals may react to vessel-generated sounds in a variety of ways. Reactions can vary by species, by sound source, by number of sound sources in the same area, and/or based on the activity the animals are engaged in (*e.g.*, feeding, mating, travelling) at the time. Dredging noise is at the lower end of the scale regarding emitted SPLs in aquatic environments and the output falls primarily within the lower frequency ranges that would be audible to mysticetes such as humpbacks, but not to toothed whales. Some higher frequency sounds are emitted by the transport of sand and gravel through a suction pipeline. These sounds would be expected to attenuate quickly, thereby limiting adverse effects. Southall *et al.* (2007) and Popper *et al.* (2006) suggest that underwater sound from dredging would be unlikely to cause injury to marine mammals (Level A harassment). If an animal was close to the dredge, and in the vicinity for a long time, temporary loss of normal hearing capabilities might happen. No permanent hearing loss would be expected. Reactions to vessel noise in pinnipeds are typically avoidance behaviors, such as swimming away from the path of the vessel, or hauling out on land. Vessel noise can also affect vocalization patterns of seals. Close approaches of a vessel were found to cause a dramatic decrease in vocalization rates and masking of harp seal sounds, possibly reflecting behavioral responses and movements away from the area of the vessel (Terhune *et al.* 1979). The monk seal would not be likely to overlap spatially or temporally with dredging, so any disturbance to an individual of this species from excavation dredge noise would be minimal.

Based on the peak sound production for TSHD of 140 dB at 40 meters, peak source level is estimated at 164 dB and the zone of audibility (to 120 dB) is approximately 850 meters from the source. As such, during active dredging, the entire harbor would experience a noise level above the threshold for Level B harassment, but would not reach the threshold of Level A harassment. Noise from dredging would not be likely to cause TTS or PTS in marine mammals as the BMPs (see Section 2.2.6) would prevent this from occurring. Transit noise would represent a small increase in noise from ship traffic. Noise from excavation would be expected to have a less than significant effect on the physiology of an individual humpback whale or monk seal. The sound from dredging would not be substantial enough to cause an acoustic disturbance to protected species in nearshore waters.

Due to the absence of high value habitat in the project footprint for monk seals and humpback whales, and thus the low likelihood of these species being in the harbor, and with the BMPs that would be implemented, noise could have a minor, direct, temporary effect on marine mammals, although this would be less than significant given their expected absence within the harbor.

3.6 Water Quality

3.6.1 Affected Environment

Water quality in the harbor project area is determined by marine conditions in Hilo Bay, and to a lesser degree in Puhi Bay, and influenced by freshwater input into the bay from the Wailoa River, Wailuku River, Pukihae Stream, Pohakaunanaka Stream, and Maili Stream. Due to the distance between Hilo Harbor and the mouths of these streams, they are not considered within the ROI.

Hilo and Puhi Bays are Class A water bodies, which are protected for recreational purposes and aesthetic enjoyment. Uses are permitted as long as they are compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. Class A waters must not receive discharge waters that have not received the best degree of treatment compatible with the criteria established for Class A.

In accordance with Section 303(d) of the federal Clean Water Act, water bodies that do not meet standards for the six conventional pollutants have been listed as impaired. The conventional pollutants include total suspended solids, nitrates, total nitrogen, total phosphorous, turbidity, and *Enterococcus* bacteria. Hilo and Puhi Bays are currently listed by the State of Hawaii Department of Health (DOH) as water bodies in which water quality is impaired for some of these pollutants. Total Maximum Daily Loads (TMDLs) are needed for both bays. Hilo Bay and Harbor, in which the proposed dredging would occur, is not in attainment for nitrates, total nitrogen, total phosphorous, and turbidity, and is ranked as a low priority for a TMDL (USEPA 2014, Hawaii DOH 2014).

Pollution in the Hilo Bay watershed originates at inland point and non-point sources and marine sources. Pollutants may enter the harbor directly from natural weather patterns that cause high turbidity or from anthropogenic sources such as shipping or recreational activities. Marine vessels such as cruise liners, tugboats, and cargo ships may introduce pollutants incrementally over time or during spills. Weather and resulting tide action can increase turbidity in the harbor, as can dredging, shipping, or other commercial or recreational activities.

Pollution may also enter the harbor during rainfall events, when runoff passes through residential and commercial lands, picking up household and industrial wastes and moving them into the harbor. Drainage into the bay passes through the urban centers of Hilo and through the industrial and commercial sectors of the Hilo Harbor. These are in addition to typical stormwater runoff from roads and other impervious surfaces (parking lots, outdoor storage facilities, etc.) which can contain oils, greases, other petroleum products, heavy metals, etc.

3.6.2 Environmental Consequences

3.6.2.1 No Action Alternative

Under the No Action Alternative, water quality in Hilo Harbor would remain in its current state of impairment due to turbidity and other constituents, pending remedial actions. The conditions causing impairments are independent of the proposed action; therefore, implementing the No Action Alternative would have no impact on water quality.

3.6.2.2 Proposed Action

Existing Uses. Existing uses of Hilo Bay, as defined in the Hawaii Administrative Rules, Section 11-54, including propagation of fish, shellfish, and wildlife; recreation; and aesthetic values, would not be compromised. Uses of Hilo Harbor include navigation, commerce, recreational fishing, and launching of pleasure craft. Very minor impairments of these uses could occur due to the presence of the *Essayons*, but boats would be able to navigate around the *Essayons* and fishermen would be able to move to slightly different location to avoid the dredging operations. Very minor impairment of propagation of fish, shellfish, and wildlife may occur for up to one week, but dredging operations would be timed to avoid breeding periods for coral.

Turbidity and Total Suspended Sediments. Turbidity and total suspended solids concentrations both indicate the amount of solids suspended in water; however, total suspended solids are the actual quantity of material per volume of water while turbidity is a measure of the amount of light scattered off of these particles. Temporary increases in turbidity, total suspended solids, minor increases in pollutants, and decreases in dissolved oxygen could occur during dredging. Suspended sediments cause an increase in light attenuation, resulting in less available lighting for marine mammals, sea turtles, benthic resources, or other ocean resources, and a decrease in primary productivity. Based on previous dredging projects by the *Essayons* in Hawaiian harbors, turbidity levels would be expected to recede to background levels in 2 to 3 hours, depending on tidal influence and currents (Conner *et al.* undated). Turbidity levels would be monitored in accordance with the USACE’s Water Quality Monitoring Plan, and BMPs listed in Section 2.2.6 would help to keep turbidity levels to a minimum.

Suspended sediments flocculating from the water column could leave a coating of fine sediment on corals, temporarily impeding their ability to feed; and on sea grass, temporarily impeding its ability to conduct photosynthesis. This effect is similar to the effects of propeller wash from large ships, or temporary re-suspension of fine sediments when waters are disturbed during storms or strong tides. This coating of corals and sea grass would be temporary and should be removed by the actions of tides and currents before causing any damaging effects.

The *Essayons* would stop dredging when the hopper reached its economic load, which would allow for overflow of entrained water back into the harbor. To limit excess turbidity, the *Essayons* will monitor turbidity and will alter the operations in accordance with the Water Quality Monitoring Plan. Upon implementation of these measures, combined with other BMPs, effects from turbidity and total suspended sediments would be temporary and less than significant.

Dissolved Oxygen. Dissolved oxygen levels could decline near dredging as suspended anoxic sediments created high biochemical oxygen demand. Based on monitoring done by the *Essayons* during other dredging operations, temporary decreases in dissolved oxygen generally last less than half an hour, and are localized to the immediate area around the points of discharge. In accordance with the Water Quality Monitoring Plan, dissolved oxygen would be monitored at regular intervals by the *Essayons* during dredging operations. Effects of project actions on dissolved oxygen would be less than significant.

Sediment Quality. Sediment samples from the four DMMUs were analyzed for chemical contaminants and their potential toxicological effects on marine organisms prior to dredging and all DMMUs met ocean disposal criteria. The proposed action would have no effect on sediment quality.

