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SER-2016-17736

AUG 0 2 2016

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Ref.: Endangered Species Act Biological Opinion for the Proposed Construction of New San Idelfonso Auxiliary Cargo Port and Reconstruction of Sardinas Bay Cargo Ferry Ramp and Installation of Passenger Ferry Dock Mooring Dolphin

Dear Messieurs De La Campa andCastillo:

The enclosed Biological Opinion ("Opinion") was prepared by the National Marine Fisheries Service (NMFS) pursuant to Section 7(a)(2) of the Endangered Species Act (ESA). The Opinion considers the potential effects of the proposed construction of a new cargo port at San Idelfonso and the reconstruction of the existing Sardinas Bay Cargo Ferry Ramp and installation of a new mooring dolphin for the existing passenger ferry dock by the Puerto Rico Ports Authority (PRPA) with funds from the Federal Emergency Management Agency (FEMA, funding application number HMGP-FEMA-DR-4017-PR) and a federal permit from the U.S. Army Corps of Engineers (USACE, permit application number SAJ-2002-01425) on listed species. NMFS concludes that the proposed action is not likely to adversely affect green (*Chelonia mydas,* North Atlantic distinct population segment [DPS]), leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*, Northwest Atlantic Ocean DPS), and hawksbill (*Eretmochelys imbricata*) sea turtles; elkhorn (*Acropora palmata*), staghorn (*Acropora cervicornis*), boulder star (*Orbicella franksi*), mountainous star (*Orbicella faveolata*), rough cactus (*Mycetophyllia ferox*), and pillar (*Dedrogyra cylindrus*) corals; and North Atlantic DPS green sea turtle and elkhorn and staghorn coral critical habitats. NMFS also concludes that the proposed action is likely to adversely affect, but is not likely to jeopardize the continued existence of, lobed star coral (*Orbicella annularis*).

NMFS published a final listing rule for Nassau grouper (*Epinephelus striatus*) on June 29, 2016 (81 FR 42268), to list this species as threatened, effective July 29, 2016. FEMA included an effects determination for Nassau grouper in their consultation request for this project. Because the species listing decision has been finalized, we include an analysis of potential project effects to Nassau grouper and conclude that the proposed action is not likely to adversely affect the species.

NMFS is providing an Incidental Take Statement (ITS) with the Opinion. The ITS describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The ITS also specifies nondiscretionary terms and conditions, including monitoring and reporting requirements with which FEMA, USACE, and PRPA must comply to carry out the reasonable and prudent measures. Incidental take from actions described or evaluated in this Opinion that complies with these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

Please direct questions regarding this Opinion to Dr. Lisamarie Carrubba, Consultation Biologist, by phone at787-851-3700, or by email at lisamarie.carrubba@noaa.gov.

Sincerely,

for Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosures

cc: F/SER4 – Wilber, Rivera
USACE – Sasso
FEMA – Ayala
PRPA – Rodriguez

File: 1514-22.O

Endangered Species Act
Biological Opinion

for the

Construction of New San Idelfonso Auxiliary Cargo Port and Reconstruction of Sardinas Bay Cargo Ferry Ramp and Installation of Passenger Ferry Dock Mooring Dolphin

NMFS Consultation Number: SER-2016-17736

Federal Action Agency: Federal Emergency Management Agency (Lead) and U.S. Army Corps of Engineers

Affected Species and Critical Habitat Determinations:

ESA-Listed Species and Critical Habitat	ESA Status of the Species	Is the action likely to adversely affect this species or critical habitat?	Is the action likely to jeopardize this species?	Is the action likely to destroy or adversely modify critical habitat for listed species?
Hawksbill sea turtle, *Eretmochelys imbricata*	E	No	No	N/A
Green sea turtle, North Atlantic (NA) Distinct Population Segment (DPS), *Chelonia mydas*	T[1]	No	No	No
Leatherback sea turtle, *Dermochelys coriacea*	E	No	No	N/A
Loggerhead sea turtle, Northwest Atlantic Ocean (NWA) Distinct Population Segment (DPS), *Caretta caretta*	T	No	No	N/A
Elkhorn coral, *Acropora palmata*	T	No	No	No
Staghorn coral, *Acropora cervicornis*	T	No	No	No
Pillar coral, *Dendrogyra cylindrus*	T	No	No	N/A
Lobed star coral, *Orbicella* (formerly *Montastraea*) *annularis*	T	Yes	No	N/A
Mountainous star coral, *Orbicella faveolata*	T	No	No	N/A

[1] On April 6, 2016 (81 FR 20058), NMFS published a final rule listing 11 DPSs of the green sea turtle, including the North Atlantic DPS.

Boulder star coral, *Orbicella franksi*	T	No	No	N/A
Rough cactus coral, *Mycetophyllia ferox*	T	No	No	N/A
Nassau grouper, *Epinephelus striatus*[2]	T	No	No	N/A

Consultation
Conducted By: National Marine Fisheries Service
Southeast Region

Issued By: for Roy E. Crabtree, Ph.D.
Regional Administrator

Date: 8/2/16

[2]On June 26, 2016 (81 FR 42268), NMFS published a final rule listing Nassau grouper.

TABLE OF CONTENTS

1. INTRODUCTION 2
2. CONSULTATION HISTORY 3
3. DESCRIPTION OF THE PROPOSED ACTION AND THE ACTION AREA 4
3.1. Proposed Action 4
3.2. Action Area 11
4. STATUS OF SPECIES AND CRITICAL HABITATS 12
4.1. Analysis of Species and Critical Habitats Not Likely to be Adversely Affected. 13
4.2. Analysis of Species Likely to be Adversely Affected 22
4.2.1 General Threats Faced by All Coral Species 22
4.2.2 Lobed Star Coral (*Orbicella annularis*) 27
5. ENVIRONMENTAL BASELINE 33
5.1. Status of Lobed Star Corals in the Action Area 33
5.2. Factors Affecting Lobed Star Corals in the Action Area 33
6. EFFECTS OF THE ACTION ON LOBED STAR CORAL 38
7. CUMULATIVE EFFECTS 39
8. INTEGRATION AND SYNTHESIS 40
8.1. Jeopardy Analysis 40
9. CONCLUSION 43
10. INCIDENTAL TAKE STATEMENT 43
10.1. Amount or Extent of Take 43
10.2. Effect of the Take 44
10.3. Reasonable and Prudent Measures 44
10.4. Terms and Conditions 44
11. CONSERVATION RECOMMENDATIONS 45
12. REINITIATION OF CONSULTATION 46
13. LITERATURE CITED 46
Appendix A 50
Appendix B 87
Appendix C 88
Appendix D 90
Appendix E 96
Appendix F 116
Appendix G 129

LIST OF FIGURES

Figure 1. Proposed plan for seaward and coastal portion of new San Ildefonso auxiliary cargo facility showing location of cargo platform and ramp, new aluminum pier, passenger catwalk, and passenger holding area (from Atkins Caribe 2015) 6
Figure 2. Proposed plan for landward portion of new auxiliary cargo facility parking area and roadway improvements (from Atkins Caribe 2015) 7
Figure 3. Proposed plan for improvements to Sardinas Bay Cargo Ramp shown in grey with new catwalk extending from it and new mooring dolphin and catwalk for passenger ferry on far left in figure (from Atkins Caribe 2015) 8
Table 1. Pile Installation Required for Project..... 9
Figure 4. Image of 2 project locations and locations (existing cargo ferry ramp in Sardinas Bay and proposed new facility in Ensenada Honda) in relation to Culebra and the main island of Puerto Rico (from Atkins Caribe 2015)..... 11
Table 2. Status of Listed Species that May be Present in the Action Area..... 12
Table 3. Critical Habitats in the Action Area 13

LIST OF TABLES

Table 1. Pile Installation Required for Project..... 9
Table 2. Status of Listed Species that May be Present in the Action Area..... 12
Table 3. Critical Habitats in the Action Area 13

ACRONYMS AND ABBREVIATIONS

ATONS – Aids to Navigation
DNER – Department of Natural and Environmental Resources
DPS – Distinct Population Segment
ESA – Endangered Species Act
FEMA – Federal Emergency Management Agency
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
NWA DPS – Northwest Atlantic Distinct Population Segment
PRPA – Puerto Rico Ports Authority
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USFWS – U.S. Fish and Wildlife Service

1. INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 et seq.), requires each federal agency to "insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species." To fulfill this obligation, Section 7(a)(2) requires federal agencies to consult with the appropriate Secretary on any action that "may affect" listed species or designated critical habitat. The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) share responsibilities for administering the ESA. Consultations on most listed marine species and their designated critical habitat are conducted between the action agency and NMFS.

Consultation is concluded after the appropriate Secretary (of Commerce if NMFS, of Department of the Interior if USFWS) determines that the action is not likely to adversely affect listed species or critical habitat, or issues a Biological Opinion ("Opinion") that identifies whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify critical habitat. If either of those circumstances is expected, the Secretary identifies reasonable and prudent alternatives to the action as proposed that can avoid jeopardizing listed species or resulting in the destruction/adverse modification of critical habitat. In the Opinion, the Secretary states the amount or extent of incidental take of the listed species that may occur, develops reasonable and prudent measures (RPMs) to reduce the effect of take, monitors to validate the expected effects of the action, and recommends conservation measures to further conserve the species.

This document represents NMFS's Opinion based on our review of impacts associated with the construction of a new cargo port at San Idelfonso and the reconstruction of the existing Sardinas Bay Cargo Ferry Ramp and installation of a new mooring dolphin for the existing passenger ferry dock. The Federal Emergency Management Agency (FEMA) is funding the reconstruction, and the U.S. Army Corps of Engineers (USACE) Jacksonville District is the permitting authority. The Puerto Rico Ports Authority (PRPA) is the permit applicant. This Opinion analyzes potential project effects on green (North Atlantic distinct population segment [NA DPS]), leatherback, loggerhead (Northwest Atlantic Ocean distinct population segment [NWA DPS]), and hawksbill sea turtles; elkhorn, staghorn, pillar, rough cactus, lobed star, mountainous star, and boulder star corals; and green sea turtle (NA DPS) and elkhorn and staghorn coral critical habitats in accordance with Section 7 of the ESA. NMFS published a final rule listing Nassau grouper (*Epinephelus striatus*) as threatened on June 29, 2016 (81 FR 42268), therefore this Opinion also analyses potential project effects on Nassau grouper. This Opinion is based on project information provided by FEMA and PRPA including reports from Atkins Caribe, the project consultant for PRPA. In addition, NMFS utilized published literature.

It is NMFS's Biological Opinion that the project, as proposed, may affect, but is not likely to adversely affect hawksbill, loggerhead NWA DPS, leatherback, and green NA DPS sea turtles; elkhorn, staghorn, rough cactus, pillar, boulder star, and mountainous star corals; and NA DPS green sea turtle and elkhorn and staghorn coral critical habitat. It is also NMFS's Biological Opinion that the project, as proposed, is likely to adversely affect, but not likely to jeopardize the

continued existence of lobed star coral. NMFS also concludes that the proposed project may affect, but is not likely to adversely affect Nassau grouper.

2. CONSULTATION HISTORY

The consultation history for this project is as follows:

- Prior to receiving an ESA Section 7 consultation request, NMFS provided technical assistance to FEMA and PRPA beginning in January 2013, when the proposed project consisted only of repairs to the existing cargo ferry ramp.
- NMFS participated in a meeting led by FEMA on May 30, 2014, to discuss the changes to the project scope that included the construction of a new cargo port facility at San Idelfonso as well as the repairs to the existing cargo ramp in Sardinas Bay. NMFS sent an email dated June 7, 2014, to FEMA as a follow up to the meeting detailing the ESA Section 7 consultation requirements for the project.
- NMFS received a consultation request from FEMA dated February 5, 2015. We informed FEMA via email dated March 3, 2015, that we were preparing a request for additional information and could not proceed with the consultation based on the information provided. A request for additional information was sent via email dated June 1, 2015, detailing the information needed to proceed with the ESA Section 7 consultation for the project.
- A meeting was held on June 25, 2015, with FEMA, PRPA and its consultants, Atkins Caribe, to discuss our additional information request. Some of the requested information was hand delivered during the meeting.
- The rest of the additional information was received via email dated August 25, 2015.
- The USACE published a public notice for the project on September 29, 2015. NMFS began coordination with the USACE for this project on October 15, 2015.
- While drafting our consultation response letter, NMFS sent an email dated November 2, 2015, to FEMA, PRPA, and USACE requesting some additional information, such as specifics regarding the type of hammer to be used for pile driving. We received a response via email dated November 5, 2015. We initiated consultation the same day.
- We drafted an informal consultation response letter and began the review process for the document on December 14, 2015.
- We received information from the Puerto Rico Department of Natural and Environmental Resources (DNER) on January 5, 2016, that 4 colonies on the piles of the existing cargo ramp are lobed star coral and will be transplanted prior to reconstruction of the cargo ferry ramp. Based on this information, we informed FEMA the same day that we were withdrawing the informal consultation request and initiating formal consultation based on the “take” on lobed star coral.
- FEMA agreed with our determination that the formal consultation was required via email January 14, 2016, and sent a copy of the coral transplant plan, which was developed by PRPA and its consultant, Atkins Caribe, at DNER’s request.
- NMFS initiated formal consultation for the project on January 14, 2016.

3. DESCRIPTION OF THE PROPOSED ACTION AND THE ACTION AREA

3.1. Proposed Action

Existing Site Conditions

New San Idelfonso Auxiliary Cargo Port: This area was the location of the first settlement on Culebra, San Idelfonso that was later taken over by the U.S. Navy to establish the Culebra Naval Reservation in 1903. There are historic structures, a small parking area, and boat launching facilities. There is an existing 140-foot (ft)-long concrete seawall, 2 boat ramps, each measuring 25 ft wide, and a concrete dock covered with wooden decking measuring approximately 20 ft wide by 40 ft long. Riprap is present along the seaward side of the seawall mixed with sand patches with scattered turtle grass. Small coral colonies are present on the riprap, but no ESA-listed corals were observed on the riprap during the benthic survey. The seawall and existing pier are colonized by macroalgae, sponges, and other invertebrates. Four colonies of lobed star corals are present on piles of the existing San Idelfonso pier along with 2 other hard coral species. Within the footprint of the new proposed facilities, there is a sand and mud bottom colonized by patches of macroalgae and seagrass. Outside the proposed project footprint, there are denser seagrass beds and areas of shoreline mangroves in many areas of the bay. The entrance of the bay through which cargo vessels transiting to and from the new cargo port facilities is bordered by shallow coral reefs and seagrass beds. While a detailed benthic survey was not conducted in this area as part of this project, information in our project files and scientific surveys indicate that ESA-listed corals, including elkhorn, staghorn, and lobed star corals, are present on these coral reefs.

Sardinas Bay Cargo Pier: This facility is located in Dewey, the main commercial area on Culebra where there is also a passenger ferry dock and terminal. There is an existing concrete seawall along the shoreline and the cargo ramp extends from this structure seaward. The bottom substrate is largely sand with some rock rubble. Scattered hard coral colonies are present on the rock rubble and on the piles of the existing pier. No ESA-listed corals were observed in the project footprint on the marine bottom, seawall, or pier piles according to the benthic surveys conducted for the project. The piles are also colonized by sponges, macroalgae, and other invertebrates. Away from the shadow of the existing cargo ramp and passenger ferry dock, there are seagrass beds. There are also hard bottom and coral reef areas at the mouth of the bay and ESA-listed coral colonies, including staghorn and lobed star corals, are present in these areas based on information in our project files and scientific surveys. To the north of the cargo pier, there is a mangrove-lined channel into a lagoon that also connects to Ensenada Honda.

Project Description

PRPA proposes the construction of the project in 2 phases. The first phase will be the construction of the new cargo port facility at San Idelfonso. At the same time, the new passenger dock mooring dolphin will be constructed in Sardinas Bay. The first phase of the project is expected to take 7 months to complete. Once the construction of the new cargo port facility is complete, cargo ferry operations will be transferred temporarily to the San Idelfonso facility. The second phase of the project will then begin: to reconstruct the existing cargo ferry ramp in Sardinas Bay. This is expected to take 6 months. Once the reconstruction of the cargo ramp in Sardinas Bay is complete, cargo ferry operations will be transferred back to the Sardinas Bay

facility. The auxiliary port at San Idelfonso will be retained only for emergency operations, such as during storms, or if the Sardinas facilities are rendered nonoperational.

New San Idelfonso Auxiliary Cargo Port: One construction barge held in place with spuds will be used during construction activities. The barge will be used to install the in-water structures. The project includes the installation of a pre-fabricated aluminum pontoon platform measuring 40 ft long by 56 ft wide (Figure 1). The pontoon platform will be supported by 4-6 30-in-round concrete piles. The pontoon platform will be connected to land by a pre-fabricated aluminum vehicle bridge measuring 35 ft long by 22 ft wide. The existing recreational dock will be demolished and the existing piles removed at the mudline unless specified in the coral transplant plan due to colonization by non-ESA-listed and ESA-listed corals. The dock will be replaced with a pre-fabricated aluminum platform supported by 8 new 18-in steel-encased concrete piles. An aluminum catwalk measuring 20 ft long by 4 ft wide will be constructed for passenger boarding to connect the new dock and cargo platform. A concrete pile cap and fender measuring 56 ft long by 6 ft wide will be installed on the seaward side of the cargo pontoon platform to protect the platform from impacts from the ferry during docking maneuvers. The pile cap and fender will be supported by 11 new 30-in-diameter, round concrete piles. The pile cap beam will be located in 16 ft of water. To protect the existing historic seawall, an additional pile cap beam will be constructed measuring 29 ft long by 3 ft wide and supported by 6 new 18-in concrete piles. This pile cap and fender will be constructed 5 ft seaward of the existing seawall. All piles will be installed using the auger drilling method, which consists of the placement of a thick-walled steel pile casing, using an auger to create a pilot hole, and vibratory hammering the casing into place. A rebar form is then installed inside the casing using a vibratory hammer, and concrete is poured into the casing.

The construction of the auxiliary cargo port facility also requires construction in upland areas and modifications of the existing road and parking area (Figure 2). Upland construction includes the widening of the existing access road and loop lane for turn-arounds, the construction of 30 parking spaces, the relocation of 2 electrical poles, handicap parking and bathroom facilities, and a passenger holding area. One of the existing concrete boat ramps and a wooden dock south of the new facilities will remain.

PRPA reports that it is considering the installation of additional aids-to-navigation (ATONS) to (1) delimit the inner range of the new cargo port to minimize recreational and commercial vessel anchoring in the approach to the new cargo port; (2) mark the turning basin in front of the new cargo ramp where ferries will turn in order to approach the new ramp in reverse, and (3) delimit the area around the new cargo port where recreational vessels will need to adhere to strict speed limits. PRPA has met met with DNER and the Municipality of Culebra (Municipality), as well as the U.S. Coast Guard (USCG) regarding this possibility, but a plan for the installation of ATONS has not been completed. If it is determined that additional ATONS will be installed, a separate permit request will be submitted. Because the plan for the ATONS is not final and the installation of the ATONS is not being considered as part of this federal funding and permit request, we have not analyzed the installation of ATONS in this Opinion. Should a permit application be submitted in the future for the installation of ATONS for the new cargo port, NMFS will conduct an ESA Section 7 consultation for the ATONS.

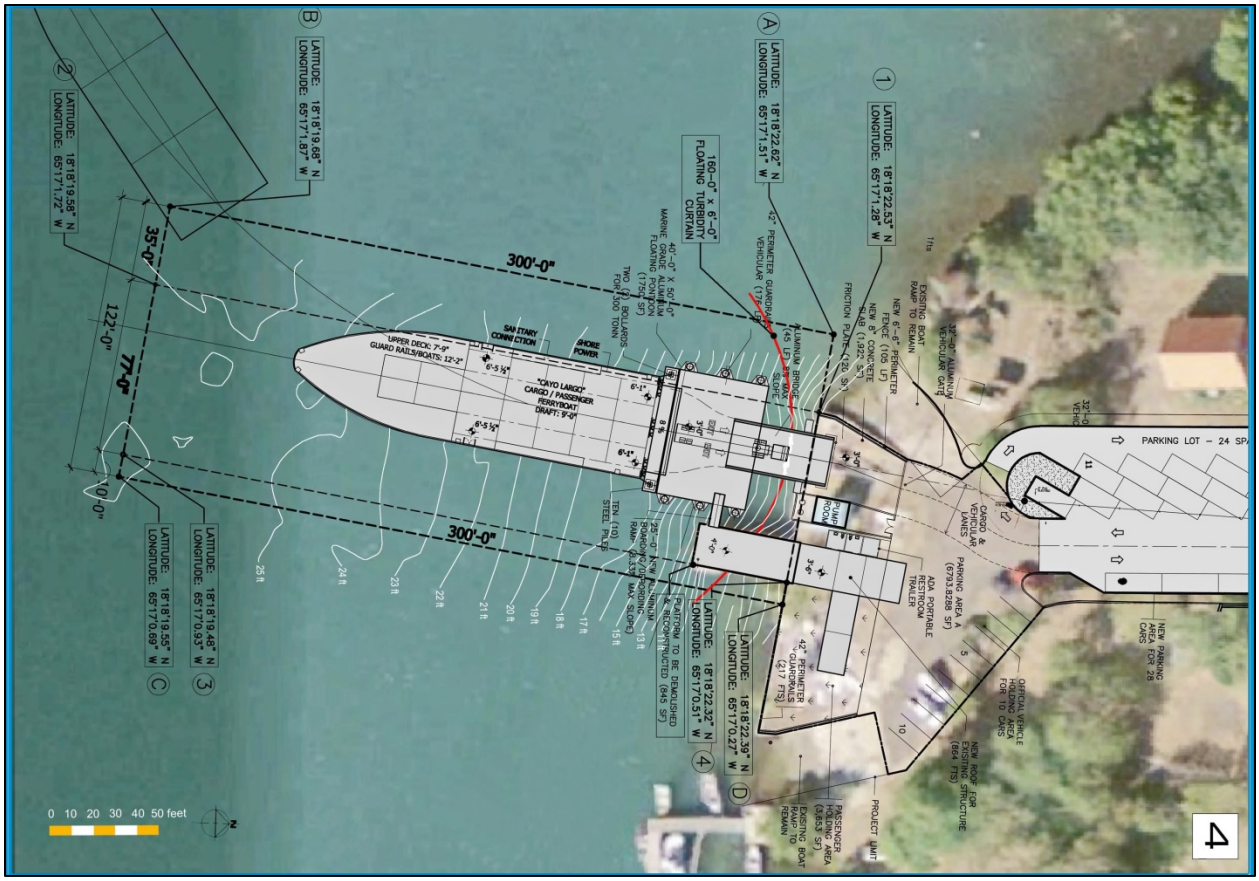

Figure 1. Proposed plan for seaward and coastal portion of new San Ildefonso auxiliary cargo facility showing location of cargo platform and ramp, new aluminum pier, passenger catwalk, and passenger holding area (from Atkins Caribe 2015)

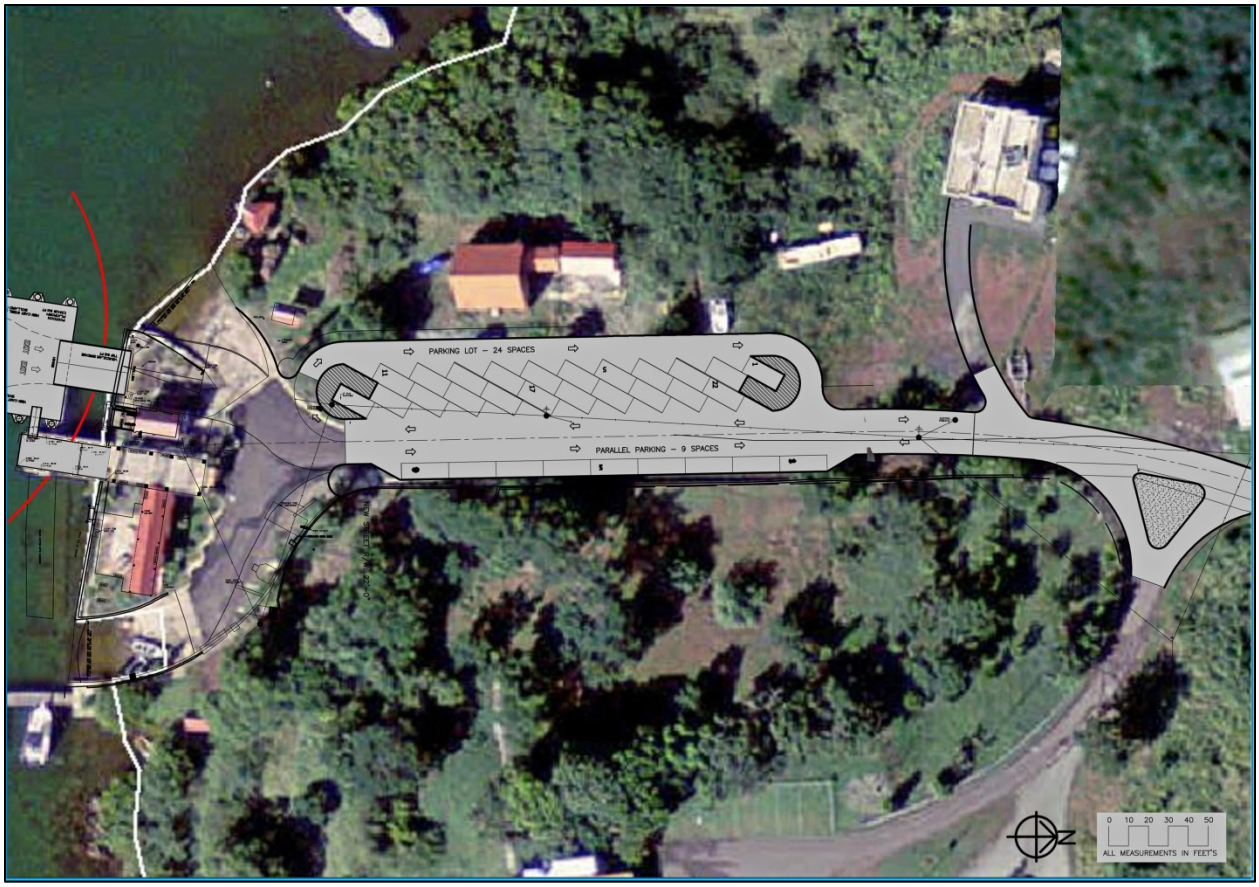

Figure 2. Proposed plan for landward portion of new auxiliary cargo facility parking area and roadway improvements (from Atkins Caribe 2015)

Sardinas Bay Cargo Pier and Passenger Ferry Mooring Dolphin: The project requires the removal of 27 existing 15-inch (in) by 15-in H-piles at the mudline and the demolition of the existing concrete platform (Figure 3). Twenty-five new 20-in concrete diameter piles will be installed within the existing footprint of the cargo ramp. A new concrete cargo platform will be constructed with a slightly larger footprint than the existing ramp. The existing cargo ramp measures approximately 39 ft wide by 70 ft long with a 14-ft-wide by 28-ft-long additional section along the north portion of the dock extending from the shoreline. A new catwalk measuring approximately 10 ft wide by 98 ft long will be installed for passenger boarding. The construction of the new catwalk requires the installation of 3 new 20-in concrete piles. The catwalk will be attached to a new mooring dolphin serving the cargo pier. The mooring dolphin will be supported by 5 new 20-in concrete piles. The method of pile installation will depend on the contractor selected for the project. The applicant has recommended that auger drilling be used to install the steel casing that will then be filled with concrete, but the contractor may decide to use an impact hammer to install a smaller steel casing and rebar form inside it for the concrete pouring. If an impact hammer is used to install the rebar form, PRPA will require that a steel casing be installed using an auger to drill a pilot hole and vibrating the casing into place using a vibratory hammer. Air will then be pumped into the space within the steel casing to create bubbles, or the water will be pumped out of the area enclosed by the steel casing. A smaller steel pile casing will then be driven inside the existing steel casing using an impact hammer. A spacer made of rubber or similar material will be installed inside the sleeve pile to

prevent contact with the smaller driven steel casing. A rebar form will be driven into place within the smaller steel casing, and concrete will then be poured into the casing. Our noise impact analysis and Table 1 assume the use of an impact hammer because this is the method that would result in potentially greater acoustic impacts.

A new catwalk and mooring dolphin will also be installed at the existing passenger ferry dock (Figure 3). The catwalk will measure 4 ft wide by 25 ft long and will provide access to the new mooring dolphin at the passenger ferry dock. The new mooring dolphin will measure 10 ft by 10 ft and will be supported by 4 new 20-in piles. These will be installed in the same way as the piles for the cargo ramp.

Once construction is complete in Sardinas Bay, regular cargo ferry service will resume at these facilities. The San Idelfonso Auxiliary Cargo Port would then be used only during emergency situations that render the Sardinas Bay cargo ramp inoperable.

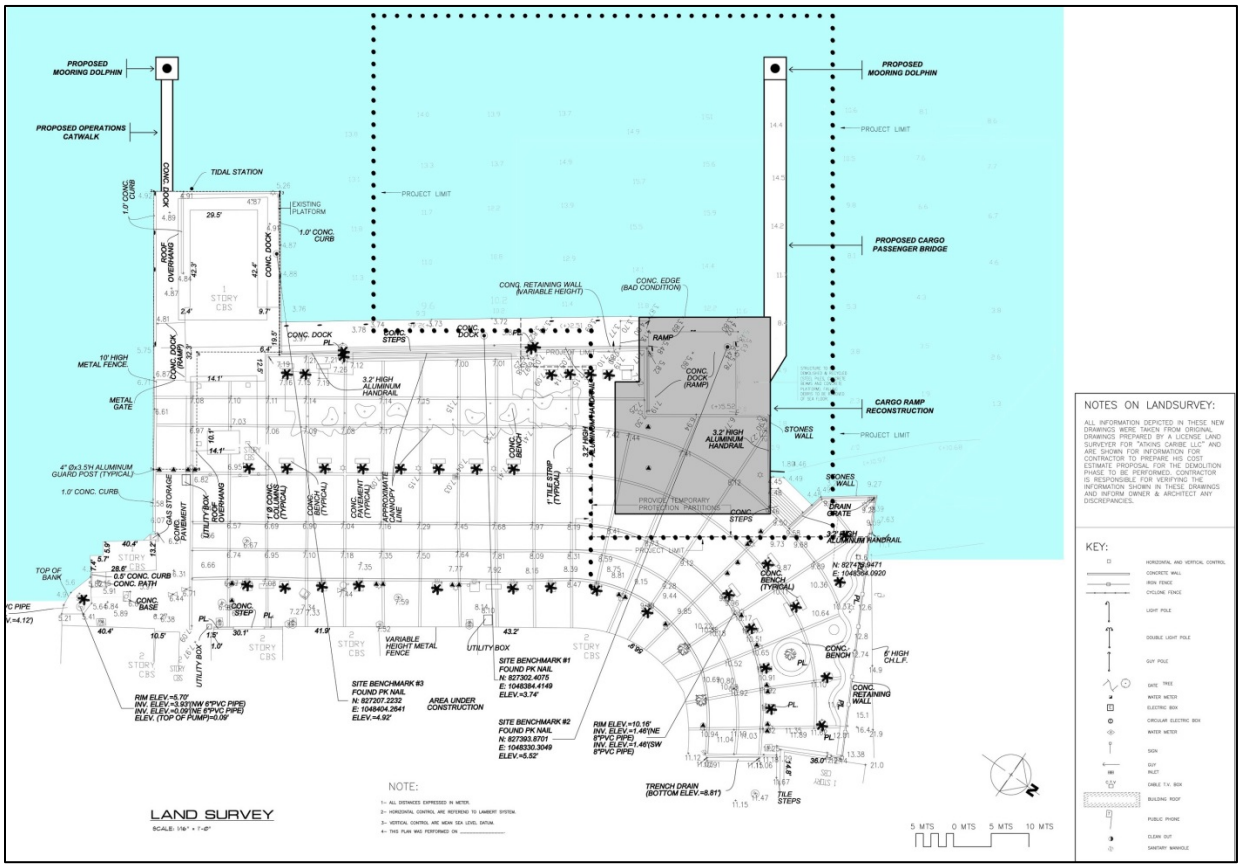

Figure 3. Proposed plan for improvements to Sardinas Bay Cargo Ramp shown in grey with new catwalk extending from it and new mooring dolphin and catwalk for passenger ferry on far left in figure (from Atkins Caribe 2015)

Table 1. Pile Installation Required for Project

Location	Pile type	Number of Piles	Installation Method	Confined Space or Open Water
San Idelfonso	30-in steel casing with poured cement 18-in steel casing with poured cement	15-17 14	Auger drilling and vibratory hammer to install steel casing and rebar form Auger drilling and vibratory hammer to install steel casing and rebar form	Open water
Sardinas	20-in double steel casing with poured cement	37	Auger drilling and vibratory hammer to install steel casing, impact hammer to install smaller steel casing and rebar form inside it	Open water

Construction Conditions
The applicant has agreed to the following conservation measures for the construction in both locations and the operation of the auxiliary cargo port:

- Turbidity barriers will be installed around in-water work areas prior to commencement of any pile-driving activities to contain any sediment suspended during pile-driving.
- A Spill Prevention Control and Countermeasures Plan will be implemented to prevent hydraulic fluid, diesel, and other potential pollutants from heavy equipment from entering surface waters (in development). The final plan must be approved by the USCG to ensure it is adequate to prevent contamination of surface waters due to accidental spills from vessels and facility operation.
- A Turbidity Monitoring Plan and Erosion and Sedimentation Control Plan (see drafts in Appendix A) will be finalized in coordination with NMFS prior to commencement of any construction activities. The Erosion and Sedimentation Control Plan will be implemented for sediment and erosion control during construction of the upland sections of the San Idelfonso Auxiliary Cargo Port portion of the project in order to minimize the potential transport of land-based contaminants, including sediments, to nearshore waters. The Turbidity Monitoring Plans will be implemented for monitoring turbidity levels outside the turbidity barriers in Sardinas and San Idelfonso to ensure that sediment resuspension and transport outside the in-water construction footprint at each site is minimal. In the event that these plans are modified in a manner that causes an effect on the ESA-listed species or designated critical habitats not considered in this Opinion, reinitiation of ESA Section 7 consultation for the project may be necessary.
- Divers will backfill spud holes once the construction barge changes position.

- A new stormwater system will be constructed to collect and treat the first flush from each rain event at the new San Idelfonso Auxiliary Cargo Port facility.
- Turbidity barriers shall be constructed of a material that prevents entanglement by sea turtles and marine mammals. These barriers must be properly secured and regularly monitored to avoid entrapment of sea turtles and marine mammals.
- Compliance with NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions* (dated March, 23, 2006, Appendix B)
- Compliance with NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners* (revised February 7, 2008, Appendix C)
- A protocol for the approach and departure from the auxiliary ferry terminal at San Idelfonso will be required for ferry captains. The protocol will emphasize the need for slow speed (8-10 knots) inside Ensenada Honda in part to reduce propeller impacts to seagrass and corals at the entrance to the bay and at the new facility (Appendix D).
- A 100-meter (m) safety zone will be established for monitoring for sea turtles during pile-driving activities in both locations. A trained vessel crew will monitor and report observations of sea turtles within a 100-m radius of the pile driving barge. NMFS will be notified of sea turtle sightings. If a sea turtle is sighted within a 100-m radius of the pile-driving activity, the activity will cease until the turtle moves out of the exclusion zone and has not been sighted for 30 minutes.
- The auger drilling method will be used to install steel pile casings at the San Idelfonso site in Ensenada Honda. A double casing system will be required for pile driving in Sardinas Bay.
- An Underwater Noise Monitoring Plan will be implemented for all pile-driving activities. The final plan will be coordinated with NMFS prior to commencement of any in-water construction activities (see draft in Appendix E).
- In-water construction work will occur during daylight hours only.
- The applicant has reported that a Quit Claim Deed will be finalized in coordination with the U.S. Fish and Wildlife Service because of the auxiliary cargo port's location within a portion of the Culebra Island National Wildlife Refuge. The deed will restrict use to temporary operations during the reconstruction of the existing cargo facilities in Sardinas Bay and, upon completion of the reconstruction of the existing facilities, use only in the event that the facility in Sardinas Bay is damaged or inoperable or cannot be used due to inclement weather or another emergency.
- A monitoring plan will be implemented to assess the condition of ESA-listed corals at the entrance to Ensenada Honda and seagrass beds outside the construction footprint at San Idelfonso before and after the construction and operation of the auxiliary cargo port facilities. The plan is meant to determine whether the construction and operation of the auxiliary cargo port results in impacts to ESA-listed corals and green sea turtle critical habitat in order to develop additional minimization measures for any future temporary cargo operations at this facility. The final plan will be coordinated with NMFS prior to commencement of any in-water construction activities (see draft in Appendix F).
- A Coral Transplant Plan, including the transplant of 4 colonies of ESA-listed lobed star corals, will be implemented prior to commencement of any in-water construction at the San Idelfonso site (see draft in Appendix G). ESA-listed corals and other coral species are on the piles of the existing dock at the San Idelfonso site. All corals will be removed

and relocated to a recipient site or sites determined in coordination with DNER and NMFS.

3.2. Action Area

The action area is defined by regulation as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 CFR 402.02). The new San Idelfonso Auxiliary Cargo Port is located at 18.30629ºN, 65.28346ºW (World Geodetic System 1984 [WGS 84]). The existing Sardinas Bay Cargo Pier is located at 18.30154ºN, 65.30271ºW WGS 84.

For purposes of this consultation, NMFS will consider the action area to be the area between Fajardo, on the east coast of the main island of Puerto Rico, where ferries transit to and from Culebra and Sardinas Bay, and the approach to the bay for the existing cargo ferry and all of Ensenada Honda where the new auxillary cargo ferry port will be located in San Idelfonso. The action area encompasses all potential routes for work vessels transiting to and from the project site and the ferry routes for cargo ferries transiting between the main island of Puerto Rico and Culebra. The action area also includes all of Ensenada Honda, where the new auxiliary cargo port will be located, because sediments and other pollutants from the construction of this new facility may be transported to other portions of this bay during project construction and operation.

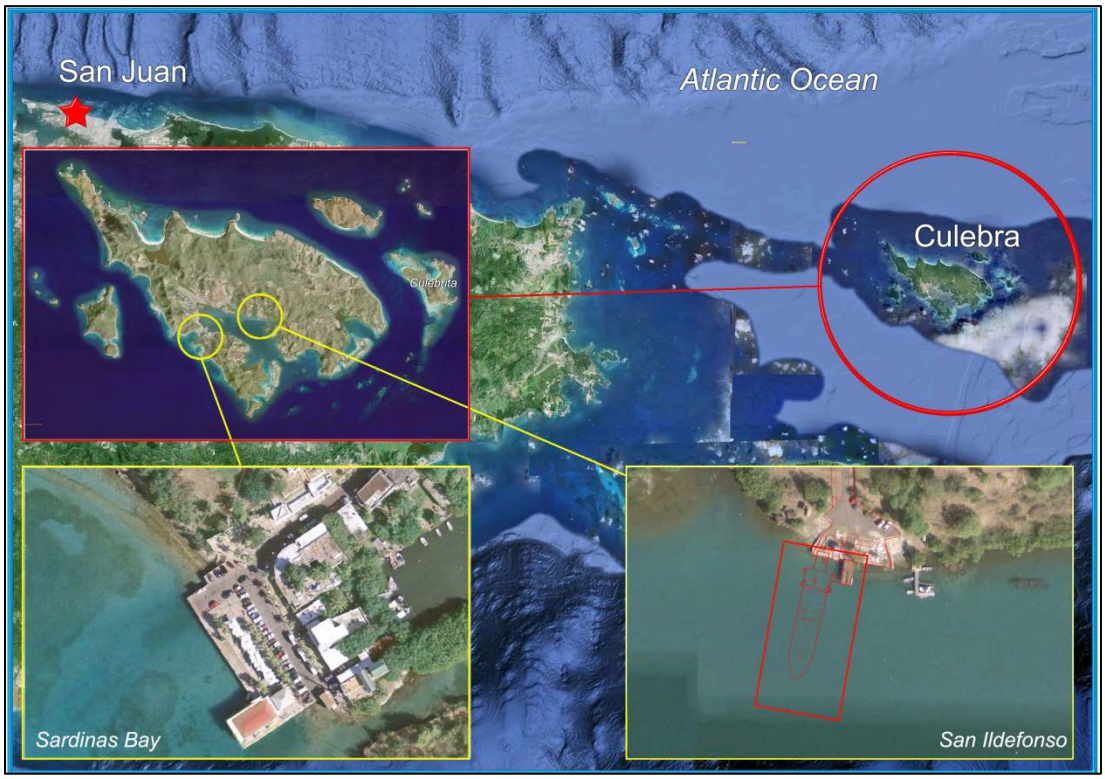

Figure 4. Image of 2 project locations and locations (existing cargo ferry ramp in Sardinas Bay and proposed new facility in Ensenada Honda) in relation to Culebra and the main island of Puerto Rico (from Atkins Caribe 2015)

4. STATUS OF SPECIES AND CRITICAL HABITATS

Listed species occurring within the action area that may be affected by the proposed action are itemized in Table 2 with their respective scientific name and status. Designated critical habitat in the action area is listed in Table 3.