BMPs would be in place throughout the course of the project to minimize water quality impacts. In accordance with the project-specific Water Quality Monitoring Plan (USACE 2015), turbidity and dissolved oxygen would be measured and visually assessed to ensure they remain within allowable levels. If turbidity or dissolved oxygen levels became unacceptable, the *Essayons* would implement the needed corrective actions until the affected parameter returns to acceptable levels. Corrective actions include:

a. Employ anti-turbidity valves within the hopper to slow the entrainment of air and increase laminar flow, minimizing mixing and increasing the settling rate of the sediment, allowing for the return of cleaner overflow water.

b. Adjust pump speed to slow the flow rate of the water-dredged material slurry into the hopper, providing more time for the sediment to fall out of suspension, allowing for the return of cleaner overflow water.

c. Reduce the total overflow time to less than the economic load in areas of fine silt and clay sediments, where corrective actions a and b prove less effective.

d. Reposition the *Essayons* to a new area within the harbor to allow for turbidity to naturally dissipate through current action and settlement of fine particles.

Where reposition is not an option, the *Essayons* will stop dredging and transit to the ODMDS, allowing for natural dissipation of turbidity.

3.7 Cultural and Historic Resources

Cultural resources can be prehistoric, Native Hawaiian, or historic. Prehistoric resources are physical properties resulting from human activities that predate written records and are generally identified as isolated finds or sites. Native Hawaiian resources consist of properties of traditional religious and cultural importance to a Native Hawaiian group. These include traditional cultural places or properties; prehistoric and historical (pre- and post-European contact) archaeological sites, which may include heiau (places of worship) and burial sites, traditional dwelling sites and other gathering places, and work sites and other special-use sites; and plants and animals used for subsistence and other cultural purposes. Historic resources consist of properties, structures, or built items resulting from human activities that post-date written records. Architectural resources are potentially historic if they are more than 50 years old.

3.7.1 Affected Environment

Hilo was one of the first settlements on Hawaii, established between 300 and 600 AD. Between 1845 and 1865, traditional land use patterns and residences transformed under the influence of the whaling industry, sugar cane industry, missionaries, and visits of foreign vessels in Hilo Harbor (Kelly *et al.* 1981). Construction of the Hilo Harbor began in 1908. Three piers and the breakwater around the harbor were constructed and dredging completed by 1929 (Hawaii Department of Transportation [DOT] 2001).

The Area of Potential Effect (APE) for cultural resources for this project is the harbor footprint (Figure 3-1). The APE was delineated as such because project activities are limited to the harbor waters.

Figure 3-1. Area of Potential Effect for Cultural Resources

The proposed action would not change the configuration or location of the authorized navigation channel or affect any land-based cultural or historic resources. The project area excludes berthing and mooring areas in the harbors that are maintained by the HDOT – Harbors.

A search of the Hawaii State Historic Preservation Division (SHPD) records (online research and in person) was done on October 15, 2014 to identify any known cultural resources in or adjacent to the project area. The Hilo Breakwater (constructed in 1908 and 1929), which is eligible for listing in the National Register of Historic Places (NRHP), is an historic property along the northern boundary of the APE. A known heiau is at the shoreline near Baker's Beach, adjacent to the APE boundary. Historic structural remains (buildings and railroad bridge remnants) are offshore of the heiau and at other locations along the west shoreline of Reed's Bay, within the APE. Mokuola (Coconut) Island where Makaoku Heiau was known to have been located, is immediately west of the APE. The Kanokea Fishpond is located at the inland extent of Reeds Bay, within the APE. The Waihonu Fishpond is just outside the western boundary of the APE. There are a number of historic districts that extend into Hilo Bay to the west of the APE: the Hilo Commercial District, the Puueo District, and the Wainaku District (SHPD 2015). An underwater wreck site 300 feet offshore of Bakers Beach in 20 feet of water in Hilo Bay was determined not eligible for the NHRP in 2008 (Scientific Consultant Services 2008).

3.7.2 Environmental Consequences

Significant archaeological and historic properties are those districts, sites, structures, or objects listed in or eligible for listing in the NRHP while cultural resources are those places, practices, or beliefs important to native Hawaiians and other ethnic groups. The threshold for significant impacts to the archaeological, historic, and traditional cultural resources is any loss or destruction of the current or future integrity of the property or belief. In addition to historic significance, a property must have integrity to be eligible for the NRHP. Integrity is the property's ability to convey its demonstrated historical significance through location, design, setting, materials, workmanship, feeling, and association.

3.7.2.1 No Action Alternative

Under the No-Action Alternative, dredging would not occur, so there would be no potential to encounter submerged cultural resources and no impact to cultural resources.

3.7.2.2 Proposed Action

Based on the extensive disturbance of the harbor floor due to the original dredge, it would be highly unlikely that any intact submerged cultural deposits are in the project area. Under the proposed action, the proposed maintenance dredging would be limited to previously dredged areas, would not change the configuration or location of the authorized navigation channel, and would not occur near any land-based cultural or historic resources. Accumulated sediment at harbor dredge sites would not be likely to contain cultural or historic submerged artifacts as the sediment has been disturbed for routine maintenance as recently as 25 years ago. The project would not demolish or alter existing structures and would not change the surrounding view shed, so there would be no direct or indirect effects to the built environment. For these reasons, there would be no impacts to cultural resources. In a letter dated December 18, 2014, the SHPD concurred with the USACE's assessment that no historic properties would be affected by the proposed action (Appendix B).

3.8 Socioeconomic Resources and Environmental Justice

3.8.1 Affected Environment

***Census Tracts*.** Socioeconomic data presented includes population size and characteristics, housing, employment, income, and basis of economy for Hawaii County, the Hilo Census Designated Place (CDP), Wainaku CDP, and Paukaa CDP (Figure 3-2). Census Tracts and County Subdivisions in the area were comparable to these CDPs or were too large to capture meaningful community data. Data presented is taken from the U.S. Census Data website unless otherwise noted (U.S. Census Bureau 2014a, 2014b).

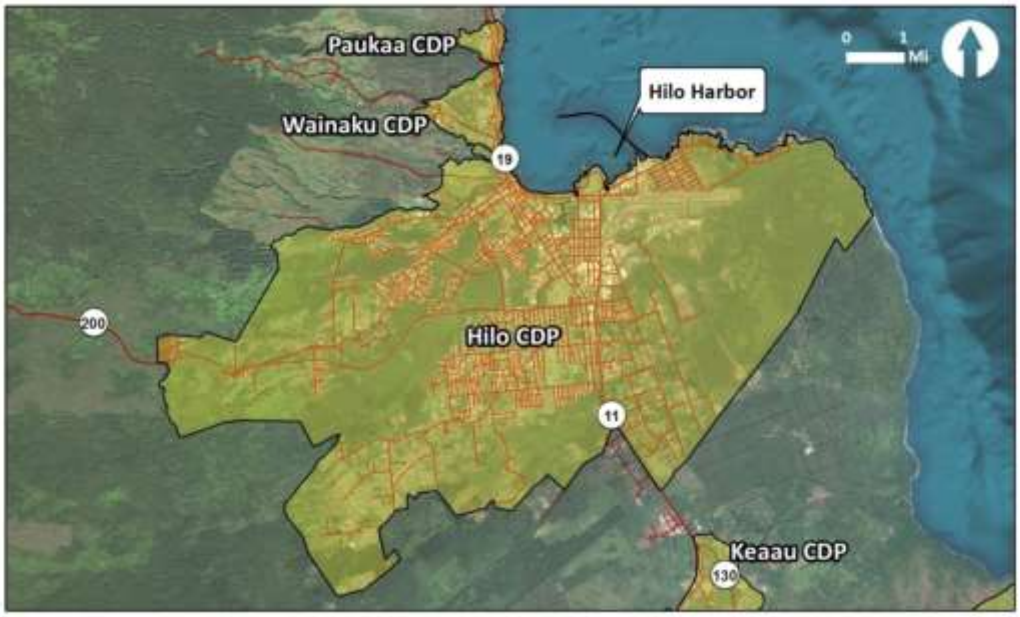

Figure 3-2. Census Designated Places near the Project Area

Demographics. The population of the CDPs surrounding Hilo Harbor is 44,912. Hawaii County experienced annual population growth of 2.2% between 2000 and 2010, a figure that slowed to 1.0% between 2010 and 2013 (Hawaii Department of Business, Economic Development and Tourism 2012). This rate of growth brought the resident population of Hawaii County from 149,244 in 2000 to 185,079 in 2010, and the county's population is expected to grow to 220,900 by 2020. Density in Hawaii County is approximately 46 persons per square mile; much lower than the density of the State of Hawaii, which is approximately 212 persons per square mile. The size of the island (the largest of the Hawaiian Islands) and the presence of several major volcanos, account for the lower density of Hilo County. The population density of Hilo, Wainaku, and Paukaa CDPs is much higher than the county (Table 3-3). Children under 19 and adults aged 50-64 are the most numerous age groups overall (U.S. Census Bureau 2014c).