Table 2. Status of Listed Species that May be Present in the Action Area

Species		Status	Action Agency Effect Determination	NMFS Effect Determination
Sea Turtles	Loggerhead sea turtle, NWA DPS, *Caretta caretta*	T	NLAA	NLAA
	Green sea turtle, NA DPS, *Chelonia mydas*	T	NLAA	NLAA
	Leatherback sea turtle, *Dermochelys coriacea*	E	NLAA	NLAA
	Hawksbill sea turtle, *Eretmochelys imbricata*	E	NLAA	NLAA
Invertebrates	Staghorn coral, *Acropora cervicornis*	T	NLAA	NLAA
	Elkhorn coral, *Acropora palmata*	T	NLAA	NLAA
	Boulder star coral, *Orbicella franksi*	T	NLAA	NLAA
	Mountainous star coral, *Orbicella faveolata*	T	NLAA	NLAA
	Lobed star coral, *Orbicella annularis*	T	LAA	LAA
	Rough cactus coral, *Mycetophyllia ferox*	T	NLAA	NLAA
	Pillar coral, *Dendrogyra cylindrus*	T	NLAA	NLAA
Fish	Nassau grouper, *Epinephelus striatus*	T	NLAA	NLAA
E = Endangered; T = Threatened; NLAA = Not Likely to Adversely Affect; LAA = Likely to Adversely Affect				

Table 3. Critical Habitats in the Action Area

Critical Habitat For:	Species	Unit	Action Agency Effect Determination	NMFS Effect Determination
	Elkhorn and staghorn coral	Puerto Rico Unit	ND	NLAA
	NA DPS Green sea turtle[3]	Culebra Island	ND	NLAA
NLAA = Not Likely to Adversely Affect; ND = No Determination				

4.1. Analysis of Species and Critical Habitats Not Likely to be Adversely Affected

As discussed below, NMFS concludes that the proposed action is not likely to adversely affect the following species or critical habitats:

<u>Sea Turtles</u>
Effects to green, loggerhead, and hawksbill sea turtles include the risk of direct physical impact from the in-water equipment during in-water construction activities. There has been limited leatherback nesting reported in the bays to the north of Sardinas. We do not expect leatherback sea turtles to be in Ensenada Honda because this is an offshore species that only comes inshore to nest. While there are nesting beaches on Culebra for this species, none of them are found in Ensenada Honda. Based on a review of our records and data from the Puerto Rico Department of Natural and Environmental Resources, leatherbacks have not been sighted in Ensenada Honda. Therefore, we believe there will be no effect to leatherback sea turtles from in-water equipment. There are coral and seagrass habitats in various locations within Ensenada Honda and Sardinas Bay. Sponges and other marine invertebrates were found on the existing piles of the piers at both locations. Some scattered seagrass beds are within the footprint of the proposed auxiliary cargo port at San Idelfonso and more extensive seagrass beds are found further outside the footprint. Coral reefs and colonized hard bottom are found at the entrance to Ensenada Honda and several of the smaller embayments within the larger bay, as well as around an island located to the north of the proposed port facility. Similarly, there are dense seagrass beds outside the footprint of the existing cargo and passenger ferry facilities in Sardinas Bay, as well as coral reefs and colonized hard bottom at the entrance to the bay. During the benthic surveys conducted for the project, no sea turtles were observed in the project area. However, green and hawksbill sea turtles are common around Culebra and have been observed by NMFS biologists at the entrance to Sardinas Bay and in various areas in Ensenada Honda during site inspections for other projects. There are few reports of loggerhead nesting on Culebra and sightings of this species are very rare but the species could be present in nearshore habitats in the action area. The species' ability to move away from the project site if they encounter moving equipment means effects associated with direct physical impact will be extremely unlikely to occur and will therefore be discountable. The implementation of a 100-m safety zone (in addition to NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*) will further reduce the risk of injury

[3] The existing green turtle critical habitat designation (i.e., waters surrounding Culebra Island, Puerto Rico; 63 FR 46693; Sept. 2, 1998) remains in effect for the green sea turtle NA DPS.

with the requirement that all work be stopped if a sea turtle is observed less than 100-m from the operating or moving equipment.

Green, leatherback, loggerhead and hawksbill sea turtles could be injured or killed if they are struck by work vessels transiting to and from the Sardinas Bay project site. There is limited leatherback nesting on beaches around Culebra, none of which are within Ensenada Honda or Sardinas Bay where the 2 portions of this project will be constructed. There is potential for leatherbacks to be in the area of barge traffic if construction takes place during the nesting season for this species because barges will be transiting through deep water offshore areas between the main island of Puerto Rico and the 2 bays where in-water construction will take place. Compliance with NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners* will minimize the risk of injury because vessels will operate at low speeds and have sea turtle and marine mammal observers. This will provide protection to sea turtles during the transit of barges used during the dredging operation, by requiring that vessels maintain set distances from sea turtles for their transit. As stated above, sea turtles were not observed during the benthic survey conducted for the project, and the Puerto Rico Ports Authority does not have any reports of impacts to sea turtles associated with operation of the existing cargo and passenger ferry facilities in Sardinas Bay. The construction barge will operate at low speeds that enable sea turtles to move out of the path of this type of vessel. Based on this information, we believe the risk of injury from collision with work vessels during transit will be discountable.

Green, loggerhead and hawksbill sea turtles will be temporarily unable to use refuge and foraging habitat at the project sites due to avoidance of construction activities. Leatherback sea turtles are an offshore species that are found in nearshore environments only during nesting season while transiting to and from nesting beaches. This species does not use nearshore habitat for refuge and foraging. Turbidity caused by pile driving may also temporary impact impact these species. Turbidity will be minimized by installing turbidity barriers around the area where pile driving will take place at both cargo ferry locations. The use of the auger drilling method to install steel casings at each location will also result in minimal sediment resuspension during the installation of the casing. Once this casing is installed, it will serve as a physical barrier to prevent additional sediment resuspension during pile driving. A monitoring plan will be implemented to ensure the barriers are effective in controlling sediment transport outside the work areas (Appendix A). If sediment transport outside the areas enclosed by the turbidity barriers is observed, work will stop immediately. At the San Idelfonso site, the transport of sediments from land-based construction activities could also affect green, loggerhead, and hawksbill refuge and foraging habitat. The applicant will implement a sediment and erosion control plan for all terrestrial construction activities that will include the installation of turbidity curtains and other barriers to sediment transport to nearshore waters. This plan, along with a plan for monitoring turbidity during all in-water construction work and during operation of the San Idelfonso facility, will be finalized in coordination with NMFS to ensure that effective control measures to minimize sediment transport outside work and operational footprints are implemented to protect ESA resources in a manner consistent with this Opinion. The applicant will also construct permanent stormwater controls at the site to minimize the potential transport of sediment and other land-based pollutants from the terrestrial portion of the project during construction and operation. Seagrass and coral habitats outside the project footprints will continue to provide refuge and foraging habitat for green, loggerhead, and hawksbill sea turtles during the project. Therefore, we believe effects to green, loggerhead, and hawksbill sea turtles

due to temporary avoidance of refuge and foraging habitat during in-water work hours and temporary sediment impacts to habitat will be insignificant.

Green, loggerhead, and hawsbill sea turtles could also be affected by temporary impacts to refuge and foraging habitat at the project sites due to water quality declines associated with spills from facility operations. The cargo facility has been operating in Sardinas Bay for decades and has a Spill Prevention and Control Countermeasures Plan approved by the USCG. There have been no major incidents associated with the operation of the facility that have resulted in impacts to ESA resources, including sea turtle refuge and foraging habitat based on information in our project files and from NOAA's Office of Response and Restoration. The San Idelfonso facility will also have a Spill Prevention and Control Countermeasures Plan approved by the USCG prior to commencing operations. Given the history of the existing cargo port operated by PRPA, we anticipate that operation of the San Idelfonso site will no result in significant impacts to refuge and foraging habitat for green, loggerhead, and hawksbill sea turtles as a result of spills. The San Idelfonso operation will be similar to that in Sardinas Bay where seagrass and coral resources are present outside the cargo port footprint despite decades of port operation. Therefore, we believe the potential effects to sea turtles from temporary habitat impacts associated with spills from facility operations will be discountable.

There will be minor impacts to seagrass associated with the construction of the auxiliary cargo port platform at the San Idelfonso site, which may impact green sea turtle refuge and foraging habitat. Given the amount of seagrass outside the project footprint and the fact that seagrass within the footprint of the proposed facility are sparse because the area has served as a dock and boat launching facility for decades, we believe that any effect on green sea turtles from the potential impact to scattered seagrass from shading by the cargo vessel will be insignificant. There will be no loss of seagrass or coral habitats at Sardinas Bay as all work will take place within the existing footprints of the cargo pier and passenger ferry.

The project will result in the transit of cargo ferry vessels in and out of Ensenada Honda each time the new auxiliary cargo port facilities are in use at San Idelfonso. Three trips per day will be made to and from the auxiliary cargo port facilities over the 6-month construction period needed to complete the proposed reconstruction of the Sardinas Bay cargo ramp. Four vessels that range from 155-165 ft in length, with drafts of 7 or 11.75-ft, will use the auxiliary cargo port facilities. This will result in a temporary increase in the transit of large vessels in Ensenada Honda. Currently there is a considerable amount of recreational vessel traffic, including sailing and motorized vessels. During the winter months, there are also occasional visits by small cruise ships that anchor in Ensenada Honda in accordance with permits issued by the Puerto Rico Department of Natural and Environmental Resources. These cruise ships are approximately 344 ft long. The temporary regular transit of the cargo vessels to and from the new auxiliary cargo port at San Idelfonso will represent an increase in the traffic of larger vessels in the area but not an increase in the number of cargo vessels transiting to Culebra, as this will remain constant at 2 vessel trips per day. However, this temporary increase in the traffic of larger vessels in the San Idelfonso area will not result in an increase in the concentration of vessels operating in Culebra, which is what poses an increased risk of vessel strikes. Regular cargo ferry traffic to the San Idelfonso facilities will cease once the cargo ramp in Sardinas Bay has been reconstructed and can resume operations. Therefore, we believe that the risk to sea turtles from vessel strikes

associated with the use of the new auxiliary cargo port facilities by cargo ferries on a temporary basis will be discountable.

Effects to sea turtles as a result of noise created by construction activities can physically injure animals in the affected areas or change animal behavior in the affected areas. Injurious effects can occur in 2 ways. First, effects can result from a single noise event exceeding the threshold for direct physical injury to animals, and these constitute an immediate adverse effects on these animals. Second, effects can result from prolonged exposure to noise levels that exceed the daily cumulative exposure threshold for the animals, and these can constitute adverse effects if animals are exposed to the noise levels for sufficient periods. Behavioral effects can be adverse if such effects prevent animals from migrating, feeding, resting, or reproducing, for example. Our evaluation of effects to listed species as a result of noise created by construction activities is based on the analysis prepared for the California Department of Transportation (CALTRANS 2009) and SAJ-82 (NMFS 2014). The noise analysis in this consultation evaluates effects to ESA-listed sea turtles identified by NMFS as potentially affected in the table above.

Based on our noise calculations in SAJ-82 (NMFS 2014), the use of an auger to create a pilot hole at both sites will not result in injurious or behavioral noise effects.

Based on our noise calculations, installation of steel pipe piles using vibratory hammer at both sites will not result in any form of injurious noise effects to sea turtles. We used CALTRANS (2009) noise analysis for the vibratory installation of 36-in steel pipe piles and assumed a maximum of 8 hours of vibratory pile driving per day (which is likely an overestimate) as a surrogate for the installation of steel pipe piles with a diameter of up to 30-in. Based on our analysis, vibratory pile driving will not result in peak pressure or single-strike (SEL) noise effects. There will essentially be no cumulative SEL effects either, as a sea turtle would have to remain within 2 ft (0.6 m) of the pile for these effects to occur, and work will not continue with an animal at such close range. This installation method could result in behavioral effects at radii of up to 152 ft (46 m) for sea turtles. Given the mobility of sea turtles, we expect them to move away from noise disturbances. Because there are seagrass beds and coral habitats nearby in each project location, as discussed above, we believe this effect will be insignificant. If an individual chooses to remain within the behavioral response zone, it could be exposed to behavioral noise impacts during pile installation. Since installation will occur only during the day, these species will be able to resume normal activities during quiet periods between pile installations and at night. In addition, the 100-m distance observation area established for this project to ensure that sea turtles are not present near pile-driving activity will minimize the potential for behavioral impacts to sea turtles to occur associated with pile driving. Therefore, it is extremely unlikely that installation of piles by vibratory hammer will result in injurious noise effects, and we anticipate any behavioral effects will be insignificant.

Based on our noise calculations using CALTRANS (2009) data for the installation of 24-in steel pipe piles with an impact hammer, if selected by the contractor, the installation of 20-in steel pipe piles at the Sardinas Bay site will not exceed the single-strike threshold for injury to sea turtles. Without the proposed use of double casing for impact pile-driving activities, the peak-pressure threshold for injurious noise effects would be exceeded at 21 ft (6 m) from the source. The cumulative sound exposure level of multiple pile strikes over the course of a day would

cause injury to ESA-listed sea turtles up to 1,470 ft (448 m) away from the pile. This is based on the assumption that up to 5 piles will be driven per day, and approximately 600 strikes will be needed to drive each pile (CALTRANS 2009). However, because PRPA will require the use of a double-casing system for pile-driving activities involving any use of an impact hammer in Sardinas Bay, we expect the injurious noise effects threshold to be reduced. CALTRANS (2009) found the use of this system with air bubbles inside or with the water removed proposed by the applicant), reduced sound impacts by 20 decibels. This means that there would be no single-strike or peak-pressure noise effects to sea turtles. The cumulative sound exposure level would be reduced to 68 ft (21 m) away from the pile for sea turtles. To avoid potential noise effects to sea turtles, prior to active pile driving, a marine observer must be present. This observer will survey the area for sea turtles prior to the commencement of any pile-driving activities, and delay pile driving if one is seen in the area. If a sea turtle is noted within 100-m of the pile-driving barge or during driving of piles, pile driving will not take place until the turtle leaves the area and has not been re-sighted for 30 minutes. This distance, coupled with the use of the double casing system and the use of observers to survey the 100-m safety zone, will ensure the potential for sea turtles to suffer injurious effects from pile-driving activities in Sardinas Bay is extremely unlikely. Also, we assume that if a sea turtle were in the action area undetected when pile driving commenced, it would leave the area of its own volition as there are no physical impediments to prevent it from leaving. Because we anticipate the animal will move away, and observers will survey the area prior to and during any pile driving, we believe that an animal suffering physical injury from cumulative noise exposure is extremely unlikely to occur and is therefore discountable. An animal's movement away from the injurious sound radius is a behavioral response, with the same effects discussed below.

The installation of steel pipe piles using an impact hammer could also result in behavioral effects at radii of 152 ft (46 m) from the sound source for sea turtles. Due to the mobility of sea turtles, we expect them to move away from noise disturbances in the open-water environment where the existing cargo pier is located. Because there are other areas of colonized hard bottom and seagrass beds in the action area and because the piles will be installed within the footprint of the existing cargo pier in Sardinas Bay, we believe behavioral effects will be insignificant. If an individual chooses to remain within the behavioral response zone, it could be exposed to behavioral noise impacts during pile installation. Since installation will occur only during the day, these species will be able to resume normal activities during quiet periods between pile installations and at night. In addition, because this area is an active cargo and passenger port, the number of sea turtles is already limited compared to other areas of Culebra based on unpublished data from the Puerto Rico DNER. Furthermore, the potential radii of 46 m for behavioral impacts is within the 100-m safety zone within which the contractor will be required to monitor for sea turtles during all pile-driving activity. Therefore, we anticipate any behavioral effects will be insignificant. Individuals will be able to resume normal activities during quiet periods between pile installations and at night, and pile driving will not occur if sea turtles are observed within 100-m of the activity.

<u>Elkhorn, Staghorn, Pillar, Rough Cactus, Mountainous Star, and Boulder Star Corals</u>
Lobed star corals are present on the piles of the existing pier at the San Idelfonso site. No other ESA-listed coral species are present on the piles of the existing structures or within the project

footprints in Sardinas Bay and the San Idelfonso site. The project effects to lobed star corals are discussed in Section 6 of this document.

Based on a review of our project files and observations by NMFS's biologists during site inspections for other projects in Culebra, there are ESA-listed corals on coral reefs and colonized hard bottom at the mouth of Ensenada Honda and other small embayments in it, as well as at the mouth of Sardinas Bay. We do not have a species list, but elkhorn, staghorn, and pillar coral colonies and colonies from the star coral (*Orbicella* spp.) complex have been observed in these areas. Because there are a number of coral reef and colonized hard bottom sites in the action area and there is no comprehensive survey of coral habitats around Culebra, it is possible that rough cactus corals occur on reefs and colonized hard bottom in nearshore areas to the east and west of the harbor. The project may result in impacts to ESA-listed coral colonies outside the in-water construction footprint if suspended sediments are transported outside the work area. The use of turbidity barriers at both project sites and the method of pile driving that includes the installation of a steel casing using auger drilling at each site are expected to minimize the transport of sediments outside the construction footprint. The applicant will implement a Turbidity Monitoring Plan at each work site (Appendix A) to be sure the barriers and other control measures such as the use of a steel pipe pile as a casing are effective in minimizing the transport of sediments outside the in-water construction footprint. Measures such as work stoppage will be taken if sediment transport beyond the barriers is found to occur. These measures will protect ESA-listed coral colonies that are in the project area. Thus, we believe that impacts to elkhorn, staghorn, pillar, rough cactus, boulder star, and mountainous star corals outside the in-water construction footprint associated with the transport of sediments will be discountable.

The project may also result in impacts to staghorn, elkhorn, boulder star, mountainous star, pillar, and rough cactus corals due to accidental groundings, particularly at the entrance to Ensenada Honda during the use of the San Idelfonso Auxiliary Cargo Port. There are existing federal ATONS marking the channel entrance and the USCG notified the applicant that these will be adequate for the proposed operation of cargo ferries associated with the auxiliary port. (However, as noted in Section 4.1, PRPA is considering the installation of additional ATONS but these will be treated in a future consultation, if proposed.) The applicant noted that there are no records of accidental groundings by the cargo ferries in Sardinas Bay, where cargo ferry operations have been ongoing for decades. The applicant will implement a monitoring plan to determine whether the operation of the new auxiliary cargo port has an effect on ESA-listed corals (Appendix F) and will ensure that pilots use primary and secondary navigation systems to avoid accidental groundings while leaving and entering Ensenada Honda (Appendix D). In addition, regular cargo ferry traffic to the San Idelfonso facilities will cease once the Sardinas Bay cargo ramp reconstruction is complete. The San Idelfonso facilities will then be used only in emergency situations that render the Sardinas Bay cargo ramp inoperable or inaccessible. Thus, we believe the potential impacts of accidental groundings associated with the new auxiliary cargo port at San Idelfonso in particular will be discountable.

<u>Elkhorn and Staghorn Coral Critical Habitat</u>

The project is located within the boundary of the Puerto Rico elkhorn and staghorn coral critical habitat unit. The physical feature essential to the conservation of elkhorn and staghorn corals,

namely substrate of suitable quality and availability[4] to support larval settlement and recruitment and reattachment and recruitment of asexual fragments is present within the action area.

Reefs and colonized hard bottom at the mouth of Ensenada Honda, as well as at the entrances to smaller embayments within this larger bay and around the small cay north of the project in the bay, and at the entrance to Sardinas Bay contain the essential feature of elkhorn and staghorn critical habitat. These areas could be affected during in-water construction activities through the transport of suspended sediments associated with pile driving. These areas could also be affected by accidental groundings associated with the construction and operation of the new auxiliary cargo port facilities at San Idelfonso. The use of turbidity barriers around the in-water construction areas coupled with water quality monitoring and the use of pile casings to ensure sediment plumes are not transported outside the in-water work areas are expected to minimize the potential impacts of sediment to elkhorn and staghorn coral critical habitat. The existing navigation markers at the entrance to Ensenada Honda, as well as the requirements for ferry captains related to safe navigation are expected to minimize the potential for accidental groundings of cargo ferries using the auxiliary facilities. There are no records of cargo ferry groundings associated with past operation and transit to the existing facilities in Sardinas Bay and this project is not expected to introduce any change that would increase the likelihood of groundings. Therefore, we believe that in-water construction turbidity effects are insignificant, and the potential effects of accidental groundings to elkhorn and staghorn coral critical habitat are discountable.

Green Sea Turtle Critical Habitat

The project is located in green sea turtle critical habitat. Critical habitat for the North Atlantic DPS of green sea turtles includes waters extending seaward 3 nautical miles from the mean high water line of Culebra Island, Puerto Rico, including outlying keys (Cayo Norte, Cayo Ballena, Cayos Geniquí, Isla Culebrita, Arrecife Culebrita, Cayo de Luís Peña, Las Hermanas, El Mono, Cayo Lobo, Cayo Lobito, Cayo Botijuela, Alcarraza, Los Gemelos, and Piedra Steven), that provide habitat necessary for the continued survival and recovery of green sea turtles in the region.[5] This area provides important green turtle developmental habitat. In particular, it hosts seagrass beds, including turtle grass, which serve as the principal dietary component of juvenile and adult green turtles throughout the Wider Caribbean region. In addition, the coral reefs and other topographic features within the waters around Culebra Island and surrounding islands and cays provide green turtles with shelter during interforaging periods that serve as refuge from predators.

A portion of the footprint of the new auxiliary cargo port will be located adjacent to scattered seagrass beds that are part of the critical habitat utilized by green sea turtles. Based on information provided by PRPA, no direct impacts to seagrass will occur as a result of the construction of the new cargo port facility in San Idelfonso as there is no seagrass within the

[4] Substrate of suitably quality and availability is defined as natural consolidated hard substrate or dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover.

[5] On April 6, 2016, NMFS published a final rule listing 11 DPSs of the green sea turtle, including the North Atlantic DPS. 81 FR 20058; April 6, 2016. NMFS will issue a rule designating critical habitat for the DPSs in a future rulemaking. In the interim, the existing critical habitat designation (i.e., waters surrounding Culebra Island, Puerto Rico; 63 FR 46693; Sept. 2, 1998) remains in effect for the North Atlantic DPS. 81 FR 20058; April 6, 2016.

dock footprint. The cargo vessel, when moored to the ramp in San Idelfonso, will shade an area of seagrass with less than 10% cover by *Halophila decipiens*. However, seagrass loss from shading typically occurs when fixed objects are located over seagrass for 2 weeks or more. Therefore, because the vessel is expected to remain at the dock for hours rather than days, we do not expect any loss of seagrass. No seagrass is located within the footprint of the existing cargo ramp in Sardinas Bay. There are dense seagrass beds outside the project footprints and in other portions of Ensenada Honda and Sardinas Bays. These areas could be affected during in-water construction activities through the transport of suspended sediments associated with pile driving. However, the use of turbidity barriers, coupled with water quality monitoring and the use of pile casings to ensure sediment plumes are not transported outside the in-water work areas, are expected to minimize the potential impacts of sediment on nearby seagrass beds. We believe that any vessel shading impacts to seagrass that serves as foraging habitat for green sea turtles at the San Idelfonso Auxiliary Cargo Port site will be insignificant given the extent of seagrass beds in the project area and around Culebra and because we do not expect shading to result in a loss of seagrass. We also believe that any impacts to seagrass beds that serve as foraging habitat for green sea turtles at both project sites during in-water construction activities will be insignificant due to the implementation of the measures described above and the temporary nature of any impacts, and will not result in a loss of seagrass from the action area.

Coral reefs and other coral habitats that provide refuge from predators and shelter during interforaging periods to green sea turtles will not be directly affected by the construction of the new cargo port facility in San Idelfonso or the reconstruction of the existing cargo ramp and installation of a new mooring dolphin for the existing passenger ferry dock in Sardinas Bay. The only corals within the footprint of the project are colonies growing on the piles of existing piers in each location. There are no coral reefs or other natural coral habitats in the project footprints. As discussed above, reefs and colonized hard bottom are present at the entrance to and within Ensenada Honda and at the entrance to Sardinas Bay. These areas could be affected by the transport of suspended sediments during in-water construction activities. The use of turbidity barriers around the in-water construction areas coupled with water quality monitoring and the use of pile casings to ensure sediment plumes are not transported outside the in-water work areas are expected to minimize the potential impacts of sediment to coral reefs and colonized hard bottom that provide shelter and refuge habitat to green sea turtles. These areas could also be affected by accidental groundings associated with the construction and operation of the new auxiliary cargo port facilities at San Idelfonso. The existing navigation markers at the entrance to Ensenada Honda, as well as the requirements for ferry captains related to safe navigation are expected to minimize the potential for accidental groundings of cargo ferries using the auxiliary facilities. Therefore, we believe that in-water construction turbidity effects are insignificant, and the potential effects of accidental groundings to coral areas that provide shelter and refuge habitat to green sea turtles are discountable.

<u>Nassau grouper</u>

NMFS published a final listing rule for Nassau grouper (*Epinephelus striatus*) on June 29, 2016 (81 FR 42268) to list this species as threatened. FEMA included an effects determination for Nassau grouper in their consultation request for this project. FEMA concluded that the project may affect, but is not likely to adversely affect this species. Because the species listing decision has been finalized, we include an analysis of potential project effects to Nassau grouper herein.

Benthic surveys completed at San Idelfonso and in Sardinas Bay did not find Nassau grouper. Because there are extensive seagrass beds, coral reefs, and colonized hard bottom in the action area, it is possible that Nassau grouper are present in these habitats. Thus, the species could be affected by impacts to their habitat associated with the transport of sediments during in-water construction activities. The minimization measures to be employed to control sediment resuspension and transport will prevent the transport of large sediment plumes to areas containing benthic habitat used by Nassau grouper for refuge and foraging.

Our evaluation of effects to Nassau grouper as a result of noise created by construction activities is based on the analysis prepared for the California Department of Transportation (CALTRANS 2009) and SAJ-82 (NMFS 2014). The noise analysis in this consultation evaluates effects to Nassau grouper.

Based on our noise calculations in SAJ-82 (NMFS 2014), the use of an auger to create a pilot hole at both sites will not result in injurious or behavioral noise effects to Nassau grouper.

Based on our noise calculations, installation of steel pipe piles using vibratory hammer at both sites will not result in any form of injurious noise effects. We used CALTRANS (2009) noise analysis for the vibratory installation of 36-in steel pipe piles and assumed a maximum of 8 hours of vibratory pile driving per day (which is likely an overestimate) as a surrogate for the installation of steel pipe piles with a diameter of up to 30-in. Based on our analysis, vibratory pile driving will not result in peak pressure, single-strike (SEL), or cumulative SEL noise effects. This installation method could result in behavioral effects at radii of up to 705 ft (215 m) for fish. Given the mobility of fish, we expect them to move away from noise disturbances. Because there are seagrass beds and coral habitats nearby in each project location, as discussed above, we believe this effect will be insignificant. If an individual chooses to remain within the behavioral response zone, it could be exposed to behavioral noise impacts during pile installation. Since installation will occur only during the day, these species will be able to resume normal activities during quiet periods between pile installations and at night. Because there is no refuge or foraging habitat within the project footprints and the species was not observed at either project location during benthic surveys conducted for the project, we anticipate any behavioral effects will be insignificant.

Based on our noise calculations using CALTRANS (2009) data for the installation of 24-in steel pipe piles with an impact hammer, if selected by the contractor, the installation of 20-in steel pipe piles at the Sardinas Bay site will not exceed the single-strike threshold for injury to fish. Without the proposed use of double casing for impact pile-driving activities, the peak-pressure threshold for injurious noise effects would be exceeded at 21 ft (6 m) from the source. The cumulative sound exposure level of multiple pile strikes over the course of a day would cause injury to ESA-listed sea turtles up to 2,070 ft (631 m) away from the pile. This is based on the assumption that up to 5 piles will be driven per day, and approximately 600 strikes will be needed to drive each pile (CALTRANS 2009). However, because PRPA will require the use of a double-casing system for pile-driving activities involving any use of an impact hammer in Sardinas Bay, we expect the injurious noise effects threshold to be reduced. CALTRANS (2009) found the use of this system with air bubbles inside or with the water removed reduced sound

impacts by 20 decibels. The use of a double casing system therefore means that there would be no single-strike or peak-pressure noise effects to Nassau grouper. The cumulative sound exposure level would be reduced to 96 ft (29 m) away from the pile for fish. The use of the double casing system will ensure any injurious effects from pile-driving activities in Sardinas Bay are extremely unlikely. Also, we assume that if a fish were in the action area undetected when pile driving commenced, it would leave the area of its own volition as there are no physical impediments to prevent it from leaving. Because we anticipate the animal will move away, and observers will survey the area prior to and during any pile driving, we believe that an animal suffering physical injury from cumulative noise exposure is extremely unlikely to occur and any effect is therefore discountable. An animal's movement away from the injurious sound radius is a behavioral response, with the same effects discussed below.

The installation of steel pipe piles using an impact hammer could also result in behavioral effects at radii of 707 ft (215 m) from the sound source for Nassau grouper. Due to the mobility of fish, we expect them to move away from noise disturbances in the open-water environment where the existing cargo pier is located. Because there are other areas of colonized hard bottom and seagrass beds in the action area and because the piles will be installed within the footprint of the existing cargo pier in Sardinas Bay, we believe behavioral effects will be insignificant. If an individual chooses to remain within the behavioral response zone, it could be exposed to behavioral noise impacts during pile installation. Since installation will occur only during the day, these species will be able to resume normal activities during quiet periods between pile installations and at night. In addition, there is no habitat within the footprint of the existing cargo ramp or location of the new passenger ferry mooring and no Nassau groupers were observed during benthic surveys conducted for the project. Therefore, we anticipate any behavioral effects will be insignificant. Additionally, individuals will be able to resume normal activities during quiet periods between pile installations and at night.

4.2. Analysis of Species Likely to be Adversely Affected

Four colonies of lobed star corals that are located on the existing dock at the San Idelfonso site are likely to be adversely affected by the proposed action. As required by this Opinion, these colonies will be transplanted to a location outside the construction footprint prior to commencement of in-water construction work.

The summary that follows describes the status of lobed star coral. More detailed information on the status and trends of this listed resource and its biology and ecology can be found in the listing regulation published in the Federal Register, status reviews, recovery plans, and on these NMFS websites:

- http://sero.nmfs.noaa.gov/protected_resources/index.html
- http://www.nmfs.noaa.gov/pr/species/esa/index.htm.

4.2.1 General Threats Faced by All Coral Species

Corals face numerous natural and man-made threats that shape their status and affect their ability to recover. Many of the threats are either the same or similar in nature for all listed coral species,

those identified in this section are discussed in a general sense for all corals. More detailed information on the threats to listed corals is found in the final rule listing 20 coral species as threatened, including lobed star coral (79 FR 53851; September 10, 2014,Final Listing Rule). Threat information specific to a particular species are then discussed in the corresponding status sections where appropriate.

Coral reefs are vulnerable to destruction and degradation caused by human activities (e.g., nutrient pollution, sedimentation, contaminant spills, vessel groundings and anchoring, recreational uses) and are also highly sensitive to the effects of climate change (i.e., higher incidences of disease and coral bleaching) (Crabbe et al. 2008; Wilkinson 2004). Continued loss of coral reef communities (especially in the greater Caribbean region) represents a major threat to recovery of the species, as well as a major threat to the recovery of ESA-listed corals due to the loss of areas containing the essential feature of coral critical habitat.

Multiple threats stress corals simultaneously or sequentially, whether the effects are cumulative, synergistic, or antagonistic. Ocean warming is likely to interact with many other threats, especially considering the long-term consequences of repeated thermal stress, and ocean warming is expected to worsen over the foreseeable future. Increased seawater temperature interacts with coral diseases to reduce coral health and survivorship. Coral disease outbreaks often have accompanied or immediately followed bleaching events and also follow seasonal patterns of high seawater temperatures. The effects of greater ocean warming (i.e., increased bleaching, which kills or weakens colonies) are expected to interact with the effects of higher storm intensity (i.e., increased breakage of dead or weakened colonies) in the Caribbean, resulting in an increased rate of coral declines. Likewise, land-based runoff, pollution, or other local stressors may worsen bleaching impacts by increasing coral susceptibility to bleaching and/or increasing the duration of lowered growth after a bleaching event (Carilli et al. 2009; Wooldridge 2009).

Several of the most important threats contributing to the extinction risk of corals are related to global climate change. The main concerns regarding impacts of global climate change on coral reefs generally, and on listed corals in particular, are the magnitude and the rapid pace of change in greenhouse gas (GHG) concentrations (e.g., carbon dioxide [CO_2] and methane) and atmospheric warming since the Industrial Revolution in the mid-19th century. These changes are increasing the warming of the global climate system and altering the carbonate chemistry of the ocean (ocean acidification), which affects a number of biological processes in corals, including secretion of their skeletons. The National Oceanic and Atmospheric Administration's (NOAA's) climate information portal provides basic background information on these and other measured or anticipated effects (see http://www.climate.gov).

Ocean Warming

Ocean warming is one of the most important threats posing extinction risks to the listed coral species; however, individual susceptibility varies among species. The primary observable coral response to ocean warming is bleaching of adult coral colonies, wherein corals expel their symbiotic algae in response to stress. For many corals, an episodic increase of only 1°C–2°C above the normal local seasonal maximum ocean temperature can induce bleaching. Corals can withstand mild to moderate bleaching; however, severe, repeated, and/or prolonged bleaching

can lead to colony death. Coral bleaching patterns are complex, with several species exhibiting seasonal cycles in symbiotic algae density. Thermal stress has led to bleaching and associated mass mortality in many coral species during the past 25 years. In addition to coral bleaching, other effects of ocean warming detrimentally affect virtually every life-history stage in reef-building corals. Impaired fertilization, developmental abnormalities, mortality, impaired settlement success, and impaired calcification of early life phases have all been documented. Average seawater temperatures in reef-building coral habitat in the wider-Caribbean have increased during the past few decades, and are predicted to continue to rise between now and 2100. Further, the frequency of warm-season temperature extremes (warming events) in reef-building coral habitat has increased during the past 2 decades, and it is also predicted to increase between now and 2100.

In addition to coral bleaching, other effects of ocean warming detrimentally affect virtually every life-history stage in reef-building corals. For 1 Indo-Pacific *Acropora* species, abnormal embryonic development occurs at 32°C, and complete fertilization failure occurs at 34°C (Negri and Heyward 2000). In addition to abnormal embryonic development (Lundgren and Hillis-Starr 2008; Miller 2002; Polato et al. 2010; Randall and Szmant 2009a), symbiosis establishment, larval survivorship, and settlement success are impaired in some Caribbean brooding (Randall and Szmant 2009b) and broadcast spawning (Lundgren and Hillis-Starr 2008; Randall and Szmant 2009a; Voolstra et al. 2009) coral species at temperatures as low as 30°C-32°C. Further, warmer temperatures appreciably accelerate the rate of larval development in the water column for spawning species (Polato et al. 2010; Randall and Szmant 2009a), which suggests that total dispersal distances could also be reduced, potentially decreasing the likelihood of successful settlement and the potential for replenishment of depleted areas (Brainard et al. 2011)

Ocean Acidification

Ocean acidification is a result of global climate change caused by increased GHG accumulation in the atmosphere. Reef-building corals produce skeletons made of the aragonite form of calcium carbonate; thus, reductions in aragonite concentrations caused by ocean acidification pose a major threat to these species and other marine calcifiers because it is more difficult to build their skeletons. Ocean acidification has the potential to cause substantial reduction in coral calcification and reef cementation. Further, ocean acidification adversely affects adult growth rates and fecundity, fertilization, pelagic planula settlement, polyp development, and juvenile growth. Ocean acidification can lead to increased colony breakage, fragmentation, and mortality. Based on observations in areas with naturally low pH, the effects of increasing ocean acidification may also include potential reductions in coral size, cover, diversity, and structural complexity.

As CO_2 concentrations increase in the atmosphere, more CO_2 is absorbed by the oceans, causing lower pH and reduced availability of carbonate ions, which in turn results in lower aragonite saturation state in seawater. Because of the increase in CO_2 and other GHGs in the atmosphere since the Industrial Revolution, ocean acidification has already occurred throughout the world's oceans, including in the Caribbean, and is predicted to considerably increase between now and 2100. Along with ocean warming and disease, we considered ocean acidification to be one of the most important threats posing extinction risks to coral species between now and the year 2100; however, individual susceptibility varies among the listed corals.

Sea Level Rise
Sea level rise may affect various coral life history events, including larval settlement, polyp development, and juvenile growth. It may also contribute to adult mortality and colony fragmentation, mostly due to increased sedimentation and decreased water quality (reduced light availability) caused by coastal inundation. The best available information suggests that sea level will continue to rise due to thermal expansion and the melting of land and sea ice. Theoretically, any rise in sea level could potentially provide additional habitat for corals living near the sea surface. Many corals that inhabit the relatively narrow zone near the ocean surface have rapid growth rates when healthy, which allowed them to keep up with sea level rise during the past periods of rapid climate change associated with de-glaciation and warming. Depending on the rate and amount of sea level rise, rapid rises can lead to reef drowning. Rapid rises in sea level could affect many coral species by both submerging them below their common depth range and, more likely, by degrading water quality through coastal erosion and potentially severe sedimentation or enlargement of lagoons and shelf areas.

Rising sea level is likely to cause mixed responses in coral species depending on their depth preferences, sedimentation tolerances, and growth rates. Reductions in growth rate due to local stressors, bleaching, infectious disease, and ocean acidification may prevent the species from keeping up with sea level rise (e.g., from growing at a rate that will allow them to continue to occupy their preferred depth range despite sea level rise). Additionally, lack of suitable new habitat, limited success in sexual recruitment, coastal runoff, and coastal hardening will compound some corals' ability to survive rapid sea level rise.

Diseases
Disease adversely affects various coral life history events by, among other processes, causing adult mortality, reducing sexual and asexual reproductive success, and impairing colony growth. A diseased state results from a complex interplay of factors including the cause or agent (e.g., pathogen, environmental toxicant), the host, and the environment. All coral disease impacts are presumed to be attributable to infectious diseases or to poorly-described genetic defects. Coral disease often produces acute tissue loss. Other manifestations of disease in the broader sense, such as coral bleaching from ocean warming, are incorporated under other factors (e.g., manmade factors such as ocean warming as a result of climate change).

Coral diseases are a common and significant threat affecting most or all coral species and regions to some degree, although the scientific understanding of individual disease causes in corals remains very poor. The incidence of coral disease appears to be expanding geographically, though the prevalence of disease is highly variable between sites and species. Increased prevalence and severity of diseases is correlated with increased water temperatures, which may correspond to increased virulence of pathogens, decreased resistance of hosts, or both. Moreover, the expanding coral disease threat may result from opportunistic pathogens that become damaging only in situations where the host integrity is compromised by physiological stress or immune suppression. Overall, there is mounting evidence that warming temperatures and coral bleaching responses are linked (albeit with mixed correlations) with increased coral disease prevalence and mortality.

Trophic Effects of Reef Fishing
Fishing, particularly overfishing, can have large scale, long-term ecosystem-level effects that can change ecosystem structure from coral-dominated reefs to algal-dominated reefs ("phase shifts"). Even fishing pressure that does not rise to the level of overfishing potentially can alter trophic interactions that are important in structuring coral reef ecosystems. These trophic interactions include reducing population abundance of herbivorous fish species that control algal growth, limiting the size structure of fish populations, reducing species richness of herbivorous fish, and releasing corallivores from predator control.

In the Caribbean, parrotfishes can graze at rates of more than 150,000 bites per m^2 per day (Carpenter 1986), and thereby remove up to 90-100% of the daily primary production (e.g., algae; (Hatcher 1997). With substantial populations of herbivorous fishes, as long as the cover of living coral is high and resistant to mortality from environmental changes, it is very unlikely that the algae will take over and dominate the substrate. However, if herbivorous fish populations, particularly large-bodied parrotfish, are heavily fished and a major mortality of coral colonies occurs, then algae can grow rapidly and prevent the recovery of the coral population. The ecosystem can then collapse into an alternative stable state, a persistent phase shift in which algae replace corals as the dominant reef species. Although algae can have negative effects on adult coral colonies (e.g., overgrowth, bleaching from toxic compounds), the ecosystem-level effects of algae are primarily from inhibited coral recruitment. Filamentous algae can prevent the colonization of the substrate by planula larvae by creating sediment traps that obstruct access to a hard substrate for attachment. Additionally, macroalgae can block successful colonization of the bottom by corals because the macroalgae takes up the available space and causes shading, abrasion, chemical poisoning, and infection with bacterial disease. Trophic effects of fishing are a medium importance threat to the extinction risk for listed corals. Because the main effect of trophic effects of reef fishing is habitat alteration, there are no species-specific levels of exposure and susceptibility.

Sedimentation
Human activities in coastal and inland watersheds introduce sediment into the ocean by a variety of mechanisms, including river discharge, surface runoff, groundwater seeps, and atmospheric deposition. Humans also introduce sewage into coastal waters through direct discharge, treatment plants, and septic leakage. Elevated sediment levels are generated by poor land use practices and coastal and nearshore construction.

The most common direct effect of sedimentation is sediment landing on coral surfaces as it settles out from the water column. Corals with certain morphologies (e.g., mounding) can passively reject settling sediments. In addition, corals can actively remove sediment but at a significant energy cost. Corals with large calices (skeletal component that holds the polyp) tend to be better at actively rejecting sediment. Some coral species can tolerate complete burial for several days. Corals that cannot remove sediment will be smothered and die. Sediment can also cause sublethal effects, such as reductions in tissue thickness, polyp swelling, zooxanthellae loss, and excess mucus production. In addition, suspended sediment can reduce the amount of light in the water column, making less energy available for coral photosynthesis and growth. Sedimentation also impedes fertilization of spawned gametes and reduces larval settlement and survival of recruits and juveniles.

Nutrient Enrichment
Elevated nutrients affect corals through 2 main mechanisms: direct impacts on coral physiology and indirect effects through nutrient-stimulation of other community components (e.g., macroalgal turfs and seaweeds, and filter feeders) that compete with corals for space on the reef. Increased nutrients can decrease calcification; however, nutrients may also enhance linear extension, while reducing skeletal density. Either condition results in corals that are more prone to breakage or erosion, but individual species do have varying tolerances to increased nutrients. The main vectors of anthropogenic nutrients are point-source discharges (such as rivers or sewage outfalls) and surface runoff from modified watersheds. Natural processes, such as *in situ* nitrogen fixation and delivery of nutrient-rich deep water by internal waves and upwelling also bring nutrients to coral reefs.