Table 3-3. Population and Age Characteristics of the Region of Influence

Demographic	Hawaii County	Hilo CDP	Wainaku CDP	Paukaa CDP
Population	185,079	43,263	1,224	425
Male	92,821	21,131	633	199
Female	92,258	22,132	591	226
0-19	46,933	8,169	201	58
20-24	10,833	3,373	67	13
25-34	22,225	4,988	155	38
35-49	34,039	7,299	171	70
50-64	44,215	9,030	307	101
65+	26,834	7,807	249	145
Population Density [1]	45.9	810.3	931[2]	1,008[2]

Source: U.S. Census Bureau 2014c
CDP = Census Designated Place
[1] People per square mile
[2] City Data 2014

***Population and Housing*.** Hawaii County has a total of 67,096 occupied housing units, with an average household size of 2.7 people. Hilo CDP has 15,483 occupied housing units with an average household size of 2.7 people. Wainaku and Paukaa CDPs are much smaller areas, with fewer occupied households (409 and 190 respectively). The 2008 to 2012 homeownership rate in Hawaii County was 65.1% (U.S. Census Bureau 2014c).

***Employment and Income*.** The 2005-2012 American Communities Survey estimates that 61.9% of Hawaii County's population (employed citizens over the age of 16) is employed in the civilian labor force, while less than 0.1% are in the Armed Forces, and 8% were unemployed. However, recent data indicates that unemployment rates have dropped substantially from 2012 to the most recently reported rate of 5.9% in March of 2014 (State of Hawaii 2014). National unemployment rates were reported at 6.7% for the same time period (U.S. Bureau of Labor Statistics 2014). Table 3-4 shows that Hawaii County and each of the CDPs of interest had comparable incomes to the national median ($53,046) in 2010, except for a higher median household income for the Wainaku CDP (U.S. Census Bureau 2014c).

Table 3-4. Income Data for Region of Influence

Income Statistics	Hawaii County	Hilo CDP	Wainaku CDP	Paukaa CDP
Median household income	$52,098	$51,929	$63,021	$53,889
Mean household income	$66,722	$68,424	$88,920	$66,699
Median earnings for workers	$27,917	$28,654	$25,162	$30,000
Median earnings for full-time male workers	$41,437	$44,454	$40,000	$45,694
Median earnings for full-time female workers	$35,550	$40,114	$26,574	$38,125

Source: U.S. Census Bureau 2014b
CDP = Census Designated Place

Economy. In a 2007 economic census, the top three largest employers in Hawaii County included accommodation and food services (12,280 employees), retail trade companies (9,730), and health care and social assistance groups (7,285). The largest annual revenue was generated by retail trade ($2.56 billion), accommodation and food services ($874 million), and wholesale trade ($732 million). Tourism is the largest industry in Hawaii County, creating an industry workforce employed in hotels, restaurants, airlines, car rental companies, airport operations, security, retail stores, entertainment, and other traveler services (U.S. Census Bureau 2014b).

Hilo Harbor is one of three harbors on the island of Hawaii that work together to transfer consumable goods, durable goods, building materials, fuels, and visitors to and from the island. In 2008, cargo volume to the island of Hawaii reached 2.78 million tons and there were 1,674 vessel arrivals (Hawaii DOT 2011). Exports that pass through the harbor primarily include sugar cane and cattle. In addition, the harbor handles unique items such as scientific equipment for Mauna Kea Observatory and military equipment for the U.S. Army's largest training area in the state, Pohakuloa Training Area. In recent years, passenger cruises have become common at Hilo Harbor, contributing substantially to the tourism economy of the island with an average daily visitor estimate of 23,251 people (Hawaii DOT 2011). The combined value of all harbor industries output in 2009 was $337.9 million, and in 2005, harbor industries contributed to 2.1% of jobs and 2.5% of payroll. Economic growth of Hawaii Counties' harbors is projected to increase by 30.3% between 2009 and 2035 if necessary improvements are made to harbor facilities. Without improvements, that increase is only estimated at 17.8%, resulting in an annual lost growth of $42.3 billion dollars from 2009 to 2035.

Maintenance of the shipping lane depths supports the growing use of the harbor. In 2012, 637 commercial vessels (excluding fishing vessels) moved 1.97 million tons of freight through Hilo Harbor. In 2014, 112 cruise ships were scheduled to call at the port, bringing an estimated 235,527 passengers to the island of Hawaii (Hawaii DOT 2014).

Languages Spoken at Home. The residents in areas of interest primarily speak only English (Table 3-5). The second most commonly spoken languages are Asian or Pacific Islander languages. Fewer than 3% of Hawaii County residents speak Spanish or other languages (U.S. Census Bureau 2014b).

Table 3-5. Language Spoken at Home

Language	Hawaii County	Hilo CDP	Wainaku CDP	Paukaa CDP
English Only	80.6%	84.2%	75.4%	87%
Other than English	19.4%	15.8%	24.6%	13%
Spanish	3%	0.6%	0%	1.1%
Other Indo-European Languages	1.8%	1.4%	0.9%	2.3%
Asian and Pacific Islander Languages	14.4%	13.7%	23.7%	9.5%
Other Languages	0.1%	0.1%	0%	0%

Source: U.S. Census Bureau 2014b
CDP = Census Designated Place, % = percent

Race. Race and ethnicity demographics are largely driven by location; Hawaii is at a crossroads between North America, the South Pacific, and Asian countries. As a result, a large percentages of Asian and mixed race populations live in Hawaii County (Table 3-6). More than 30% of the population local to Hilo Harbor is Asian (U.S. Census Bureau 2014c).

As is typical in an environmental justice analysis in Hawaii, a comparison of the project area with the State of Hawaii figures is important. Hawaii County has a larger percentage of white population (33.7%) than the state as a whole (24.7%) while the Hilo CDP has a lower percentage (17.6%). Wainaku and Paukaa also have higher percentage of white population (25.1% and 40.9%, respectively) than the state (U.S. Census Bureau 2014c).

Table 3-6. Race and Ethnicity

Race	State of Hawaii	Hawaii County	Hilo CDP	Wainaku CDP	Paukaa CDP
White	335,994 (24.7%)	62,348 (33.7%)	7,617 (17.6%)	307 (25.1%)	174 (40.9%)
Black or African American	32,765 (1.6%)	1,020 (0.6%)	227 (0.5%)	3 (0.2%)	0
American Indian and Alaska Native	4.081 (0.3%)	869 (0.5%)	132 (0.3%)	2 (0.2%)	3 (0.7%)
Asian	525,076 (38.6%)	41,050 (22.2%)	14,833 (34.3%)	509 (41.6%)	139 (32.7%)
Native Hawaiian and Other Pacific Islander	136,030 (10.0%)	22,389 (12.1%)	6,132 (14.2%)	85 (6.9%)	26 (6.1%)
Some Other Race	n/a	2,868 (1.5%)	258 (0.6%)	2 (0.2%)	3 (0.7%)
Two or More Races	321,031 (23.6%)	54,535 (29.5%)	14,064 (32.5%)	316 (25.8%)	80 (18.8%)
Hispanic	121,067 (8.9%)	21,383 (11.6%)	4,501 (10.4%)	109 (8.9%)	27 (6.4%)

Source: U.S. Census Bureau 2014b
CDP = Census Designated Place, % = percent

People in Poverty. Poverty thresholds are determined by the U.S. Census Bureau following the Office of Management and Budget's Statistical Policy Directive 14. It is based on a family's total income compared to the family's need threshold, which is calculated based on family size and ages of the members. The percentage of the population of the Hilo CDP living below the poverty line is 16.9% (Table 3-7; U.S. Census Bureau 2014b).