4.2.2 Lobed Star Coral (*Orbicella annularis*)
On September 10, 2014, NMFS listed lobed star coral as threatened (79 FR 53851). Lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), and boulder star coral (*Orbicella franksi*) are the 3 species in the star coral complex. These 3 species were formerly in the genus *Montastraea*; however, recent work has reclassified the 3 species in the *annularis* complex to the genus *Orbicella* (Budd et al. 2012). The species complex was historically one of the primary reef framework builders throughout the wider Caribbean. The complex was considered a single species – *Montastraea annularis* – with varying growth forms ranging from columns, to massive boulders, to plates. In the early 1990s, Weil and Knowlton (1994) suggested the partitioning of these growth forms into separate species, resurrecting the previously described taxa, *Montastraea* (now *Orbicella*) *faveolata* and *Montastraea* (now *Orbicella*) *franksi*. The 3 species were differentiated on the basis of morphology, depth range, ecology, and behavior (Weil and Knowton 1994). Subsequent reproductive and genetic studies have supported the partitioning of the *annularis* complex into 3 species.

Some studies report on the species complex rather than individual species since visual distinction can be difficult where colony morphology cannot be discerned (e.g., small colonies or photographic methods). Information from these studies is reported for the species complex. Where species-specific information is available, it is reported. However, information about *Orbicella annularis* published prior to 1994 will be attributed to the species complex since it is dated prior to the split of *Orbicella annularis* into 3 separate species.

Species Description and Distribution
Lobed star coral colonies grow in columns that exhibit rapid and regular upward growth. In contrast to the other 2 star coral species, margins on the sides of columns are typically dead. Live colony surfaces usually lack ridges or bumps.

Lobed star coral is common throughout the western Atlantic and greater Caribbean including the Flower Garden Banks, but may be absent from Bermuda. Lobed star coral is reported from most reef environments in depths of approximately 1.5-66 ft (0.5-20 m). The star coral species complex is a common, often dominant component of Caribbean mesophotic (e.g., > 100 ft [30 m]) reefs, suggesting the potential for deep refuge across a broader depth range, but lobed star coral is generally described with a shallower distribution.

Asexual fission and partial mortality can lead to multiple clones of the same colony. The percentage of unique individuals is variable by location and is reported to range between 18% and 86% (thus, 14-82% are clones). Colonies in areas with higher disturbance from hurricanes tend to have more clonality. Genetic data indicate that there is some population structure in the eastern, central, and western Caribbean with population connectivity within but not across areas. Although lobed star coral is still abundant, it may exhibit high clonality in some locations, meaning that there may be low genetic diversity.

Life History Information

The star coral species complex has growth rates ranging from 0.02-0.5 in (0.06-1.2 centimeter [cm]) per year and averaging approximately 0.3 in (1 cm) linear growth per year. The reported growth rate of lobed star coral is 0.4 to 1.2 cm per year (Cruz-Piñón et al. 2003; Tomascik 1990). They grow more slowly in deeper water and in less clear water.

All 3 species of the star coral complex are hermaphroditic broadcast spawners[6], with spawning concentrated on 6-8 nights following the full moon in late August, September, or early October depending on location and timing of the full moon. All 3 species are largely self-incompatible (Knowlton et al. 1997; Szmant et al. 1997). Further, mountainous star coral is largely reproductively incompatible with boulder star coral and lobed star coral, and it spawns about 1-2 hours earlier. Fertilization success measured in the field was generally below 15% for all 3 species, as it is closely linked to the number of colonies concurrently spawning. Lobed star coral is reported to have slightly smaller egg size and potentially smaller size/age at first reproduction that the other 2 species of the *Orbicella* genus. In Puerto Rico, minimum size at reproduction for the star coral species complex was 12 in^2 (83 cm^2).

Successful recruitment by the star coral species complex species has seemingly always been rare. Only a single recruit of *Orbicella* was observed over 18 years of intensive observation of 130 ft^2 (12 m^2) of reef in Discovery Bay, Jamaica. Many other studies throughout the Caribbean also report negligible to absent recruitment of the species complex.

In addition to low recruitment rates, lobed star corals have late reproductive maturity. Colonies can grow very large and live for centuries. Large colonies have lower total mortality than small colonies, and partial mortality of large colonies can result in the production of clones. The historical absence of small colonies and few observed recruits, even though large numbers of gametes are produced on an annual basis, suggests that recruitment events are rare and were less important for the survival of the lobed star coral species complex in the past (Bruckner 2012). Large colonies in the species complex maintain the population until conditions favorable for recruitment occur; however, poor conditions can influence the frequency of recruitment events. While the life history strategy of the star coral species complex has allowed the taxa to remain abundant, the buffering capacity of this life history strategy has likely been reduced by recent population declines and partial mortality, particularly in large colonies.

[6] Simultaneously containing both sperm and eggs, which are released into the water column for fertilization.

Status and Population Dynamics
Information on lobed star coral status and populations dynamics is spotty throughout its range. Comprehensive and systematic census and monitoring has not been conducted. Thus, the status and populations dynamics must be inferred from the few locations were data exist.

Lobed star coral has been described as common overall. Demographic data collected in Puerto Rico over 9 years straddling the 2005 bleaching event showed that population growth rates were stable in the pre-bleaching period (2001–2005) but declined 1 year after the bleaching event. Population growth rates declined even further 2 years after the bleaching event, but they returned and then stabilized at the lower rate the following year.

In the Florida Keys, abundance of lobed star coral ranked 30 out of 47 coral species in 2005, 13 out of 43 in 2009, and 12 out of 40 in 2012. Extrapolated population estimates from stratified random samples were 5.6 million ± 2.7 million (standard error [SE]) in 2005, 11.5 million ± 4.5 million (SE) in 2009, and 24.3 million ± 12.4 million (SE) in 2012. Size class distribution was somewhat variable between survey years, with a larger proportion of colonies in the smaller size classes in 2005 compared to 2009 and 2012 and a greater proportion of colonies in the greater than 36-in (90 cm) size class in 2012 compared to 2005 and 2009. Partial colony mortality was lowest at less than 4 in (10 cm; as low as approximately 5%) and up to approximately 70% in the larger size classes. In the Dry Tortugas, Florida, abundance of lobed star coral ranked 41 out of 43 in 2006 and 31 out of 40 in 2008. The extrapolated population estimate was 0.5 million ± 0.3 million (SE) colonies in 2008. Differences in population estimates between years may be attributed to sampling effort rather than population trends (Miller et al. 2013).

Colony density varies by habitat and location, and ranges from less than 0.1 to greater than 1 colony per approximately 100 ft^2 (10 m^2). In surveys of 1,176 sites in southeast Florida, the Dry Tortugas, and the Florida Keys between 2005 and 2010, density of lobed star coral ranged between 0.09 and 0.84 colonies per approximately 100 ft^2 (10 m^2) and was highest on mid-channel reefs followed by inshore reefs, offshore patch reefs, and fore-reefs (Burman et al. 2012). Along the east coast of Florida, density was highest in areas south of Miami (0.34 colonies per approximately 100 ft^2 [10 m^2]) compared to Palm Beach and Broward Counties (0.04 colonies per ~100 ft2 [10 m2]; Burman et al. 2012). In surveys between 2005 and 2007 along the Florida reef tract from Martin County to the lower Florida Keys, density of lobed star coral was approximately 1.3 colonies per approximately 100 ft^2 (10 m^2) (Wagner et al. 2010). Off southwest Cuba on remote reefs, lobed star coral density was 0.31 ± 0.46 (SD) per approximately 30 ft (10 m) transect on 38 reef-crest sites and 1.58 ± 1.29 colonies per approximately 30 ft (10 m) transect on 30 reef-front sites. Colonies with partial mortality were far more frequent than those with no partial mortality which only occurred in the size class less than 40 in (100 cm) (Alcolado et al. 2010).

Population trends are available from a number of studies. In a study of sites inside and outside a marine protected area in Belize, lobed star coral cover declined significantly over a 10-year period (1998/99 to 2008/09) (Huntington et al. 2011). In a study of 10 sites inside and outside of a marine reserve in the Exuma Cays, Bahamas, cover of lobed star coral increased between 2004 and 2007 inside the protected area and decreased outside the protected area (Mumby and Harborne 2010). Between 1996 and 2006, lobed star coral declined in cover by 37% in

permanent monitoring stations in the Florida Keys (Waddell and Clarke 2008) and cover of lobed star coral in permanent monitoring stations between 1996 and 1998 on a reef in the upper Florida Keys declined 71% (Porter et al. 2001).

Star corals are the third most abundant coral by percent cover in permanent monitoring stations in the U.S. Virgin Islands. A decline of 60% was observed between 2001 and 2012 primarily due to bleaching in 2005. However, most of the mortality was partial mortality, and colony density in monitoring stations did not change (Smith 2013).

Bruckner and Hill (2009) did not note any extirpation of mountainous star coral at 9 sites off Mona and Desecheo Islands, Puerto Rico, monitored between 1995 and 2008. However, mountainous star coral and lobed star coral sustained the largest losses with the number of colonies of lobed star coral decreasing by 19% and 20% at Mona and Desecheo Islands, respectively. In 1998, 8% of all corals at 6 sites surveyed off Mona Island were lobed star coral colonies, dipping to approximately 6% in 2008. At Desecheo Island, 14% of all coral colonies were lobed star coral in 2000 while 13% were in 2008 (Bruckner and Hill 2009).

In a survey of 185 sites in 5 countries (Bahamas, Bonaire, Cayman Islands, Puerto Rico, and St. Kitts and Nevis) in 2010 and 2011, size of lobed star coral and boulder star coral colonies was significantly smaller than mountainous star coral. Total mean partial mortality of lobed star coral colonies at all sites was 40%. Overall, the total area occupied by live lobed star coral declined by a mean of 51%, and mean colony size declined from 299 in^2 to 146 in^2 (1927 cm^2 to 939 cm^2). There was a 211% increase in small tissue remnants less than 78 in^2 (500 cm^2), while the proportion of completely live large (1.6-32 ft^2 [1,500- 30,000 cm^2]) colonies declined. Star coral colonies in Puerto Rico were much larger with large amounts of dead sections. In contrast, colonies in Bonaire were also large with greater amounts of live tissue. The presence of dead sections was attributed primarily to outbreaks of white plague and yellow band disease, which emerged as corals began recovering from mass bleaching events. This was followed by increased predation and removal of live tissue by damselfish algal lawns (Bruckner 2012).

Cover of lobed star coral at Yawzi Point, St. John, U.S. Virgin Islands declined from 41% in 1988 to approximately 12% by 2003 as a rapid decline began with the aftermath of Hurricane Hugo in 1989 (Edmunds and Elahi 2007). This decline continued between 1994 and 1999 during a time of 2 hurricanes (1995) and a year of unusually high sea temperature (1998) but percent cover remained statistically unchanged between 1999 and 2003. Colony abundances declined from 47 to 20 colonies per approximately 10 ft^2 (1 m^2) between 1988 and 2003, due mostly to the death and fission of medium-to-large colonies ($\geq$ 24 in^2 [151 cm^2]). Meanwhile, the population size class structure shifted between 1988 and 2003 to a higher proportion of smaller colonies in 2003 (60% less than 7 in^2 [50 cm^2] in 1988 versus 70% in 2003) and lower proportion of large colonies (6% greater than 39 in^2 [250 cm^2] in 1988 versus 3% in 2003). The changes in population size structure indicated a population decline coincident with the period of apparent stable coral cover. Population modeling forecasted the 1988 size structure would not be reestablished by recruitment and a strong likelihood of extirpation of lobed star coral at this site within 50 years (Edmunds and Elahi 2007).

Lobed star coral colonies were monitored between 2001 and 2009 at Culebra Island, Puerto Rico. The population was in demographic equilibrium (high rates of survival and stasis) before the 2005 bleaching event, but it suffered a significant decline in growth rate (mortality and shrinkage) for 2 consecutive years after the bleaching event. Partial tissue mortality due to bleaching caused dramatic colony fragmentation that resulted in a population made up almost entirely of small colonies by 2007 (97% were less than 7 in^2 [50 cm^2]). Three years after the bleaching event, the population stabilized at about half of the previous level, with fewer medium-to-large size colonies and more smaller colonies (Hernandez-Delgado et al. 2011).

Lobed star coral was historically considered to be one of the most abundant species in the Caribbean (Weil and Knowton 1994). Percent cover has declined to between 37% and 90% over the past several decades at reefs at Jamaica, Belize, Florida Keys, The Bahamas, Bonaire, Cayman Islands, Curaçao, Puerto Rico, U.S. Virgin Islands, and St. Kitts and Nevis. Based on population estimates, there are at least tens of millions of lobed star coral colonies present in the Florida Keys and Dry Tortugas combined. Absolute abundance is higher than the estimate from these 2 locations given the presence of this species in many other locations throughout its range. Star coral remains common in occurrence. Abundance has decreased in some areas to between 19% and 57%, and shifts to smaller size classes have occurred in locations such as Jamaica, Colombia, The Bahamas, Bonaire, Cayman Islands, Puerto Rico, U.S. Virgin Islands, and St. Kitts and Nevis. At some reefs, a large proportion of the population is comprised of non-fertile or less-reproductive size classes. Several population projections indicate population decline in the future is likely at specific sites, and local extirpation is possible within 25-50 years at conditions of high mortality, low recruitment, and slow growth rates. We conclude that while substantial population decline has occurred in lobed star coral, it is still common throughout the Caribbean and remains one of the dominant species numbering at least in the tens of millions of colonies. We conclude that the buffering capacity of lobed star coral's life history strategy that has allowed it to remain abundant has been reduced by the recent population declines and amounts of partial mortality, particularly in large colonies. We also conclude that the population abundance is likely to decrease in the future with increasing threats.

Threats

A summary of threats to all corals is provided in Section 4.2.1 General Threats Faced by All Coral Species. Detailed information on the threats to lobed star coral can be found in the Final Listing Rule (79 FR 53851; September 10, 2014); however, a brief summary is provided here. Lobed star coral is highly susceptible to ocean warming, disease, ocean acidification, sedimentation, and nutrients, and susceptible to trophic effects of fishing.

Lobed star coral is highly susceptible to bleaching with 45-100% of colonies observed to bleach. Reported mortality from bleaching ranges from 2-71%. Recovery after bleaching is slow with paled colonies observed for up to a year. Reproductive failure can occur a year after bleaching, and reduced reproduction has been observed 2 years post-bleaching. There is indication that symbiont shuffling can occur prior to, during, and after bleaching events and results in bleaching resistance in individual colonies. Thus, lobed star coral is highly susceptible to ocean warming.

In addition to elevated temperature-induced bleaching, corals can also bleach and die in response to cold temperatures. In a 2010 cold-water event that affected south Florida, mortality of lobed

star coral was higher than any other coral species in surveys from Martin County to the lower Florida Keys. Average partial mortality was 56% during the cold-water event compared to 0.3% from 2005 to 2009. Surveys at a Florida Keys inshore patch reef, which experienced temperatures less than 18˚C for 11 days, revealed lobed star coral was one of the most susceptible coral species with all colonies experiencing total colony mortality.

Although there is no species-specific information on the susceptibility of lobed star coral to ocean acidification, genus information indicates the species complex has reduced growth and fertilization success under acidic conditions. Thus, we conclude lobed star coral likely has high susceptibility to ocean acidification.

Lobed star coral is highly susceptible to disease. Most studies report lobed star coral as among the species with the highest disease prevalence. Disease can cause extensive loss in coral cover, high levels of partial colony mortality, and changes in the relative proportions of smaller and larger colonies, particularly when outbreaks occur after bleaching events.

Lobed star coral has high susceptibility to sedimentation. Sedimentation can cause partial mortality and decreased coral cover of lobed star coral. In addition, genus information indicates sedimentation negatively affects primary production, growth rates, calcification, colony size, and abundance. Lobed star coral also has high susceptibility to nutrients. Elevated nutrients cause increased disease severity in lobed star coral. Genus-level information indicates elevated nutrients also cause reduced growth rates and lowered recruitment.

Summary of Status

The species has undergone major declines mostly due to warming-induced bleaching and disease. Several population projections indicate population decline in the future is likely at specific sites and that local extirpation is possible within 25-50 years at conditions of high mortality, low recruitment, and slow growth rates. There is evidence of synergistic effects of threats for this species including disease outbreaks following bleaching events and increased disease severity with nutrient enrichment. Lobed star coral is highly susceptible to a number of threats, and cumulative effects of multiple threats have likely contributed to its decline and exacerbate vulnerability to extinction. Despite high declines, the species is still common and remains one of the most abundant species on Caribbean reefs. Its life history characteristics of large colony size and long life span have enabled it to remain relatively persistent despite slow growth and low recruitment rates, thus moderating vulnerability to extinction. However, the buffering capacity of these life history characteristics is expected to decrease as colonies shift to smaller size classes, as has been observed in locations in the species' range. Its absolute population abundance has been estimated as at least tens of millions of colonies in the Florida Keys and Dry Tortugas combined and is higher than the estimate from these 2 locations due to the occurrence of the species in many other areas throughout its range. Despite the large number of islands and environments that are included in the species' range, geographic distribution in the highly disturbed Caribbean exacerbates vulnerability to extinction because lobed star coral is limited to an area with high, localized human impacts and predicted increasing threats. Star coral occurs in most reef habitats 0.5-20 m in depth which moderates vulnerability to extinction because the species occurs in numerous types of reef environments that are predicted, on local and regional scales, to experience high temperature variation and ocean chemistry at any given

point in time. Its abundance and life history characteristics, combined with spatial variability in ocean warming and acidification across the species' range, moderate vulnerability to extinction because the threats are non-uniform. Subsequently, there will likely be a large number of colonies that are either not exposed or do not negatively respond to a threat at any given point in time. We also conclude that the population abundance is likely to decrease in the future with increasing threats.

5. ENVIRONMENTAL BASELINE

This section identifies the effects of past and ongoing human and natural factors leading to the current status of the species, their habitat and ecosystem, within the action area. The environmental baseline includes state, tribal, local, and private actions already affecting the species, or that will occur contemporaneously with the consultation in progress. Unrelated federal actions affecting the same species or critical habitat that have completed formal or informal consultation are also part of the environmental baseline, as are federal and other actions within the action area that may benefit listed species or critical habitat.

The environmental baseline for this Opinion includes several activities that affect the survival and recovery of lobed star corals. Certain activities require a Section 7 consultation with NMFS as part of the federal action. As part of the Section 7 process, NMFS will continue to establish conservation measures to ensure that the construction and operation of facilities and other actions with a federal nexus avoid or minimize adverse effects to ESA-listed lobed star corals.

5.1. Status of Lobed Star Corals in the Action Area

In Section 4.2 (Analysis of Species Likely to be Adversely Affected), we described the range-wide status of lobed star corals. Within the action area, this species occurs within the project footprint at the San Idelfonso site (4 colonies on existing dock piles), as well as likely in reef and colonized hard bottom habitats within and at the entrance to Ensenada Honda. The species also occurs on reefs near potential vessel transit routes from the main island to Culebra. Lobed star coral colonies are non-motile and susceptible to localized adverse effects as a result. Localized adverse effects on lobed star coral colonies in the action area have resulted from many of the same stressors affecting this species throughout its range, namely anthropogenic breakage, disease, and intense weather events (i.e., hurricanes and extreme cold-water disturbances). These stressors have led to declines in abundance of lobed star coral in the action area commensurate with the declines seen elsewhere in the species' range, though the species remains one of the most abundant on Caribbean reefs. Therefore, we believe the status of the species described in Section 4.2 is an accurate reflection of the species status for lobed star coral within the action area.

5.2. Factors Affecting Lobed Star Corals in the Action Area

The activities that shape the environmental baseline in the action area of this consultation are fisheries, effects of vessel operations, private vessel traffic and recreational uses, coastal development, and natural disturbance.

Although many regulations exist to protect corals (see Section 5.2.8), including ESA-listed corals, many of the activities identified as threats (see Section 4.2.1) still adversely affect the

species. Poor boating and anchoring practices, poor snorkeling and diving techniques, and destructive fishing practices cause physical damage to habitat and coral colonies. Nutrients, contaminants, and sediment from point and non-point sources create an unfavorable environment for reproduction and growth of corals by promoting overgrowth of hard substrate by algae or the buildup of sediment layers that prohibit coral settlement and may promote the spread of coral disease.

5.2.1 Fisheries

Several types of fishing gears may be used within the action area and may adversely affect coral colonies. Hook-and-line fishing is practiced near reefs at the entrance to Ensenada Honda based on information from DNER. While it is unlikely that trap and net fishing impact ESA-listed corals in the Sardinas Bay and Ensenada Honda, because the shallow waters and frequent vessel traffic in these areas limit areas where net and trap fishers can place their gear, these activities may occur in the waters between Fajardo and Culebra where there are deep water spur-and-groove reefs. Hook-and-line gear and traps have all been documented as interacting with coral colonies in general, though no data specific to ESA-listed corals are available. Available information suggests hooks and lines can become entangled in reefs, resulting in breakage and abrasion of corals. Net fishing can also affect coral colonies if this gear drags across the marine bottom either due to efforts targeting reef and hard bottom areas or due to derelict gear. Studies by Sheridan et al. (2003) and Schärer et al. (2004) showed that most trap fishers do not target high-relief bottoms to set their traps due to potential damage to the traps. However, lost traps and illegal traps can affect corals if they are moved onto reefs or colonized hard bottoms during storms or placed on coral habitat because the movement of the traps leads to breakage and abrasion of corals. Accordingly, these fishing activities could affect corals in the action area.

5.2.2 Vessel Operations

Potential sources of adverse effects such as anchor and propeller damage and accidental groundings from federal vessel operations in the action area include operations of the USCG, U.S. Environmental Protection Agency, and NOAA. Through the Section 7 process, where applicable, NMFS will establish conservation measures for agency vessel operations to avoid or minimize adverse effects to ESA-listed corals. At the present time, however, they present the potential for some level of interaction, although we do not have reports of damage to coral colonies or coral habitat associated with the operation of these vessels in waters around Puerto Rico.

Adverse effects from commercial vessel operations in the action area are also possible. The existing cargo and passenger ferries transit between Culebra and the Fajardo on the main island of Puerto Rico several times a day, posing a threat of accidental groundings and propeller scarring. PRPA indicated that there are no reports of groundings by ferries and this was confirmed by our search of grounding reports received from the USCG. However, the grounding reports are only generated when vessels run hard aground and have to be removed. There could be incidents of propeller scarring that are not reported and cannot be tracked. There are no detailed surveys of reefs along the ferry transit routes, which are also the transit routes that are likely to be used by construction vessels as part of the cargo ferry project, so we have no way to quantify the potential extent of impacts from propeller damage to reefs in these areas.

Culebra is now also a popular destination for small cruise ships that are allowed to anchor in Ensenada Honda and off Culebrita Island under a permit issued by DNER. Although the coordinates where vessels are allowed to anchor are provided on the permit, there is limited enforcement of the permit requirements so it is possible that anchorage of these vessels may result in impacts to ESA-listed corals. There could also be incidents of propeller scarring from these vessels due to their size and draft. We have no reports of groundings of these vessels and there have been no surveys of the areas where they anchor.

Recreational vessel traffic can also adversely affect coral colonies through anchoring, propeller scarring, propeller wash, and accidental groundings. Based on information from the NOAA Restoration Center and NOAA's ResponseLink, reports of accidental groundings are becoming more common in USVI and Puerto Rico, but numerous vessel groundings are likely not reported. In the action area, we have received notifications from the USCG of vessel groundings from different areas around Culebra. There are numerous sailboats and motorized vessels anchored in various areas within Ensenada Honda in particular at any given time, many without appropriate moorings, although the majority of these vessels are anchored in seagrass beds rather than coral habitats. There are also numerous docks, both authorized and unauthorized around Culebra, particularly in Ensenada Honda and its smaller embayments. Through the Section 7 process for dock and other recreational boating facilities under the jurisdiction of the USACE, NMFS will establish conservation measures to ensure that the construction and operation of these facilities avoids or minimizes adverse effects to ESA-listed coral species. However, the construction of unauthorized docks and other in-water structures for recreational boating and other recreational uses means direct and indirect impacts to lobed star corals may continue as a result of unauthorized construction of in-water structures and their operation.

5.2.3 ESA Research

Section 6 of the ESA allows NMFS to enter into cooperative agreements with states to assist in recovery actions of ESA-listed species, including scientific research related to documenting species condition and trends in presence and abundance. Recovery actions may also include the collection of fragments from coral colonies, their grow-out in nursery areas, and the outplanting of fragments. There are coral nurseries in some nearshore areas around Culebra, including near the entrance to Sardinas Bay, and some of the nurseries are experimenting with the use of *Orbicella* spp. fragments of opportunity (meaning corals that are broken from the main colony during storm events or due to mechanical damage such as from boats) with DNER permits. These actions may also require ESA Section 7 consultations and NMFS is currently conducting a Section 7 consultation with the USACE for a regional general permit that will cover some coral farming structure installation and maintenance activities.

5.2.4 Recreational Uses

Diving, snorkeling, kayaking and other in-water recreational activities are popular around Culebra. These activities can also lead to impacts to lobed star corals from abrasion and breakage by gear, standing on or holding onto corals to rest, and navigating non-motorized vessels through very shallow areas, among other things. Sardinas Bay is not a popular destination for recreational activities, likely due to the commercial ferry operation there as well as the use of the area as a transit route for recreational vessels coming out of the lagoon channel that is immediately adjacent to the passenger ferry dock. In Ensenada Honda, snorkeling,

kayaking, fishing, and other recreational activities take place, particularly in the reef areas near the entrance to the bay.

5.2.5 Coastal Development

Anthropogenic sources of marine pollution, while difficult to attribute to a specific federal, state, local or private action, may indirectly affect coral colonies in the action area. Nutrient loading from land-based sources, such as coastal communities, are known to stimulate plankton blooms in closed or semi-closed estuarine systems and algal blooms in these areas, as well as in near shore waters. In 2014, the U.S. Environmental Protection Agency announced a settlement with the Municipality for the discharge of sewage from a residential lot development into the municipality storm water sewer system and then into Ensenada Honda. The settlement required that 35-40 residences be connected to the Culebra municipal sewer system. Culebra's population grows during some times of year due to tourism. Estimates range from 500,000 to 1 million visitors annually (Sturm et al. 2014). This means that development in the form of hotels and service businesses, as well as second homes and rental properties, has been increasing. Due to the steep slopes and poor soils on the island, the construction of dirt roads to service new developments or during the construction phase of new development has led to an increase in sediment transport to nearshore waters (Ramos-Scharrón 2009).

5.2.6 Natural Disturbance

Hurricanes and large coastal storms can also harm coral colonies. Historically, large storms potentially resulted in asexual reproductive events, if the fragments encountered suitable substrate, attached, and grew into new colonies. Yet over the past 2 decades, the amount of suitable substrate has been significantly reduced; therefore, many fragments created by storms die. Hurricanes are also sometimes beneficial, if they do not result in heavy storm surge, during years with high sea surface temperatures, as they lower the temperatures providing fast relief to corals during periods of high thermal stress (Heron et al. 2008). Major hurricanes have caused significant losses in coral cover and changes in the physical structure of many reefs in Puerto Rico and the USVI. Hurricane David in 1979 caused violent sea conditions and flooding and was followed 5 days later by Tropical Storm Frederick which resulted in additional flooding. Hurricane Hugo in 1989 led to violent sea conditions and major flooding across USVI and Puerto Rico. Hurricanes Marilyn in 1995, Bertha in 1996, Georges in 1998, and Lenny in 1999 led to additional impacts to reefs already suffering damage from Hurricane Hugo. Tropical storms and hurricanes in 2004, 2008, and 2010 also resulted in severe flooding across USVI and in portions of Puerto Rico. Flooding from hurricane events leads to transport of land-based sources of pollutants to reefs, along with an influx of freshwater to near shore environments that affects water quality, in addition to physical damage caused by the storms themselves. In the action area, tropical storms frequently cause beach erosion, sometimes exposing bedrock along portions of the coast due to heavy surge.

5.2.7 Conservation and Recovery Actions Benefiting ESA-Listed Corals

The Commonwealth has fisheries regulations for both commercial and recreational fishers, including regulations prohibiting the use of bottom-tending fishing gear in areas containing coral habitat. In addition to regulations, education and outreach activities are ongoing as part of the NOAA Coral Reef Conservation Program (CRCP) as well as through NMFS's ESA program through the Southeast Regional Office. NOAA Restoration Center has also established a

contract position in Puerto Rico to participate in grounding response in Puerto Rico and USVI and carry out restoration activities. The summaries below discuss these measures in more detail.

NMFS convened a recovery team comprised of fishers, scientists, managers, and agency personnel from Florida, Puerto Rico, and USVI, and federal representatives and has created a recovery plan based upon the latest and best available information for ESA-listed elkhorn and staghorn corals and their habitat. It is likely this recovery plan will be used as a template to create recovery plans for other ESA-listed coral species, including lobed star coral.

5. 2.8 Regulations Reducing Threats to ESA-Listed Corals

Numerous management mechanisms exist to protect corals or coral reefs in general. Existing federal regulatory mechanisms and conservation initiatives most beneficial to branching corals have focused on addressing physical impacts, including damage from fishing gear, anchoring, and vessel groundings. The Coral Reef Conservation Act and the Caribbean Fishery Management Council (CFMC) Coral and Reef Fish Fishery Management Plans (Caribbean) require the protection of corals and prohibit the collection of hard corals. Depending on the specifics of zoning plans and regulations, marine protected areas can help prevent damage from collection, fishing gear, groundings, and anchoring.

The Commonwealth Government regulates activities that occur in terrestrial and marine habitats of Puerto Rico. Puerto Rico Regulation 6766 (Law 241 of 1999, the New Wildlife Law) establishes protections for listed species. Permits can be issued by the Secretary of DNER for the collection and transport of species listed by the Commonwealth as vulnerable, threatened, endangered, or critically endangered species for rehabilitation, scientific use, or survival and species' benefit purposes. (Note that federally-listed species are also protected through this Commonwealth regulation, as is ESA-designated critical habitat). In addition, the regulation prohibits the modification of listed species' habitat without a mitigation plan approved by the Secretary of DNER, although the regulation also restricts the type of habitat that can be modified at all. Regulation 6768 under the same law also regulates the collection of all organisms, not just listed species. The DNER Secretary can issue a collection permit for the purposes of scientific investigation, or educational activities or exhibits. Puerto Rico Law 147 of 1999 for the protection, conservation, and management of coral reefs in Puerto Rico, prohibits the removal, extraction, mutilation, or destruction of coral reefs and associated systems. The Secretary of DNER can issue permits for scientific investigations that require extraction of corals, or those that will otherwise affect corals. Additionally, Puerto Rico has a state regulatory program that regulates most land, including upland and wetland, and surface water alterations, including in partnership with NOAA under the Coastal Zone Management Act, and EPA under the Clean Water Act. EPA has maintained regulatory authority for some activities regulated under the Clean Water Act, such as the non-point source discharge elimination system permits.

5. 2.9 Other ESA-Listed Coral Conservation Efforts

Restoration

There are ongoing restoration activities in the U.S. Caribbean led by the jurisdictions and by NOAA's Restoration Center in response to vessel groundings, large storms, and other natural

and anthropogenic sources of damage to reefs that benefit boulder star corals. Restoration activities are also carried out to restore damaged coral habitat.

Outreach and Education
The NOAA CRCP, through its internal grants, external grants, and grants to the Territory, Commonwealth, and the CFMC, has providing funding for several activities with an education and outreach component for informing the public about the importance of the coral reef ecosystem of the USVI and Puerto Rico. The NMFS Southeast Regional Office has also developed outreach materials regarding the listing of elkhorn and staghorn corals, the listing of 5 other coral species on September 10, 2014, the ESA Section 4(d) rule for elkhorn and staghorn corals, and the designation of elkhorn and staghorn coral critical habitat. These materials have been circulated to constituents during education and outreach activities and public meetings, and as part of other Section 7 consultations, and are readily available on the web: http://sero.nmfs.noaa.gov/protected_resources/coral/index.html.

6. EFFECTS OF THE ACTION ON LOBED STAR CORAL

Effects of the action include direct and indirect effects of the action under consultation. Indirect effects are those that result from the proposed action, occur later in time (i.e., after the proposed action is complete), but are still reasonably certain to occur.

This Opinion also requires implementation of coral transplant and monitoring and water quality monitoring plans, because the action will result in the take of lobed star coral. Thus, these effects must be evaluated to ensure the full scope of the action is not likely to jeopardize listed species. The implementation of these monitoring plans is required to ensure the effects of the action are as predicted in this Opinion.

Based on surveys conducted by DNER of the piles at each project location, it was determined that Atkins Caribe initially misidentified 4 coral colonies growing on piles at the San Idelfonso site. These colonies have subsequently been confirmed to be lobed star coral, rather than mustard coral, which is how they were originally identified. PRPA coordinated with FEMA and DNER to draft a transplant plan (Appendix G) for these and other coral species growing on the existing piles, which will be finalized in coordination with NMFS. Corals will be transplanted from the piles to a suitable recipient site or sites in Ensenada Honda, to be selected in coordination with NMFS and DNER prior to commencement of any in-water construction. These corals will also be monitored to determine transplant success. No ESA-listed corals are within the project footprint at the Sardinas Bay cargo ramp based on information from the applicant and DNER. We expect that there could be 10% mortality of transplanted corals, based on recent coral transplant work such as that for the USACE San Geronimo restoration project in the Condado Lagoon, San Juan, Puerto Rico (Glauco A. Rivera & Associates 2013). As part of the Section 7 consultation completed for the San Geronimo project, NMFS participated in site inspections to look at the coral transplants and received all the transplant and monitoring reports generated by the project. Therefore, we have confidence in the results and the use of 10% to estimate possible transplant mortality. Temporary declines in the health of transplanted corals that survive transplantation may occur and would be evidenced by bleaching and/or partial tissue mortality, and a lack of sexual reproduction within the first spawning season following transplant. Given the low mortality rates for transplanted corals, we believe it is likely that the

transplanted lobed star corals will not suffer mortality, though they may suffer partial tissue mortality from the stress of transplantation. However, to be conservative towards the species, we note that there is a possibility that one of the lobed star coral colonies could be part of the 10% of transplanted corals expected to suffer mortality caused by transplantation.

We believe the cargo ferry ramp reconstruction and the installation of the new mooring dolphin and catwalk at the passenger ferry dock in Sardinas Bay and the construction of the new auxiliary cargo port facility at San Idelfonso in Ensenada Honda may affect, but is not likely to adversely affect, lobed star coral colonies for the reasons discussed in Section 4.1 for other ESA-listed coral species. Based on that analysis, we believe that any impact to lobed star coral as a result of sediment resuspension and transport outside the in-water work area is discountable.

We believe the continued operation of the Sardinas Bay cargo ferry facility and the operation of the new San Idelfonso Auxiliary Cargo Port during the 6 months needed to reconstruct the Sardinas Bay facilities and on an as-needed temporary basis thereafter may affect, but is not likely to adversely affect lobed star coral colonies for the reasons discussed in Section 4.1 for other ESA-listed coral species. Based on that analysis, we believe that any impact to lobed star coral as a result of accidental groundings of ferries or work vessels is discountable.

7. CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, or local private actions that are reasonably certain to occur in the action area considered in this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA (50 CFR 402.14).

Cumulative effects from unrelated, non-federal actions occurring within the action area may affect lobed star corals. Many activities affecting lobed star corals are regulated federally; therefore, future activities within the action area that have a federal nexus, which includes waters of the U.S. at both cargo ferry port locations, will likely require ESA Section 7 consultation. However, as stated in Section 5.2.5, there is an increase in residential and tourism development around Culebra that has led to declines in water quality, in particular through sediment and wastewater contamination of nearshore waters. Much of this development does not require federal authorization. Depending on the number and location of these developments, sediment and nutrient loading to nearshore waters could become a chronic stressor.

The fisheries occurring within the action area are expected to continue into the foreseeable future. NMFS is not aware of any proposed or anticipated changes in these fisheries that would substantially change the impacts each fishery has on lobed star corals in the action area.

In addition to fisheries, NMFS is not aware of any proposed or anticipated changes in other human-related actions (e.g., recreational use, habitat degradation) or natural conditions (e.g., over-abundance of predators, changes in oceanic condition) that would substantially change the impacts that each threat has on lobed star corals. Therefore, NMFS expects that the levels of interactions with lobed star corals described for each of the fishery and non-fishery activities will continue at similar levels into the foreseeable future.

8. INTEGRATION AND SYNTHESIS

8.1. Jeopardy Analysis

The analyses conducted in the previous sections of this Opinion provide a basis to determine whether the proposed action is likely to jeopardize the continued existence of lobed star coral, by identifying the nature and extent of adverse effects expected to impact the species. Next, we consider how lobed star coral will be impacted by the proposed action in terms of overall population effects and whether those effects of the proposed action will jeopardize the continued existence of the species when considered in the context of the status of the species and its habitat (Section 4), the environmental baseline (Section 5), and cumulative effects (Section 7).

To *jeopardize the continued existence of* is defined as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). The following jeopardy analysis first considers the effects of the action to determine if we would reasonably expect the action to result in reductions in reproduction, numbers, or distribution of this species. The analysis next considers whether any such reduction would in turn result in an appreciable reduction in the likelihood of survival of this species in the wild, and the likelihood of recovery of this species in the wild.

The NMFS and USFWS ESA Section 7 Handbook (USFWS and NMFS 1998) defines survival and recovery, as applied in the context of the ESA's jeopardy standard. Survival means "the species' persistence… beyond the conditions leading to its endangerment, with sufficient resilience to allow recovery from endangerment." Survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a sufficiently large population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter. Recovery means "improvement in the status of a listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act." Recovery is the process by which species' ecosystems are restored and/or threats to the species are removed so self-sustaining and self-regulating populations of listed species can be supported as persistent members of native biotic communities. To determine the impacts of the action on the affected species' likelihood of recovery, we evaluate whether the action will appreciably interfere with achieving recovery objectives in the wild. Because the final listing determination was published on September 10, 2014, a recovery plan is not available for any of the 5 Atlantic and Caribbean coral species recently listed under the ESA, which include lobed star coral. However, NMFS has developed a recovery outline for this species (available on our website at http://sero.nmfs.noaa.gov/protected_resources/coral/documents/recovery_outline.pdf) that can be used to evaluate recovery objectives for lobed star coral.

In the following analysis, we find that the anticipated take of 4 lobed star coral colonies through transplanting of the colonies from the area where the existing pier at San Idelfonso will be

removed for the construction of the new cargo platform to a recipient site in Ensenada Honda mayresult in a reduction in numbers of this species, if 1 coral colony suffers mortality. Based on recent coral transplant work such as that for the USACE San Geronimo restoration project in Condado Lagoon, San Juan, Puerto Rico, a loss of approximately 10% of transplanted corals can be expected, which could equate to 1 lobed star coral colony. Because of the high overall survival rate of transplanted corals associated with recent projects, we anticipate the 4 transplanted lobed star coral colonies will survive transplantation. If 1 lobed star coral colony were to suffer mortality, this loss would represent a reduction in numbers of the species.

The benthic survey indicated that the 4 lobed star coral colonies that will be impacted by the proposed action had a diameter greater than 10 cm. In Puerto Rico, minimum size at reproduction for the star coral species complex is 83 cm^2 (Szmant et al. 1997). Thus, if the colonies are smaller than 83 cm^2, based on the small average size reported for the corals colonizing the piles, the 4 lobed star corals proposed to be transplanted would be too small to reproduce sexually. Even if these colonies are large enough to reproduce sexually, the loss of 4 lobed star colonies from the reproduction pool due to transplant stress would be temporary, unless 1 colony suffers mortality due to transplantation in which case 3 colonies would be temporarily unavailable to reproduce. Transplant stress leading to a lack of sexual reproduction would be expected to last 1-2 years following transplantation based on our observations from other coral relocation projects. Given that corals within the *Orbicella* species complex are one of the dominant hard corals in many reef areas around Culebra, based on survey data from Hernández-Delgado (2003), the potential temporary loss of 4 lobed star coral colonies (or permanent loss of 1 colony and temporary loss of 3 colonies) from the pool of sexually mature individuals would not result in a reduction in reproduction of these species in the action area.

The proposed action will not affect the species' current geographic range. The relocation of 4 lobed star corals from the existing piles will be to a site within the action area and, thus, will not reduce the species' distribution. The potential mortality of 1 relocated lobed star coral colony would not result in changes to the overall distribution patterns of the species in Culebra and the species will still be common in the action area. Based on surveys of reef areas as part of monitoring efforts in Culebra, Hernández-Delgado (2003) noted that lobed star coral, along with other species from the star coral species complex, were present on all reef areas surveyed. The species is also found throughout the wider Caribbean. The transplantation of the 4 colonies would not result in changes to the overall distribution pattern of the species in Culebra or in the wider Caribbean. Therefore, we believe that the proposed action will not result in a reduction in the distribution of lobed star corals.

We do not have exact population estimates for the species; Hernández-Delgado (2003) study documenting the presence of coral colonies at various sampling stations in the Cayo Luís Peña Reserve on the west side of Culebra (beginning just north of Sardinas Bay) did not include numbers of each species. The 2005 bleaching event due to several months of elevated sea surface temperature, the effects of which continued to affect corals into 2006, resulted in a significant reduction in coral coverage in the Caribbean, including Culebra. Off Culebra, partial tissue mortality due to the 2005 mass coral bleaching event led to colony fragmentation such that 97% of the population of lobed star coral colonies was small colonies by 2007 (Hernández-Pacheco et al. 2011). Therefore, it is likely that any total colony estimates actually represent a

decrease in the coral population compared to what was present a decade ago. Lobed star corals are still among the dominant hard coral species around Culebra, but the populations of these corals have declined from historic numbers. Because the project will affect 4 lobed star coral colonies, and potentially result in the mortality of 1 colony, we do not believe that there will be a population change in the action area or that the overall survival of these corals in the wild will be affected. Thus, we believe the proposed project will not result in an appreciable reduction in the likelihood of survival of lobed star corals in the wild.