Hawaii has the third highest homeless rate in the U.S., with an increase of 11% between 2010 and 2011. Of these homeless individuals, 42% are children. Hawaii's housing costs are the highest in the nation. Median rent is 50% more than the national rate, and 75% of low-income households spend more than half of their income on rent. Between 2008 and 2010, the need for benefits increased; including a 13% increase in families receiving Temporary Assistance for Needy Families, a 17% increase in the amount of time on assistance, a 22% increase in the number of people receiving state medical assistance, and a 62% increase in applications to federally qualified health centers. Two-thirds of single adult families with one or two children are below the self-sufficiency level, while 18.5% of two-adult families with two children also fall below that level (U.S. Census Bureau 2013).

Table 3-7. Percentage of Population Living Below the Poverty Level 2008-2012

Demographic	U.S. Total	Hawaii County	Hilo CDP	Wainaku CDP	Paukaa CDP
Overall population	15.0%	17%	16.9%	10.8%	7%
Population under 18 years	21.3%	24.9%	25.4%	16.8%	0%
White	12.7%	15.3%	21.4%	7.1%	4%
Black or African American	27.3%	19.7%	32.8%	0%	0%
American Indian and Alaska Native	27.0%	40.9%	31.4%	0%	0%
Asian	11.7%	7.7%	6.3%	8.2%	10.3%
Native Hawaiian and Other Pacific Islander	17.6%	30.3%	26.1%	34.6%	21.1%
Hispanic	25.6%	30.7%	39.1%	0%	0%
Male	13.6%	15.5%	13.8%	10.6%	4.9%
Female	16.3%	18.5%	19.7%	11%	9.5%
Worked full time, year round	2.9%	3.1%	3.3%	0.4%	0%
Worked less than full time, year round	16.6%	17.7%	21.9%	11.7%	10.3%
Did not work	33.1%	25.6%	21.4%	22.4%	12.3%

Source: U.S. Census Bureau 2014b
CDP = Census Designated Place, % = percent

Environmental Justice Communities. Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, directs federal agencies to take the appropriate and necessary steps to identify and address disproportionately high and adverse effects of Federal projects on the health or environment of minority and low-income populations to the greatest extent practicable and permitted by law. Communities afforded protection under Environmental Justice are those that have a substantial minority or low income population. The CEQ identifies minority groups as Asian, American Indian or Alaskan Native, Pacific Islander, Black not of Hispanic origin, and Latino (CEQ 1997). It defines a minority population as any group of minorities that exceed 50% of the existing population within local area or area of interest or where a minority group comprises a meaningfully greater percentage of the local population than in the general population. Additionally, the CEQ (CEQ 1997) identifies low income using 2010 census data for "individuals living below the poverty level." For this study, a low income population is defined as a local population with more than 50% of people living below the poverty level.

Based on ethnicity data, minority or environmental justice communities in Hilo, Wainaku, and Paukaa represent over half of the total population (as it does in Hawaii County and the state of Hawaii), so an environmental justice determination is required (U.S. Census Bureau 2014b).

Poverty data show that the percentage of population living below the poverty level is higher than the national figures in Hilo and lower than the national figures in Wainaku and Paukaa (15.0% nationally, compared to 16.9% in Hilo, 10.8% in Wainaku, and just 7% in Paukaa). Less than 50% of minority populations in Hawaii County and the CDPs surrounding Hilo Bay are living below the poverty level (U.S. Census Bureau 2014b).

3.8.2 Environmental Consequences

3.8.2.1 No Action Alternative

Under the No Action Alternative, dredging of federal navigation channels would not occur and depths would not change. Although this may not exclude vessels at this time, over time it may affect entry or departure of large ships. Exclusion of large vessels would have a direct, adverse impact on the economy of Hawaii and particularly on the communities surrounding the harbor, which provide services associated with maritime import and export. Employment associated with the maritime industry could be diminished if fewer ships are able to load or unload at Hilo Harbor, constituting a direct, adverse socioeconomic impact. This impact is not seen as affecting environmental justice communities to a greater degree than other communities, therefore there would be no environmental justice impacts.

3.8.2.2 Proposed Action

Under the proposed action, the federal navigation channels would be maintenance dredged to the design depth, ensuring that all ships currently using or scheduled to use Hilo Harbor would be able to enter into and depart from the harbor. Because this access is vital to the maritime trade industry, which constitutes a large component of Hawaii's economy, maintenance of federal navigation channels provides a direct, beneficial impact on socioeconomic conditions across the state of Hawaii.

On a localized basis, short-term minor beneficial impacts to the immediate area surrounding the harbor could occur as a result of the presence of the *Essayons*. The *Essayons* would dredge in the harbor for approximately 26 days, during which the ship could need to re-provision with food and fuel, and may require other services that would be provided by local businesses. The crew of the *Essayons* would be allowed shore leave, and would likely patronize local restaurants and other facilities, providing a minor and short-term economic benefit to the local economy. No adverse socioeconomic or environmental justice impacts from the proposed action have been identified.

3.9 Transportation

3.9.1 Affected Environment

Navigation. Hilo Harbor encompasses approximately 74 acres within the basin and an additional 14 acres of cargo handling and storage area. Overseas container and cruise ships, inter-island cargo and liquid bulk cargo ships, and tugboats make up the majority of the harbor's users. The design depth at the Hilo Harbor piers is between 33 and 35 feet, with berth lengths totaling 2,605 feet (Hawaii DOT 2011). In 2012, 637 commercial vessels (not including fishing vessels) moved 1.97 million tons of freight through Hilo Harbor, making it the fourth busiest port in the state of Hawaii; 112 cruise ships were scheduled to call in the harbor during 2014.

Parking. Parking areas are provided for port employees, contractors, and visitors at various locations on the Port property. Additional parking is available on the streets near the Port.

Circulation. Hilo Harbor can be accessed by vehicle from Kalanianaole Ave, a two-lane roadway that runs parallel and south of the harbor. Direct access to the harbor from Kalanianaole Ave is provided by Kuhio and Kahanu Streets, both two lane streets. Highways leading from other parts of the island to the harbor include Mamalahoa Highway from the north (State Highway 19) and south (State Highway 11), a four- to six-lane arterial in the Hilo area, and Saddle Road (State Highway 200) from the west, a two-lane roadway that is unlikely to be used by freight haulers given the topography. According to the 2035 Master Plan Update for Hawaii's harbors, design of a new third entrance into Hilo Harbor is underway to ease traffic congestion (Hawaii DOT 2011). The harbor may also be accessed via the Hele-on Bus Hilo - Keaukaha Route, which passes along Kalanianaole Street (Hawaii County Mass Transit Agency 2014).

Airports. Hilo International Airport is the main airport serving the Hilo area and lies just south of Hilo Harbor. These two facilities represent the principal freight movement centers for the island of Hawaii. The airport's proximity to the Port also facilities passenger transfers between ship and aircraft. The Hawaii DOT, through its Airport and Harbors Divisions, operates the airport and the harbor. It provides international connections and connections to airports on other Hawaiian islands, and serves an average of 4,500 passengers daily; an average of 263 flights (air carrier, air taxi, general aviation, military). The other major airport on the island is the Kona International Airport at Keaholee, on the opposite side of the island, which is the main passenger airport serving the Island of Hawaii.

Non-Motorized Transport. Recreational paddlers use the harbor as a launching point. Bicycle transportation is supported by signs, with designated bike lanes in the roadway, or with dedicated bike trails separate from roadways. Kalanianaole Avenue does not have signed or designated bike paths, but bicycles may travel along the clearly marked shoulder of this roadway in either direction. The proposed Hilo Bayfront Trails project would incorporate portions of Kalanianaole Avenue approaching the west side of the harbor; however, no improvements have been made to bike or pedestrian lanes at this time (Hawaii County 2010).

3.9.2 Environmental Consequences

3.9.2.1 No Action Alternative

Under the No Action Alternative, Hilo Harbor would maintain current depths, which may not be in compliance with federal standards for heavy ship access. The harbor would continue to accumulate sediments, making it shallower over time. The longer that sediment is allowed to accumulate within the harbor, the more expensive and protracted the eventual dredging project will be.

3.9.2.2 Proposed Action

Under the proposed action, the harbor would be maintenance dredged back to the design depths sufficient for access for all cargo ships, cruise ships, and military vessels that are currently using or are scheduled to use the harbor. This would constitute a direct, long-term beneficial impact to maritime transportation.

Short-term, minor adverse impacts to navigation could occur while the *Essayons* is dredging the harbor, as private, recreational, and commercial ships and recreational paddlers might need to navigate around the *Essayons*. This is not expected to result in any exclusion of vessels or recreational paddlers from the harbor, and effects would be limited to causing minor increases in time needed to enter or leave the harbor, as vessels or recreational paddlers could need to navigate around the *Essayons*. This effect would be minor and short-term.

Since the proposed action would not involve any land-based operations other than access to local services by the crew of the *Essayons* during the dredging, there would be no impacts to the transportation network in or around Hilo Harbor.

3.10 Hazardous Substances

This section addresses the generation, handling, use, storage, transport, and disposal of hazardous and toxic substances and petroleum products and the health and safety of those working with these substances. The ROI for this analysis is the vessel *Essayons* and the project area shown on Figure 1-1.

3.10.1 Affected Environment

Hazardous materials and petroleum products are subject to many regulations at the federal, state, and local levels. Regulatory responsibilities for hazardous materials and waste and associated safety management are shared by the USEPA, the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), the federal and state DOT, and Hawaii DOH Hazard Evaluation and Emergency Response Office and Solid and Hazardous Waste Branch.

The *Essayons* uses hazardous materials and petroleum products during routine vessel operations such as fuel to run the ship's engines, oils and lubricants to keep machinery in working order, solvents for cleaning and degreasing, batteries, and paint during routine vessel maintenance. Federal and state laws require detailed planning to ensure that hazardous materials are properly handled, used, stored, and disposed of, and if they are accidentally released, to prevent or mitigate injury to public health or the environment. These laws require hazardous materials users to prepare written plans detailing the types and quantities of hazardous materials used on site and emergency response and training procedures. The *Essayons* maintains a health and safety plan and oil spill prevention plan to ensure compliance with applicable regulations, minimize the possibility of an accident such as a leak or spill that would adversely affect human health and safety or the environment, and prescribe appropriate response actions should an accident occur.

Due to past and ongoing industrial use of the harbor, sediments could contain hazardous substances including dioxins, polychlorinated biphenyls, chlorinated pesticides, semi-volatile organic compounds, organotins, and metals. To identify DMMUs where hazardous substances, petroleum products, or their derivatives could be present in sediment, Tier III dredged material testing was done. Testing was done in accordance with the Green Book (USEPA and USACE 1991) and the Draft Regional Implementation Manual for Hawaii (USEPA and USACE 1997). The test results were used to determine if the proposed dredge sediment would be suitable for ocean disposal at the USEPA-approved deep ocean disposal site based on the ocean disposal suitability requirements of Title 40 CFR Parts 220–238.

3.10.2 Environmental Consequences

3.10.2.1 No Action Alternative

Under the No Action Alternative, the *Essayons* would not do maintenance dredging, so there would be no effects related to hazardous substances or health and safety.

3.10.2.2 Proposed Action

Dredging operations would include the use of hazardous materials and petroleum products such as fuel to run the ship's engines, oils and lubricants to keep machinery in working order, solvents for cleaning and degreasing, batteries, and paint. To ensure compliance with regulations related to hazardous materials and petroleum products and minimize the possibility of a spill or leak of these contaminants into the water, the *Essayons* would implement their existing oil spill prevention plan. The plan describes proper methods to handle, store, transport, and dispose of hazardous materials and to comply with relevant regulations. Adherence to the vessel oil spill prevention plan would minimize the possibility of a spill or leak, so effects would be minor.

To minimize disturbance of hazardous materials, DMMUs where concentrations of hazardous materials exceed regulatory thresholds would not be dredged. Based on preliminary toxicology results, sediment in all DMMUs would pass ocean disposal criteria. Since no sediment with hazardous materials concentrations exceeding regulatory standards would be disturbed or disposed of at the deep ocean disposal site, effects would be minor.

To ensure worker health and safety, workers would comply with the *Essayons'* health and safety plan. The health and safety plan details methods for complying with applicable health and safety regulations and vessel-specific BMPs for working safely aboard a vessel. Aspects of the plan include wearing proper personal protective equipment, attending daily safety briefings, and complying with safe work practices. Adherence to the vessel health and safety plan would minimize the possibility of an accident, so effects would be minor.

3.11 Resources Not Evaluated in Detail

Per CEQ regulations (40 CFR Part 1500), federal agencies are permitted to focus their NEPA analysis on those resource areas that could be affected and to omit discussions of resource areas that clearly would not be affected by a proposed action (see 40 CFR § 1501.7[a][3]). The following resources have been examined and determined not to warrant further consideration because no nexus is known to exist between the proposed action and the resource: aesthetics and visual resources; land use; air quality, and utilities and infrastructure.

3.11.1 Aesthetics and Visual Resources

The dredging equipment would not be substantively different than other vessels that routinely use the project area and the proposed action would not alter any visual resources.

3.11.2 Land Use

The proposed action would not cause any change to existing land uses.

3.11.3 Air Quality

The *Essayons'* engines would emit some air pollutants; however, the vessel would not contribute to a violation of federal or state ambient air quality standards and would not be distinguishable from other vessel emissions in the project area.

3.11.4 Noise

The proposed action would not generate noise discernible to the human population as different from existing ambient noise. The proposed action would not substantively alter ambient noise levels in the project area. Project-associated noise is evaluated as a stressor to biological resources in the appropriate sections.

3.11.5 Utilities and Infrastructure

The proposed action would not cause any change to existing utilities or infrastructure.

3.12 Conclusions

Implementing the No Action Alternative would have no significant impact on the quality of human life or the natural environment. It would have no effect on most resources. It would have long-term, indirect, moderate adverse effects on socioeconomics and transportation because continued sedimentation would adversely affect vessels ability to enter and move within the harbor, which would adversely affect socioeconomics by impairing vessel-based economic activity such as passenger ships and importing and exporting of goods.

Implementing the proposed action would have no significant impact on the quality of human life or the natural environment. With implementation of the BMPs presented in Section 2.2.6, the proposed action would have short-term, direct, negligible to moderate adverse impacts and long-term, direct, moderate beneficial impacts on other resources. The proposed action would have no effect, negligible effects, or minor effects on fish, birds, marine mammals, cultural and historic resources, and hazardous substances. It would have moderate adverse effects on benthic habitats, seagrasses, and marine invertebrates because it would affect benthic habitat and potential cause mortality of non-motile invertebrates in the path of the dragheads. It would have moderate adverse effects on sea turtles, primarily due to the potential to entrain sea turtles during dredging. It would have moderate adverse effects on water quality, primarily from temporary turbidity and sedimentation. It would have beneficial effects on transportation by improving conditions for safe vessel navigation and socioeconomics by supporting vessel-based economic activity such as passenger ships and importing and exporting of goods.

The predicted effects of the proposed action and the No Action Alternative on resources are summarized in Table 3-8. The USACE prepared a Finding of No Significant Impact (FONSI) documenting these conclusions. Because this action does not constitute a major Federal action significantly affecting the quality of the human environment, preparing an environmental impact statement is not required and signing a FONSI is appropriate.

Table 3-8. Summary of Potential Impacts to Resources from the Proposed Action and No-Action Alternative

ALTERNATIVES	Resources Evaluated[1]									
	Benthic Habitats, Seagrasses, and Marine Invertebrates	Fish	Sea Turtles	Birds	Marine Mammals	Water Quality	Socioeconomics	Cultural and Historic Resources	Transportation	Hazardous Substances
No Action	◊	◊	◊	◊	◊	◊	●	◊	●	◊
Proposed Action	●	○	●	○	○	●	■	◊	○ ■	○

Notes:
◊ No impact
○ Negligible to minor adverse impact
● Moderate adverse impact
■ Moderate beneficial impact

[1] Neither the proposed action nor the No Action Alternative would have more than negligible effects on land use, aesthetics and visual resources, noise, utilities and infrastructure, or air quality. These resources are not analyzed in detail in the EA.