As stated above, NMFS has developed a recovery outline for the 5 coral species listed under the ESA in September 2014. The outline is meant to serve as an interim guidance document to direct recovery efforts, including recovery planning, until a full recovery plan is developed and approved. A preliminary strategy for recovery of the species is presented, as are recommended high priority actions to stabilize and recover the species. The outline is intended to guide recovery-planning efforts and provide information for ESA Section 7 consultations. The Summary Assessment in the recovery outline concludes that overall, available data indicate *Orbicella* coral populations are on the decline and that recovery will depend on successful sexual reproduction and reducing mortality of extant populations. The key challenges will be moderating the impacts of ocean warming associated with climate change and decreasing susceptibility to disease which may be furthered through the reduction of local stressors. The recovery of these species will require an ecosystem approach including habitat protection measures, a reduction in threats caused by human activity, additional research, and time. The recovery vision statement in the outline states that populations of lobed star should be present across its historic range, with populations large enough and genetically diverse enough to support successful reproduction and recovery from mortality events and dense enough to maintain ecosystem function. Given that many of the important threats to the recovery of lobed star coral are not directly manageable, the recovery strategy must pursue actions both in the shore and long term to address both global and local threats. The initial focus of the recovery action plan will be to protect extant populations and the species' habitat through reduction of threats. Specific actions identified for early in the recovery process are reducing locally-manageable stress and mortality sources (e.g., acute sedimentation, nutrients, contaminants, over-fishing).

Therefore, to determine if the proposed action will appreciably reduce the likelihood of the species' recovery, we evaluate the proposed action's impacts, if any, on the key elements of the recovery outline discussed above. The species' life history characteristics of large colony size and long life span have enabled it to remain relatively persistent despite slow growth and recruitment rates, thus moderating vulnerability to extinction. However, the buffering capacity of these life history characteristics is expected to decrease as colonies shift to smaller size classes as has been observed in locations throughout their ranges. The proposed action will not affect these life history vulnerabilities. The listing rule states that the major threats faced by these corals are high vulnerability to ocean warming, disease, acidification, sedimentation, and nutrient enrichment, and the latter has been shown to exacerbate disease. The proposed action will not increase the magnitude of or the species' vulnerability to ocean warming, disease, acidification, or nutrient enrichment. The colonies will be transplanted outside the footprint of project construction and operations so we do not expect colonies to be affected by temporary sediment increases in the action area during construction at both sites or operation of the auxiliary cargo port at San Idelfonso. We have determined that sedimentation impacts will be minimized

through the implementation of terrestrial and in-water sediment control measures, to be finalized prior to any construction in coordination with NMFS. Even if 1 transplanted lobed star coral colony dies as a result of transplant and the other 3 colonies suffer partial mortality due to transplant stress, the affected area is a small portion of the species' range and lobed star corals are among the most abundant hard coral species in areas throughout the Caribbean. As stated in the listing rule, the absolute abundance and habitat heterogeneity of these species allows for variation in the responses of individuals to threats to play a role in moderating vulnerability to extinction. Even if the proposed action causes the mortality of 4 lobed star coral colonies (which is not anticipated) ,the loss of these colonies will not affect overall density and distribution of the species, or impede sexual reproduction. Therefore, we believe that the temporary increase in sediment in the construction areas and associated with the operation of the auxiliary cargo port in San Idelfonso will not increase the magnitude of these threats rangewide to levels that will appreciably reduce the species' ability to recover in the wild.

In conclusion, NMFS has determined that the anticipated level of incidental take (nonlethal take of 4 colonies, or lethal take of 1 colony and nonlethal take of 3 colonies) of lobed star coral, discussed above and in Section 6, Effects of the Action, is not likely to jeopardize the continued existence of the species.

9. CONCLUSION

After reviewing the current status of the listed species, the environmental baseline, the effects of the proposed action, and cumulative effects, it is NMFS's Biological Opinion that the proposed action is not likely to jeopardize the continued existence of lobed star coral.

10. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. *Take* is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. *Incidental take* is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. The take of listed corals by the proposed action is not prohibited, as no Section 4(d) rule has been promulgated for lobed star coral.[7]

10.1. Amount or Extent of Take

NMFS anticipates that the nonlethal take of 4 lobed star coral colonies, or lethal take of 1 lobed star coral colony and nonlethal take of 3 lobed star coral colonies, will occur because these corals are currently present within the in-water impact footprint at the San Idelfonso cargo port site. All of these colonies will be transplanted outside the construction footprint prior to commencement of any in-water work.

[7] Providing an exemption from section 9 liability is not the only important purpose of specifying take in an incidental take statement. *CBD v. Salazar*, 695 F.3d 893 (9th Cir. 2012). Though the *Salazar* case is not binding precedent for this action outside of the 9th Circuit,SERO finds the reasoning persuasive and is following the case out of an abundance of cautionand anticipation the ruling will be more broadly followed in future cases.

10.2. Effect of the Take

In this Opinion, NMFS determined that the level of anticipated take associated with the proposed action is not likely to result in jeopardy to the species.

10.3. Reasonable and Prudent Measures

Section 7(b)(4) of the ESA requires NMFS to issue a statement specifying the impact of any incidental take on listed species, which results from an agency action otherwise found to comply with Section 7(a)(2) of the ESA. It also states that RPMs necessary to minimize the impacts of take and the terms and conditions to implement those measures must be provided and must be followed to minimize those impacts.

The RPMs and terms and conditions are specified as required by 50 CFR 402.12 (i)(1)(ii) and (iv) to document the incidental take by the proposed action and to minimize the impact of that take on ESA-listed species. FEMA and the USACE have a continuing duty to regulate the activity covered by this ITS. To monitor the impact of the incidental take, FEMA and/or the USACE must report the progress of the action and its impact on the species to NMFS as specified in the ITS [50 CFR 402.14(i)(3)].

NMFS has determined that the following RPMs are necessary and appropriate to minimize impacts of the incidental take of lobed star coral colonies during the proposed action. The following RPMs and associated terms and conditions are established to implement these measures, and to document incidental takes.

1. The USACE and FEMA shall make the implementaiton of the final coral transplant and monitoring (Appendix G) plan developed by Atkins Caribe, PRPA's consultants, a requirement of all funding and contract documents and permits issued for the project to minimize potential project impacts to ESA-listed corals. The plan will be finalized in coordination with NMFS prior to commencement of any construction activities.

2. The USACE or FEMA must provide NMFS with all data collected and all reports related to benthic surveys conducted prior to construction and associated with the implementation of the required monitoring and transplant plans.

10.4. Terms and Conditions

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). "Terms and conditions" implement the reasonable and prudent measures (50 CFR 402.14).
The following terms and conditions implement the RPMs mentioned above:

1. The coral transplant and monitoring plan shall be finalized and implemented in coordination with NMFS prior to the commencement of any in-water construction activities. The plan shall include detailed procedures and measures for coral colony removal and transplant from the in-water construction footprint, as well as monitoring requirements. The 4 lobed star coral colonies on the piles of the existing pier at the San

Idelfonso shall be relocated to a recipient site or sites selected in Ensenada Honda as part of the finalization of the plan and shall be monitored to determine transplant success. (RPM No. 1)

2. The USACE or FEMA must provide NMFS with all data collected as part of additional pre-construction benthic surveys, coral transplant activities, and the implementation of monitoring plans. This information can be submitted to nmfs.ser.esa.consultations@noaa.gov with copy to the Consultation Biologist (lisamarie.carrubba@noaa.gov). Data reports should be submitted within 30 calendar days of completion of surveys, transplant, and monitoring events. (RPM No. 2)

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the RPMs provided. FEMA and the USACE must immediately provide an explanation of the causes of the taking and review with NMFS the need for possible modification of the RPMs.

11. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to, in consultation with the Services, use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations identified in Biological Opinions can assist action agencies in implementing their responsibilities under section 7(a)(1). Conservation recommendations are discretionary activities designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The following conservation recommendations are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by the federal action agencies:

Please notify NMFS if the federal action agencies carry out any of these recommendations so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

1. We recommend that a specific turbidity monitoring threshold (in nephelometric turbidity units) be developed for each site based on pre-construction turbidity monitoring at each site. The requirement to develop this threshold through pre-construction turbidity monitoring should be included as part of the USACE permit special conditions related to the finalization and implementation of the turbidity and habitat monitoring plans in coordination with NMFS.

2. NMFS requests that the NMFS Southeast Region Protected Resources Division be provided with copies of all pre-construction surveys and pre-, during, and post-construction monitoring reports completed for the project.

12. REINITIATION OF CONSULTATION

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal action agency involvement or control over the action has been retained, or is authorized by law, and if (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this Opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

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Appendix A

OCTOBER 2015

TURBIDITY MONITORING PLAN DURING THE CONSTRUCTION OF THE CARGO FERRY RAMP IN SARDINAS BAY

PART OF THE MITIGATION PLANS FOR THE

IMPACTS ASSOCIATED TO THE RECONSTRUCTION OF THE CULEBRA CARGO FERRY TERMINAL IN SARDINAS BAY

CULEBRA, PUERTO RICO

PREPARED FOR:

AUTORIDAD de los PUERTOS de PUERTO RICO

PREPARED BY:

ATKINS

Contents

1.0 Introduction 3

2.0 Project Description 5

3.0 Turbidity Monitoring Plan during Construction at Sardinas 10

3.1 State Regulatory Frame 10

3.2 Portable Turbidity Meter 10

4.0 Monitoring Protocol 13

4.1 Monitoring Documentation 13

4.2 Monthly Reports 13

5.0 References 14

Under Revision

1.0 Introduction

The Puerto Rico Ports Authority (PRPA) conducted a structural evaluation at the Culebra Cargo Ferry Terminal on August, 2010, where advanced deterioration was observed in the deck slab and concrete beams, which has probably spread to the entire concrete surface. This appears to be a result of storm events, hurricanes and the wave action. Furthermore, if the repair and reconstruction of the cargo terminal is not conducted promptly, structural failure may occur. The PRPA has since been planning the necessary works, seeking financing and regulatory compliance.

Key stakeholders, Federal and State Agencies have been engaged since the structural deterioration findings from 2010 to thoroughly assess any potential damage to the environment through the implementation of attenuation, mitigation and/ or avoidance actions that may cause the reconstruction of the Culebra Cargo Ferry Terminal Project. Sediment resuspension in the water column is expected to occur during the removal and drilling of the cargo-platform and mooring dolphin piles. The following turbidity control and monitoring plan has been prepared in order to mitigate potential impacts caused by sediment resuspension during construction.

Therefore, this Turbidity Monitoring Plan during the Construction of the Cargo Ferry Ramp in Sardinas Bay has been prepared in accordance with the FEMA 44 CFR Part 10 Regulations, the Department of Homeland Security's Management Directive 5100.1, and the Council on Environmental Quality 40 CFR Part 1500-1508 Regulations thus complying with the NEPA process.

This monitoring plan shows the methodology and equipment required to assess turbidity values due to the construction of the Culebra Cargo Ferry Ramp.

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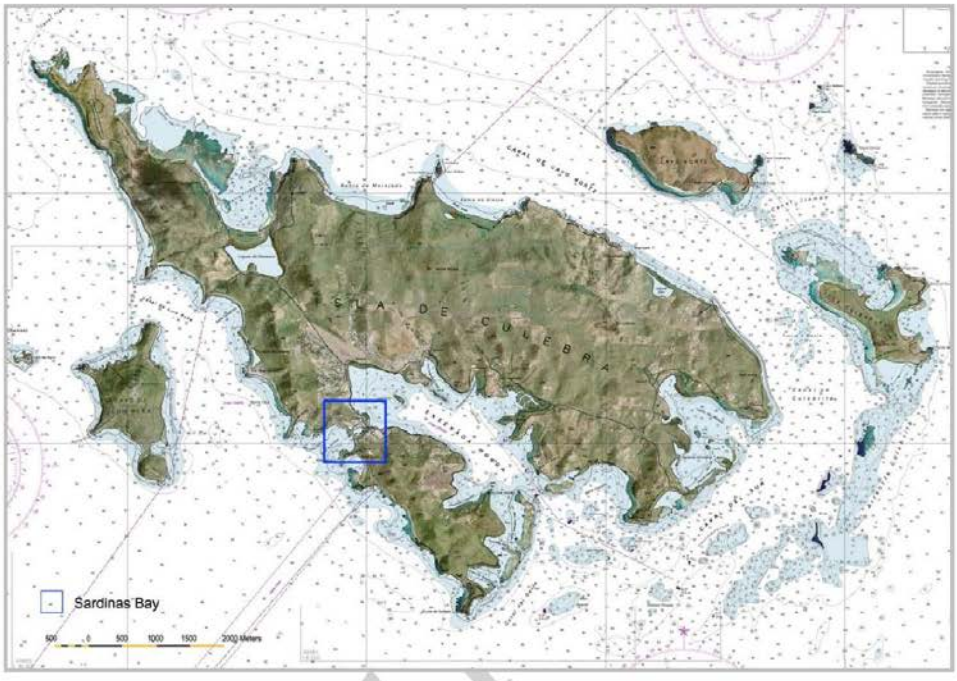

***Figure 1**: Location of the Culebra Cargo Ferry Terminal in Sardinas Bay.*

Under

2.0 Project Description

The construction of the Culebra Ferry Terminal Cargo Ramp in Sardinas Bay consists of the demolition of the existing concrete platform, which measures approximately 4,907 square feet, as well as the removal of the 27 existing H-piles, which measure 15 by 15 inches.

Once the demolition has been completed, 25 piles of 20 inches in diameter will be driven over the existing cargo ramp footprint which will support the new cargo ramp of 5,501 square feet. The new cargo facility will have a passenger boarding bridge that will measure approximately 10 feet wide by 100 feet long for passengers to board and disembark the cargo ferries. This boarding bridge will be attached at one end to a mooring dolphin, which will be supported by 4 pilings of 20 inches in diameter. Three 20-inch diameter pilings will support the boarding bridge

A mooring dolphin measuring 10 by 10 feet will be installed on the passenger ferry dock to improve docking safety. This mooring will be supported by 4 pilings of 20 inches in diameter. An operation catwalk measuring 4 feet in width by 25 feet in length will connect the passenger ferry terminal with the mooring dolphin, which will provide access to the mooring during docking maneuvers. ***Figure 2*** *illustrates the construction features described above.*

Under Revision

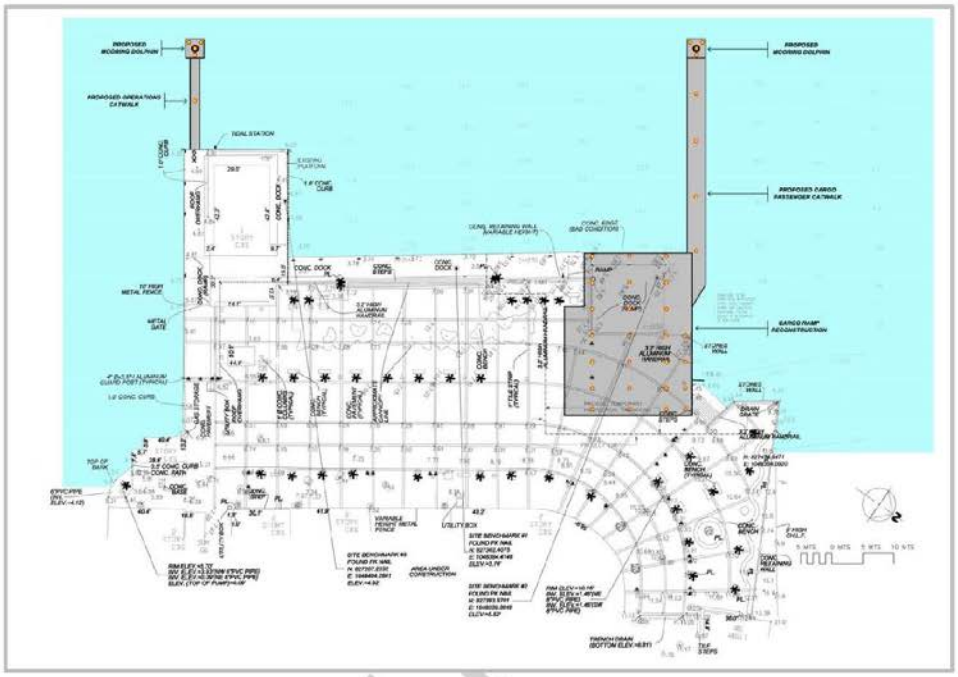

Figure 2: Construction layout. The location of the pilings is shown by the yellow/red dots.

Resuspension of sediments during construction will be controlled by installing a turbidity barrier surrounding the construction perimeter. ***Figure 3 Proposed Turbidity Barrier Layout Plan*** is showing the elements of the construction of the Cargo Ferry Terminal in Sardinas and the turibidity barrier layout.

Under

***Figure 3**: Proposed Turbidity Barrier Layout Plan of the Sardinas Bay Cargo Ferry Terminal. Areas shadowed in grey are the proposed location of the mooring dolphins, passenger boarding bridge, operations catwalk, and cargo ramp.*

The construction of the new cargo ramp facilities is estimated to take approximately 6 months. During this period, a spud barge, which will be located in front of the cargo ramp, will be used as a deck for the demolitions equipment, materials and as a general construction/operations platform. A crane will be employed for the removal and relocation of the pilings. Turbidity barriers will be installed by the contractor, which will delimit the turbidity control area of the construction. ***Figures 4*** and ***5 Turbidity Barrier Types & Details***.

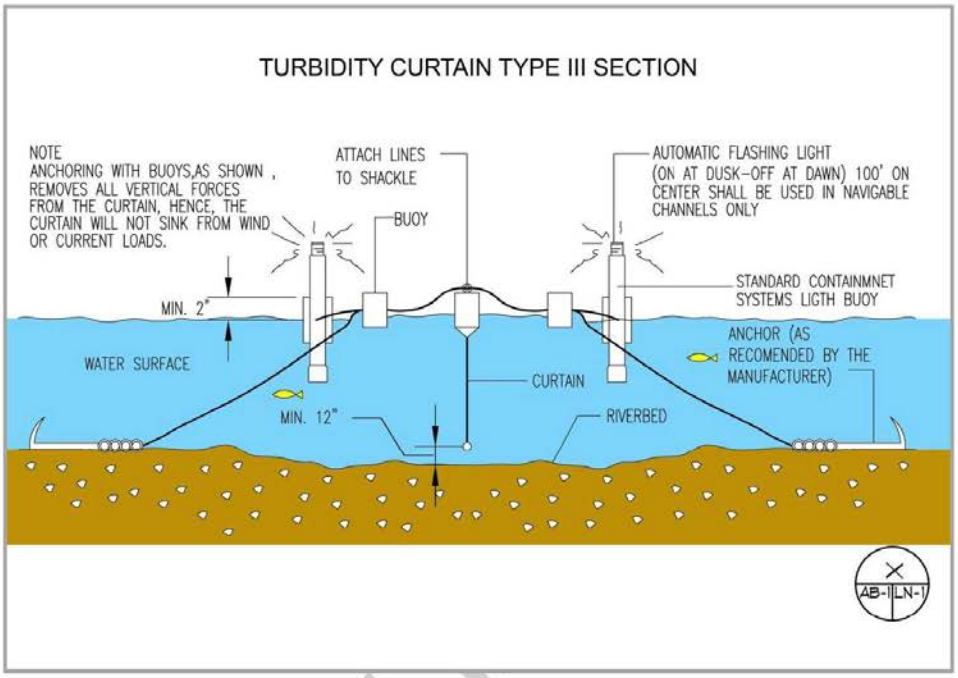

***Figure 4**: Turbidity Barrier Type III Section.*

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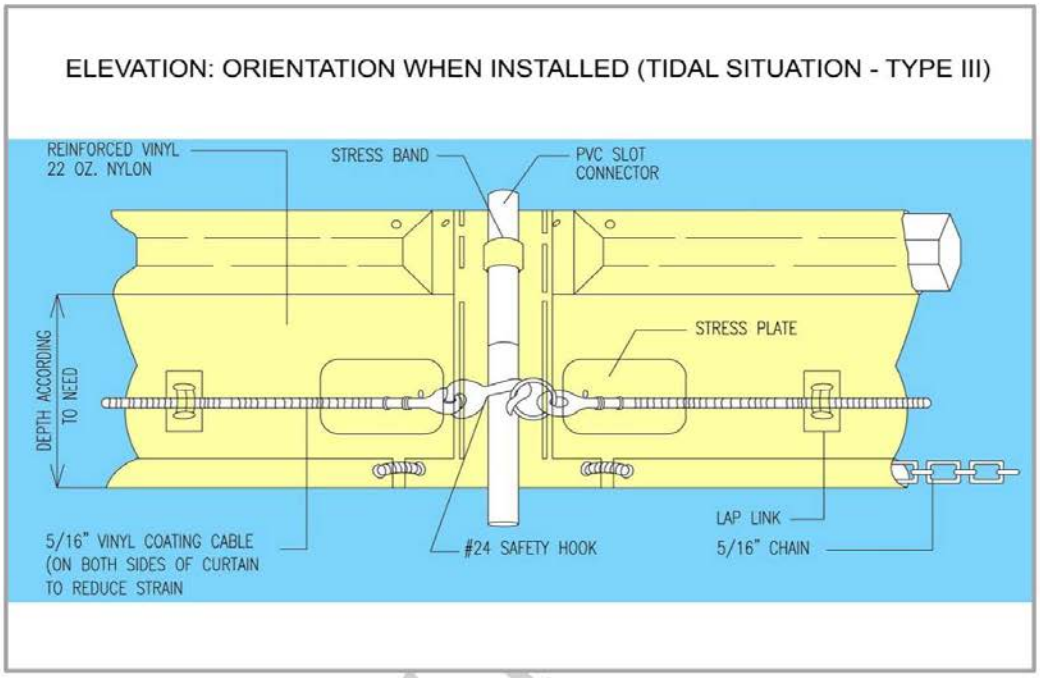

***Figure 5**: Turbidity Barrier Detail*

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3.0 Turbidity Monitoring Plan during Construction at Sardinas

3.1 State Regulatory Frame

The Puerto Rico Water Quality Standards (WQS), as amended August 19, 2014, defines the waters of the Municipality of Culebra at Sardinas Bay as Class SB. Class SB includes the coastal and estuarine waters not classified as Class SA or SC under Rules 1302.1 (A) and (C) of the WQS regulation. Class SB classification will apply from the zone subject to the ebb and flow of tides (mean sea level) up to 500 meters (0.31 mile) seaward from said zone. Beyond said limit, the next less restrictive classification will apply to a maximum of 10.35 miles seaward.