4.0 CUMULATIVE IMPACTS

The analysis of cumulative effects includes the effects of past, present and reasonably foreseeable future actions that are reasonably certain to occur in the project area and in the larger affected environment. Future federal actions are considered to the extent that some information is available to support an assessment of environmental impacts. This section reviews activities for which at a minimum a draft evaluation of potential effects under NEPA or draft permit under other environmental laws (such as the Clean Water Act or Clean Air Act) has been published.

4.1 Past, Present, and Reasonably Foreseeable Actions

Numerous federal, state, commercial, and private actions and natural events could harm or disturb resources in the project area, particularly in Hilo Harbor. In this context, cumulative impacts can be expected to accrue from intentional and unintentional human actions, and probable but uncontrollable natural events. The cumulative impacts assessment includes only those resources that would be affected by the proposed action to at least a negligible degree. In accordance with CEQ guidance and conventional NEPA practice, the depth of discussion is commensurate with the level of significance of the predicted impact of the proposed action on each resource (CEQ 2010).

Resources not affected by the proposed action are not considered in the cumulative impacts analysis. This cumulative impacts analysis addresses only impacts associated with other projects that affect resources shown on Table 3-9 as having at least a “negligible” impact from the proposed action, including (1) benthic habitats, seagrasses, and marine invertebrates; (2) fish; (3) birds; (4) sea turtles and marine mammals; (5) water quality; (6) socioeconomics; (7) maritime transport; and (8) hazardous substances.

These reasonably foreseeable actions were considered in the cumulative impacts analysis, based on the vision and objectives of the *Hawaii Island Commercial Harbors 2035 Master Plan Update* (Hawaii DOT 2011):

- **Hilo Harbor Inter-Island Cargo Terminal Project.** The Hilo Harbor inter-island cargo terminal project broke ground in August 2011 and is ongoing. The project includes harbor dredging, a new cargo pier, a cargo yard, and entrance roadway widening and improvements. The purpose of the project is to separate cargo and cruise ship activities and to expand usable space to accommodate projected cargo and visitor growth.

- **Additional berthing, navigational improvements, and shore-based redevelopment at Hilo Harbor.** The *Hawaii Island Commercial Harbors 2035 Master Plan Update* (Hawaii DOT 2001) envisions additional berthing, navigational improvements, and shore-based expansion and redevelopment projects at Hilo Harbor by 2035 to accommodate forecasted economic growth and demand for harbor capacity. The plan recommends the construction of a new dedicated passenger terminal referred to as Pier 5 at the west side of the harbor to separate passenger activities from cargo operations. The plan provides additional berth capacity at Pier 4 and over 25 acres of additional cargo handling and storage capacity. Proposed navigational improvements include new dredging to minus 35 feet at the east side of the new Pier 5 to accommodate large cruise ships and dredging at the west side of Pier 4 to provide berthing for either a second cruise ships or other vessels. The plan also recommends that the small harbor basin be expanded so that large ships can more easily navigate through the harbor, particularly in the Pier 1 area. The specifics of how these objectives would be implemented are not certain and project-specific technical and environmental studies would have to be completed before implementing them; however, the future trend for Hilo Harbor is toward redevelopment and enhancement of harbor facilities.

These projects are similar to the proposed action in that they would require disturbance of the substrate, which would increase turbidity. It is not known whether the future projects would use a TSHD or another type of dredge. Dredged material could be disposed of at the Hilo ODMDS, on land, or in another location.

4.2 Cumulative Impacts Analysis of the Proposed Action

Cumulative impacts are described in terms of the expected activities in the action area, the overlap of the proposed action with impacts of other actions, and the incremental contribution of the proposed action to cumulative impacts.

4.2.1 Cumulative Impacts on Benthic Habitats, Seagrasses, and Marine Invertebrates

The proposed action would have negligible to minor temporary adverse impacts on benthic habitats, seagrasses, and marine invertebrates. The only benthic habitats in the harbor that would be directly affected would be previously dredged areas that support few invertebrates. These resources would not be significantly affected by the short-term increases in turbidity that the proposed action would cause. The future harbor repair and expansion projects would affect different areas of substrate than the proposed action. Effects of those projects on benthic resources would be determined by the resources in the project footprints. It is assumed that BMPs and exclusion zones would be identified during the permitting phase of future projects to minimize adverse impacts to benthic resources. The contribution of the proposed action to cumulative impacts on benthic resources would be negligible.

4.2.2 Cumulative Impacts on Fish

The proposed action would have negligible to minor temporary adverse impacts on a small number of fish species. Fishes would not be significantly affected by the short-term increases in turbidity that the proposed action would cause. Conversely, some fish could benefit from the masking effects of turbidity that allow them to capture prey more easily. Fish that do not tolerate turbidity would not be likely to occur in Hilo Harbor, which is listed as impaired due to excessive turbidity. Effects on fishes at the Hilo ODMDS would be even less, as pelagic species can avoid the area during dredged material disposal, and selectively feed on inadvertently injured or dead organisms discharged along with the dredged material. The contribution of the proposed action to cumulative impacts on fish would be negligible.

4.2.3 Cumulative Impacts on Birds

The proposed action would not contribute measurably to cumulative impacts on birds. Birds are imperiled by loss of nesting habitat and predation, not by dredging or vessel-related activities. Few bird species would be exposed directly to the *Essayons*. Those that did choose to roost on the vessel or associate with the vessel could be attracted by the inadvertently injured or dead invertebrates and small fish that would be discharged at the ODMDS. Birds would not be at risk of collision with the *Essayons*. Impacts of all past, present, and anticipated actions on seabirds would be adverse, but the proposed action would contribute negligibly to cumulative impacts on birds in the action area.

4.2.4 Cumulative Impacts on Sea Turtles and Marine Mammals

The greatest existing risks to sea turtles and marine mammals are vessel strikes, entanglement in fishing gear, commercial fishing practices, and for sea turtles, degradation of nesting beaches. Of these threats, only vessel strikes overlap with the proposed action.

Objectives of the future projects expected to occur in Hilo Harbor are similar to the proposed action: reconfiguration, improvement, and expansions of the harbor. Effects of the cumulative projects are expected to be similar to, but to exceed the magnitude of, the proposed action. Any activity that increases vessel traffic would contribute to cumulative impacts on sea turtles and marine mammals in the area.

Present and reasonably foreseeable future projects with in-water construction components, such as dredging and pier upgrades, would result in temporary and localized effects to benthic habitat and water quality that would be individually comparable to those associated with the proposed harbor dredging. Changes to benthic habitat and water quality associated with in-water construction for other cumulative projects would not persist for the same reasons discussed in this EA (Section 3.1). Therefore, cumulative impacts related to turbidity and benthic habitat disturbance would occur only if the future projects were implemented concurrently with the proposed action. The Hilo Harbor inter-island cargo terminal project is ongoing; however, in-water work is not likely to overlap the proposed action. Although cumulative effects would be adverse, cumulative impacts on sea turtles and marine mammals from water quality or benthic habitat changes would remain less than significant.

Present and future projects could increase vessel traffic in the harbor and near the entrance channel. Increased vessel traffic could add to the existing risk of ship strikes. Conversely, as the harbor becomes busier, marine mammals such as the Hawaiian monk seal may avoid the area, leading to a reduction rather than increase in ship strikes. Vessels in the harbor travel at slower speeds than on the open ocean, and thus would not be likely to cause substantial mortality of sea turtles or marine mammals in the harbor. Harbor expansion would not necessarily cause an increase in vessel traffic in the open ocean portions of the project area (the transit corridor and Hilo ODMDS). Cumulative impacts of ship strikes to sea turtles and marine mammals would be negligible.

Underwater sound levels resulting from the proposed action would not significantly impact sea turtles or rise to Level B harassment of marine mammals. Proposed expansion of the commercial harbor would likely entail construction activities of greater duration and higher noise levels than the proposed action. If the port expansion does occur, the contribution of the proposed action to cumulative effects on sea turtles and marine mammals resulting from noise would be negligible.

The proposed action incorporates numerous BMPs to minimize the risk of sea turtles being entrained by the TSHD. It is reasonable to assume that, given permit requirements, comparable BMPs would be adopted by other dredging operations in the harbor, or that entrainment would be minimized by the use of a different type of dredge. The cumulative impact on sea turtles from entrainment would not rise to the level of significance because dredging permits would require BMPs that minimize sea turtle entrainment risks.

Cumulative projects would be expected to have adverse effects on sea turtles and marine mammals; however, the proposed action’s contribution to these effects would be minor. None of these groups of animals would be directly affected by the short-term increases in turbidity caused by the proposed action. BMPs would minimize vessel strikes and entrainment.

4.2.5 Cumulative Impacts on Water Quality

Both of the projects proposed for Hilo Harbor would be likely to contribute directly to cumulative impacts on water quality. Numerous land-based activities contribute to erosion and sedimentation in the harbor. It is assumed that these inputs will continue to result in impaired water quality. It is assumed that the cumulative projects would be required to implement BMPs to minimize water quality impacts.

Future projects that lead to an increase in vessel traffic in Hilo Harbor would contribute to cumulative impacts on water qualty. All vessels large enough to disturb the substrate stir up the sediment and increase turbidity. Only large vessels cause this problem in deeper areas of the harbor. Smaller recreational and fishing vessles can disturb the bottom and increase turbidity in shallower areas.

The proposed action could have a minor adverse impact on water quality by increasing turbidity in the confined space of Hilo Harbor during active dredging. The incremental contribution of the proposed action to the cumulative impact on water quality would be minor relative to the annual flow of sediment-laden stream water and non-point sources into the harbor and the projects listed above.

4.2.6 Cumulative Impacts on Socioeconomic Resources

Hilo Harbor contributes greatly to Hawaii's import/export economy, which is crucial as most of Hawaii's required goods are imported, and to the islands' tourist economy, which brings hundreds of thousands of tourists to Hawaii every year. The proposed action and other harbor projects would support Hawaii's goal of improving the state's commercial shipping capabilities, and the jobs associated with shipping and tourism. Maintenance of federal shipping channels is imperative to ensuring that cruise ships would be able to access the harbor. These improvements would constitute a long-term beneficial socioeconomic impact for the state's economy. No adverse cumulative impacts on socioeconomic resources have been identified.

4.2.7 Cumulative Impacts on Transportation

The planned projects in Hilo Harbor would contribute to the cumulative beneficial impacts of the proposed action by enhancing the capabilities of the harbor to efficiently handle large amounts of cargo and passengers from cruise ships and to allow vessels of all sizes to conduct operations without impediment. Cumulatively, these projects would result in more efficient and cost-effective movement of cargo into, out of, and within the state. No adverse impacts on the transportation system have been identified.

4.2.8 Cumulative Impacts on Hazardous Substances

The majority of the proposed harbor improvements would involve the use, storage, handling, transport, and disposal of hazardous materials and petroleum products such as fuel, oil, lubricants, and paint. The projects would generate construction debris (*e.g.*, asphalt, wood, brick, metal, and glass), nonhazardous waste, hazardous waste, and personal trash. The NEPA documentation for the Harbor Master Plan states that hazardous materials and petroleum products would be managed in accordance with applicable federal, state, and local regulations and that proper safety precautions would be implemented to protect workers and the public. Waste would be recycled, incinerated, or disposed of at an appropriate landfill, as appropriate. These measures would minimize the possibility of misuse or an accident that would adversely affect human health and safety or the environment, so the effects of all past, present, and anticipated actions would be minor. The proposed project's contribution to these effects would be minor and the cumulative impacts of the proposed project in combination with past, present, and reasonably foreseeable future projects would be minor.

5.0 PARTIES CONSULTED

5.1 Public Involvement

The USACE invites public participation in the NEPA process. Consideration of the views of and information from all interested persons promotes open communication and enables better decision-making. All agencies, organizations, and members of the public having a potential interest in the proposed action are urged to participate in the decision-making process.

To fulfill the requirements of the Coastal Zone Management Act (CZMA), the Corps submitted a Federal Consistency Assessment Application to the State of Hawaii Office of Planning, Coastal Zone Management Program (CZMP). The CZMP published a notice of this action in the Office of Environmental Quality Bulletin on November 8, 2014, soliciting public comments to this action. No comments were received. In a letter dated December 12, 2014, the CZMP issued a consistency determination for this action (Appendix B).

Since the EA concludes that the proposed action would not result in significant environmental impacts, the USACE has prepared a draft FONSI. After consideration of comments received from all stakeholders, the USACE may approve the FONSI and implement the proposed action.

5.2 Consultation History

The USACE consulted with applicable agencies during the NEPA process.

On March 24, 2014, the USFWS conducted a meeting to discuss preliminary results of the Phase I surveys. Representatives from the USACE, USEPA, NOAA Fisheries, the State of Hawaii, Division of Aquatic Resources (DAR), and the HDOT – Harbors attended. The USFWS noted that the Phase I surveys are qualitative, but were able to provide general information of areas of high ecological value (*e.g.*, coral reefs, seagrass beds).

On May 20, 2014, the USACE conducted an initial informal consultation with NOAA Fisheries PIRO staff to discuss this BA and a separate EFHA. At this meeting, USACE staff indicated that the primary objective was to avoid areas of high ecological significance identified during the Phase I surveys. This included avoidance of coral species proposed for ESA listing and larger coral reef structures.

On July 10, 2014, USFWS presented final results of the Phase I surveys to USACE, NOAA Fisheries, and DAR staff. The USACE reiterated that they plan to avoid all hardbottom areas except pavement (*i.e,* smooth hardbottom generally devoid of macrobiota) during dredging. A subsequent question raised to the *Essayons* crew indicates that all of these structures will be avoided with a 20-30 foot buffer zone.

On August 27, 2014, NOAA Fisheries issued a final rule on the proposed listing of 66 coral species under the ESA. This rule determined that the six species of coral found in Hawaii would not be listed. As such, these species have been removed from this BA.

On September 29, 2014, USACE contacted NOAA Fisheries PIRO to discuss additional concerns for sea turtles raised during the development of this document. Both agencies had been in consultation with colleagues on the East Coast, where sea turtle takes in dredging activities have been a concern. The discussion centered on the differences and similarities of the sea turtle populations and appropriateness of East Coast mitigation measures as they relate to this project. Relevant BMPs are presented in Section 2.2.6.

On December 5, 2014, the Essayons informed the Honolulu USACE project manager that dredging would be delayed due to contractual issues associated with scheduled dry dock maintenance. The USACE relayed this information to the consulting agencies, noting that a subsequent meeting would be scheduled when a revised schedule was determined.

On May 12, 2015, the USACE provided an update of the project to the USFWS and NOAA Fisheries PRD. The USACE informed NOAA Fisheries, USFWS, and the State about the delays and the rescheduled dredging schedule, which would now likely occur in two segments in early 2016 and late 2018. The USACE noted that this document as well as the EFHA and EAs would be revised to reflect changes in the project description as well as other relevant items.

On September 22, 2015, Tetra Tech staff (USACE consultant for the project) briefed NOAA Fisheries Protected Resource Staff and Habitat Conservation Division on the status of the BA and the EFHA. This was necessary as the point of contact for the BA had changed over the summer of 2015. Tetra Tech described the extensive effort that has been made by the USACE on implementing the most effective turtle mitigation measures feasible, including extensive retrofitting of equipment on the Hopper Dredge.

6.0 RELATED LAWS AND CONSIDERATIONS

This section provides an overview of USACE compliance with relevant federal and state regulations for the proposed action.

Endangered Species Act. Based on the evaluation in the BA, USACE has determined that the proposed maintenance dredging would potentially affect the following species listed under the ESA of 1973, as amended (16 United States Code [USC] §§1531-1544): green sea turtle and hawksbill sea turtle. Accordingly, USACE has initiated consultation with NOAA Fisheries and USFWS as required under Section 7 of the ESA. During consultation, the primary concern raised relates to the entrainment of sea turtles. USACE is working with NOAA Fisheries to develop appropriate mitigation measures to limit this potential impact and is seeking an ITP for the unlikely event that sea turtles are entrained in the dredge.

Marine Mammal Protection Act. The MMPA of 1972, as amended (16 USC §1361 et seq.) applies to all marine mammals and prohibits "take" of marine mammals, with certain exceptions. Effects on marine mammals are addressed in Section 3.5. The proposed impact would have a negligible adverse impact on species protected by the MMPA.

Essential Fish Habitat Assessment. The USACE has determined that the proposed project may adversely affect EFH. The project site is in an area designated as EFH under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended by the Sustainable Fisheries Act of 1996, for federally managed fish species. In accordance with the MSFCMA, USACE has prepared an EFHA and submitted it to NOAA Fisheries PIRO for review. The proposed action would not cause any significant adverse effects on EFH. Measures to reduce potential effects on EFH will be implemented pending completion of consultation with NOAA Fisheries. Measures will be implemented to ensure that effects are less than significant.

Migratory Bird Treaty Act. The MBTA (16 USC §§703–712) is domestic legislation implementing international agreements made among the U.S., England, Mexico, the former Soviet Union, and Japan to protect migratory bird populations. In addition, EO 13186 (*Responsibilities of Federal Agencies to Protect Migratory Birds*, January 10, 2001) directs federal agencies to take certain actions to further implementation of the MBTA. Effects on birds are addressed in Section 3.4. The proposed impact would have a negligible adverse impact on bird species protected by the MBTA.

Marine Protection, Research, and Sanctuaries Act. The transportation of dredged material for disposal at the ODMDS must comply with Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended (16 USC §1431 et seq. and 33 USC §1401 et seq., also known as the Ocean Dumping Act). The "*Evaluation of Dredged Material Proposed for Ocean Disposal*," commonly referred to as the "Green Book," contains technical guidance for determining the suitability of dredged material for ocean disposal through chemical, physical, and biologically evaluations (USEPA and USACE 1991). The USACE has coordinated with USEPA to evaluate the sediments proposed for ocean disposal. USEPA is reviewing the sediment evaluation results and is expected to approve sediments from DMMUs that meet the criteria for ocean disposal.

Fish and Wildlife Coordination Act. Through the Fish and Wildlife Coordination Act (FWCA), as amended (16 USC §§661-667e), the USACE provided funds to the USFWS to conduct Phase I Marine Habitat Characterizations between November 2013 and January 2014. These surveys provided data necessary to characterize the habitat and organisms in the primary footprint of the proposed project area. The USACE relied on this information to exclude sensitive habitat from the project area and to focus the analysis of this EA on relevant biological resources. The USACE consulted with USFWS under the FWCA.

Invasive Species Regulations. The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended by the National Invasive Species Act of 1996, authorizes regulation of ballast water operations to control the introduction and spread of aquatic invasive species; funding for prevention and control research; and regional involvement with the Aquatic Nuisance Species Task Force. EO 13112 of 1999 requires federal agencies to address invasive species concerns and to not authorize or carry out new actions that would cause or promote the introduction of invasive species. The proposed action would comply with applicable invasive species regulations and would have minor adverse effects with respect to invasive species. BMPs to control the introduction and spread of invasive species are in Section 2.2.6.

Clean Water Act, State Water Quality Certification, and Ocean Dumping Act. Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500), as amended by the Clean Water Act of 1971977 (Public Law 95-217) implements a federal permit program for the discharge of dredged or fill material into navigable waters of the United States that lie seaward of shore to 3-nm, and defines the conditions that must be met by federal projects before they may make such discharges. The dredged material was evaluated in accordance with the Evaluation of Dredged Material Proposed for Ocean Disposal: Testing Manual or “Green Book” (USEPA and USACE 1991) to ensure that the proposed disposal will not unreasonably degrade or endanger human health, welfare, or amenities or the marine environment, ecological systems, or economic potentialities. In making this determination, the criteria established by the Administrator, USEPA pursuant to section 102(a) of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended (16 USC §1431 et seq. and 33 USC §1401 et seq., also known as the Ocean Dumping Act), was applied. Dredge material that passed USEPA chemical and biological standards for ocean disposal from each harbor will be discharged at USEPA ocean disposal sites that are beyond the three-mile extent of the territorial sea. Dredge material that did not pass USEPA chemical and biological standards will not be dredged by this project. The Suitability and Concurrent Letters for discharge/disposal of dredge material will be issued by the USEPA. Turbidity caused by dredge activities within territorial waters will be monitored and controlled using water quality BMPs. The State Department of Health, Clean Water Branch is engaged in evaluating the BMPs. The proposed action falls under Section 10 of the Rivers and Harbors Act of 1899 (33 USC § 403 et seq.), which prohibits the obstruction or alteration of navigable waters of the U.S. without a permit from the USACE. Maintenance dredging of existing navigation basins and channels is also authorized under Nationwide Permit No. 35. USACE does not issue permits to itself, so no specific permit or further authorization is required under this act for the proposed action.

Floodplain Management. The project site is not in a floodplain, as defined by the Federal Emergency Management Agency. In accordance with EO 11988, USACE has determined that the proposed action would not contribute to negative impacts or damages caused by floods.

Coral Reef Protection. EO 13089, *Coral Reef Protection*, requires federal projects to protect coral reefs. Coral reefs identified in a small portion of DMMU N2 would be avoided. No other coral reefs are in the dredge footprint. Therefore, the project would comply with EO 13089.

National Historic Preservation Act. The National Historic Preservation Act (NHPA) of 1966, as amended (16 USC §470), establishes the national policy for the preservation of cultural and historic properties. Section 106 of the NHPA (36 CFR 800) requires Federal agencies to take into account the potential effects of their undertakings on cultural and historic resources by identifying resources in the Area of Potential Effect, evaluating the significance of the resources, and developing approaches to avoid or mitigate potential adverse effects in consultation with local organizations and interested parties. The USACE provided the SHPD, the Office of Hawaiian Affairs, the Association of Hawaiian Civic Clubs, and relevant Hawaii Canoe Clubs a letter containing the purpose of the action, the project description, and a list of cultural and historic resources in the Area of Potential Effect. In response to this, the SHPD concurred with the USACE that the proposed action would have no effect on cultural and historic resources and no historic properties would be affected (Appendix B).

Coastal Zone Management Act. The objective of the Coastal Zone Management Act (CZMA) of 1972, as amended (16 USC §§1451-1464), is to protect and restore valuable natural coastal resources, primarily by controlling nonpoint source pollution. In accordance with Hawaii Revised Statutes (HRS) Chapter 205A, the Coastal Zone Management (CZM) law, all land areas of the state (extending seaward to 3 nm) lie within Hawaii's designated coastal zone. In accordance with Section 307 of the CZMA (the "federal consistency" provision), USACE has submitted an application for CZM Federal Consistency Review and CZM Consistency Determination to the State of Hawaii Office of Planning, the lead agency for Hawaii's Coastal Zone Management Program, summarizing the effects of the proposed action. USACE determined that maintenance dredging of the authorized navigation project is consistent, to the maximum extent practicable, with the applicable management program established under the CZMA of 1972. The dredging work would be conducted, to the maximum extent practicable, in a manner that is consistent with the approved management program. In accordance with section 306(d)(14) of the CZMA, Hawaii's Coastal Zone Management Program published a public notice of the consistency determination application in the Hawaii Office of Environmental Quality Control's publication, *The Environmental Notice* on November 8, 2014, which included a 2-week comment period. No comments were received. In a letter dated December 12, 2014, the CZMP issued a consistency determination for this action (Appendix B).

Environmental Justice and the Protection of Children. EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations*, requires that federal agencies take into consideration disproportionately high and adverse environmental effects of governmental decisions, policies, projects, and programs on minority and low-income populations, and to identify alternatives that could mitigate such impacts. EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, seeks to protect children from disproportionately incurring environmental health or safety risks that might arise as a result of federal policies, programs, activities, and standards. Based on the analysis in this EA, implementing the proposed action would not result in disproportionate effects on environmental justice or the protection of children. Environmental justice is discussed in the context of socioeconomic resources in Section 3.8.

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