Class SB waters are defined as *"waters intended for use in primary and secondary contact recreation, and for propagation and preservation of desirable species, including threatened or endangered species"*.

For the purpose of this monitoring plan only the turbidity standard will be monitored in compliance with the State regulation, which will not exceed 10 nephelometric turbidity units (NTU), except by natural causes.

3.2 Portable Turbidity Meter

3.2.1 EPA Method 180.1

EPA method 180.1, "Determination of Turbidity by Nephelometry", is based upon a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension. The higher the intensity of scattered light, the higher the turbidity. Readings, in NTUs, are made in a nephelometer designed according to specifications laid out in the method. A primary standard suspension is used to calibrate the instrument. A secondary standard suspension is used as a daily calibration check and is monitored periodically for deterioration using one of the primary standards.

Under Revision

3.2.2 Portable Turbidimeter

Grab Sample Portable Unit

Portable turbidimeters are similar to the bench top units, except that they are designed for portable use and are battery operated. Portable turbidimeters are available in a variety of designs, including the single beam and ratio designs. The accuracy of portable instruments is comparable to the bench top units, but the resolution of low turbidity reading may only be 0.01 NTU as compared to the 0.001 NTU resolution of bench top units (Hach Corporation, 1995).

***Above**: 21000 HQ Turbidimeter*

Portable turbidimeters are designed for use in the field with grab samples. These instruments are designed to be rugged and capable of withstanding the effects of moving the instrument as well as variable field conditions. However, since these instruments are inherently susceptible to damage or disturbance from dropping, abuse, or environmental conditions such as dust, these units are not appropriate for the process monitoring and reporting tasks normally accomplished by on-line turbidimeters. Portable instruments are useful for measuring turbidity at remote locations such as at sampling points and for special process studies, such as backwash recycle characterization or distribution system analysis that may be accomplished more readily and accurately in the field rather than conducting analysis after transporting a sample to a laboratory.

Single Parameter Sonde

Single parameter optical monitoring sonde is recommended for this monitoring plan thus most of these instruments are display and data logger compatible, and readings are recorded by submerging the instrument down to the desire depth.

***Above**: Turbidity Spectrometer to be installed in the sonde*

Under Review

Display Unit

The display unit will retrieve and store data from the turbidity spectroscope at pre-determined intervals specified in the data logger display unit programming and ensure the data is available to the telemetry unit. When selecting a display unit, it is important to choose one that is compatible with the instrument and telemetry equipment in use. However, handheld display units are usually sold in conjunction with the multi parameter instruments. Handheld display units are useful in the field setting and connect to the instrument via a field cable. The field units allow the user to view the turbidity data in situ or via connection in the station shelter.

***Above**: YSI Multiparameter Display Unit and Data logger*

3.3.3 Calibration and Standardization

Turbidimeter calibration: The operating instructions from the manufacturer should be followed closely. Measure standards on the turbidimeter covering the range of interest. If the instrument is already calibrated in standard turbidity units, this procedure will check the accuracy of the

***Above**: Examples of YSI and Hydrolab single and multiparameter sondes*

calibration scales. At least one standard should be run in each instrument range to be used. Some instruments allow adjustments of sensitivity so that scale values will correspond to

turbidities. If a pre-calibrated scale is not supplied, calibration curves should be prepared for each range of the instrument.

3.3.4 Recommended Instrument

The follwing instruments are recommended for the intended turbidity monitoring described in this plan. The 2100Q Portable Turbidimeter, compliant with USEPA Method 180.1 design criteria, or YSI or Hydrolab single parameter optical monitoring sonde.

4.0 Monitoring Protocol

The contractor will monitor turbidity units within and outside the turbidity barrier at least twice per day during construction activities that may cause the resuspension of sediments in Sardinas Bay (***Figure 2***). First turbidity reading will be taken in the morning, prior construction activities are started, and in the afternoon before construction activities are ceased.

Should the value outside the turbidity barrier exceed the standard for ambient marine waters of 10 NTU, construction activities will be suspended, unless the excessive turbidity is caused by natural events, as specified in Puerto Rico WQS regulation.

4.1 Monitoring Documentation

The contractor will be responsible for preparing the monitoring protocol documentation which will include the Calibration Protocol, Calibration Log Sheet, and Field Monitoring Data Sheet. The calibration protocol must establish monitoring frequency at the exact locations, calibration frequency and thresholds for corrective actions in case that the instrument strays during field works.

4.2 Monthly Reports

Monthly monitoring reports will be prepared and submitted during the first 10 days of the month. Reports will include a brief description of the observed general weather conditions, a table containing turbidity readings, and original monitoring and instrument calibration data sheet.

Under Revision

5.0 References

EPA (1999) EPA Guidance Manual for Compliance with the Interim Enhanced Surface Water Treatment Rule: Turbidity Provisions, EPA 815-R-99-010.

FEMA (2011) 44 CFR §10 – Environmental Considerations

NEPA (2005) 40 CFR 1500.1, Title40, Volume 24, Parts 790 to End, Regulations for Implementing the Procedural Provisions of The National Environmental Policy Act.

NOAA (1998) Fonseca, MF, WJ Kenworthy, and GW Thayer. Guidelines for the conservation and restoration of seagrasses in the United States and adjacent waters. NOAA Coastal Ocean Program Decision Analyses Series No. 12. NOAA, Washington, DC

PREQB (2014) Puerto Rico Water Quality Standards, Act 7837, 2010, amended August 19, 2015, www.jca.pr.gov , searched September 10, 2015.

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OCTOBER 2015

WATER TURBIDITY AND SEAGRASS BIOLOGICAL MONITORING PLAN FOR THE OPERATION AT THE AUXILIARY TERMINAL IN SAN ILDEFONSO

PART OF THE MITIGATION PLANS FOR THE

IMPACTS ASSOCIATED TO THE RECONSTRUCTION OF THE CULEBRA CARGO FERRY TERMINAL IN SARDINAS BAY

CULEBRA, PUERTO RICO

PREPARED FOR:

AUTORIDAD de los PUERTOS de PUERTO RICO

PREPARED BY:

ATKINS

Contents

1.0 Introduction 3
2.0 Description of the Auxiliary Cargo Ferry Operation 5
2.1 Ferry Route 5
2.2 Ferry Operation 6
3.0 Turbidity Monitoring Plan 7
3.1 Regulatory Frame 7
3.2 Turbidity Monitoring Equipment 7
3.2.1 Continuous Turbidity Monitoring Instrument 7
3.2.2 Data Logger or Display Unit 8
3.2.3 Calibration and Standardization 8
3.3 Suggested Instrument Deployment 10
3.3.1 Pier Deployment 10
3.3.2 Shore Deployment 11
3.4 Turbidity Monitoring Protocol 11
4.0 Seagrass Monitoring Plan 13
4.1 Regulatory Frame 13
4.2 Seagrass Biological Monitoring 13
Background 13
4.3 Seagrass Monitoring Protocol 16
4.3.1 Monitoring Frequency 16
4.3.2 Methodology 16
5.0 Monitoring Report 20
6.0 References 21
Appendix A 23

Under Revision

1.0 Introduction

The Puerto Rico Ports Authority (PRPA, State proponent) conducted a structural evaluation at the Culebra Cargo Ferry Terminal on August, 2010, where advanced deterioration was observed in the deck slab and concrete beams, which has probably spread to the entire concrete surface. Said deterioration appears to be a result of storm events, hurricanes and wave action.

As the only heavy commercial cargo transportation port in Culebra, the cargo ferry provides an essential service to the island-municipality residents. An alternatives analysis resulted in the proposed construction of an Auxiliary Cargo Terminal, while the existing cargo terminal is reconstructed. After evaluating potential sites for an Auxiliary Terminal, the San Ildefonso site in Ensenada Honda (***Figure 1***) was chosen for the limited environmental impacts involved, since no dredging is required, the landside is ample, has been previously developed, and has the required power and water service. Nevertheless, there are unavoidable impacts associated with the construction and operation of the proposed action.

The National Oceanographic and Atmospheric Administration/National Marine Fisheries Service (NOAA/NMFS) designates the island of Culebra as Critical Habitat for the green turtle (*Chelonia mydas*) and as a Habitat Focus Areas.

Federal and State Agencies, and key stakeholders have been engaged since 2010 to thoroughly assess any potential adverse impact to the environment that may be caused by the reconstruction of the Culebra Cargo Terminal, and to recommend attenuation, mitigation and/or avoidance actions. According to various assessments conducted at San Ildefonso, sediment resuspension is expected to occur during docking maneuvers at the facility. These lifted sediments, when moving through the water column, could pose a potential threat to the health of seagrass beds near the Auxiliary Terminal. Seagrass beds are the main food sources for the green turtle (*Chelonia mydas)* and the West Indian manatee (*Trichechus manatus manatus*), both protected under the Endangered Species Act.

Therefore, the following *Water Turbidity and Seagrass Biological Monitoring Plan for the Operation of San Ildefonso Auxiliary Terminal* has been prepared in accordance with the requirements under the Regulations of the Federal Emergency Management Agency (FEMA) at

Under Revision

44 CFR Part 10, the Department of Homeland Security's Management Directive 5100.1, and the Council on Environmental Quality Regulations at 40 CFR Part 1500-1508 to implement the National Environmental Policy Act requirements for FEMA.

This monitoring plan shows the methodology and equipment required to assess turbidity values and changes in health condition of the seagrass meadow due to the operation of the Auxiliary Terminal.

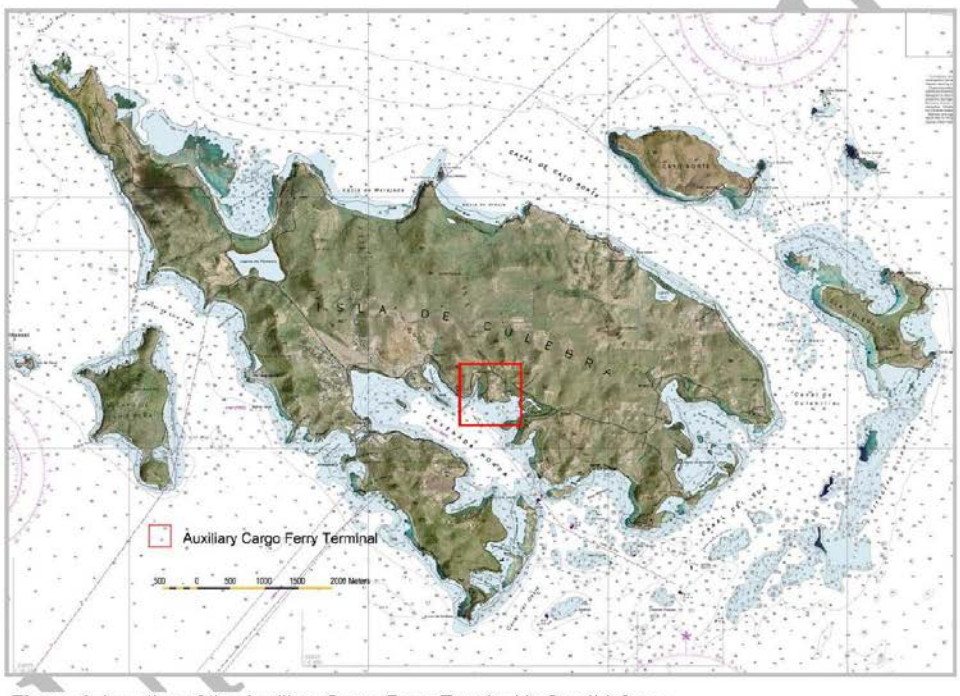

Figure 1: *Location of the Auxiliary Cargo Ferry Terminal in San Ildefonso.*

2.0 Description of the Auxiliary Cargo Ferry Operation

2.1 Ferry Route

Once the Auxiliary Terminal is completed, the scheduled cargo ferry operation will move to San Ildefonso while the existing cargo platform in Sardinas Bay is demolished and rebuilt.

To reach the proposed Auxiliary Terminal in San Ildefonso by sea, the cargo ferry would travel south around Punta del Soldado and turn 40° NE in the "Canal del Oeste" between the lighted buoy (R "2", Fl R 4s in the Nautical Chart) that marks "Bajo Amarillo", keeping this heading for approximately 1 nautical mile, where the "Canal del Este" is located. Once reaching Canal del Este, the cargo ferry must turn 325° NW to the entrance of Ensenada Honda, clearly marked by two buoys (G "9", Fl G 4s and RN "10"). Once inside Ensenada Honda, the cargo ferry must travel an additional nautical mile before arriving at San Ildefonso on the northern shoreline (***Figure 2, Ferry Route***).

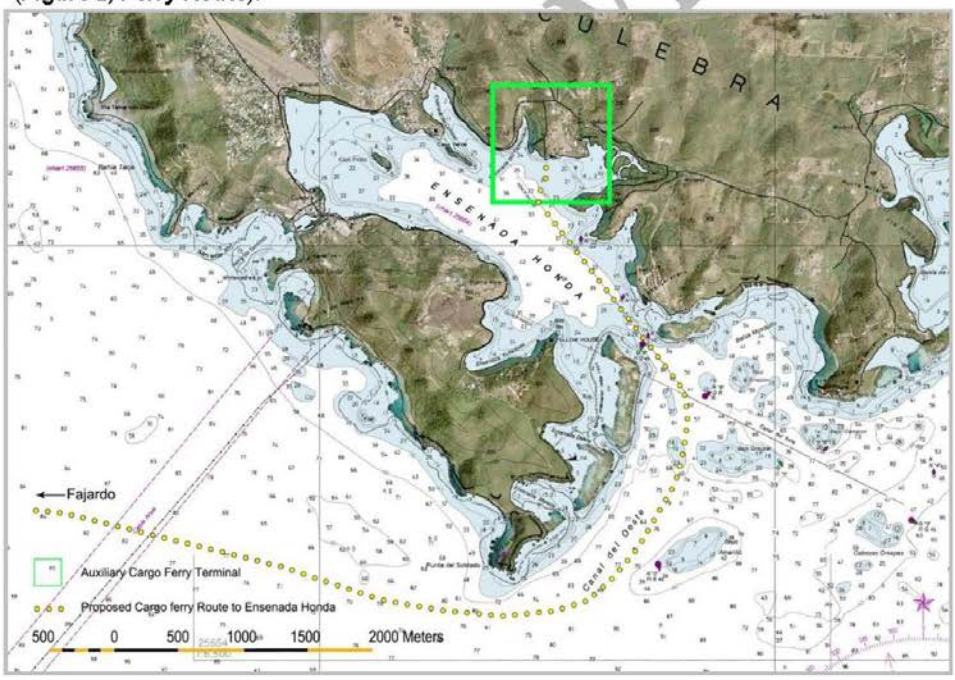

***Figure 2**: Proposed cargo ferry route to the Auxiliary Terminal in Ensenada Honda.*

2.2 Ferry Operation

The cargo ferry makes 2 round-trips on Mondays, Tuesdays and Thursdays, and 3 round-trips on Wednesdays and Fridays for a total of 10 round-trips per week. The cargo ferry service is expected to operate from the Auxiliary Terminal for approximately 7 months.

During docking maneuvers, prop wash created by the cargo ferry at San Ildefonso will cause the resuspension of sediments, which could potentially impact the seagrass beds near the facility. However, it is expected that the uplift of sediments will gradually diminish, since the continuous use of the terminal by the cargo ferry will create a new bottom topography.

Existing habitats near the Auxiliary Terminal are not anticipated to be degraded from these activities. Nevertheless, the resuspension of sediments by prop wash will be monitored at three sites. Two monitoring stations will be located in the operational area (***Figure 3***), while one will be located off site in Ensenada Honda and used as a reference station.

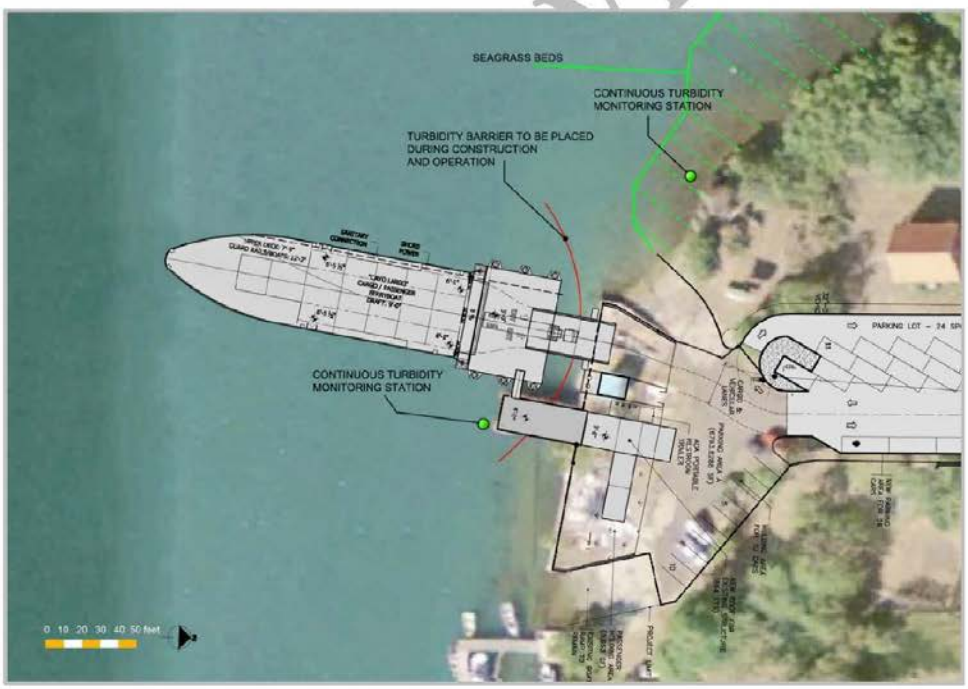

Figure 3: *Proposed Layout Plan for the Auxiliary Terminal with the location of the monitoring stations.*

3.0 Turbidity Monitoring Plan

3.1 Regulatory Frame

The Puerto Rico Water Quality Standards (WQS), as amended August 19, 2014, defines the waters of the Municipality of Culebra in San Ildefonso as Class SB. Class SB includes the coastal and estuarine waters not classified as Class SA or SC under Rules 1302.1 (A) and (C) of the WQS regulation. Class SB classification will apply from the zone subject to the ebb and flow of tides (mean sea level) up to 500 meters (0.31 mile) seaward from said zone. Beyond said limit, the next less restrictive classification will apply to a maximum of 10.35 miles seaward.

Class SB waters are defined as *"waters intended for use in primary and secondary contact recreation, and for propagation and preservation of desirable species, including threatened or endangered species"*.

For the purpose of this monitoring plan, only the turbidity standard will be monitored in compliance with the State regulation, which will not exceed 10 nephelometric turbidity units (NTU), except by natural causes.

3.2 Turbidity Monitoring Equipment

3.2.1 Continuous Turbidity Monitoring Instrument

There are a variety of continuous water quality monitoring instruments available from different manufacturers which offer different designs, options and combinations of sensors. For the purpose of this monitoring plan, a single parameter sonde with a reading range from 0 to 1,000 NTU, a resolution of 0.1 NTU, and accuracy of ± 2 % or 0.3 NTU is recommended for turbidity monitoring

***Above**: Turbidity spectrometers*

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For better accuracy and maintenance, sensor deployment should not be longer than a period of 30 days, even though spectroscopic instruments can sometimes be deployed for longer periods of time. Some sensors or instrument casings are available in titanium (vs. stainless steel) and can be used in salt water environments. Due to the errors introduced from biofouling, many manufacturers now offer an anti-bio-fouling kit.

Finally, it is important to consider the functions provided by the instrument. Instruments may feature different types of battery packs, internal logging capabilities and memory capacities. All of these options have to be considered when selecting and purchasing the instruments for the 3 stations.

3.2.2 Data Logger or Display Unit

The data loggers bridge the gap between instruments immersed underwater and the telemetry system used to relay water quality data to a database. The data logger will retrieve and store data from the turbidity spectroscope at pre-determined intervals specified in the data logger programming and ensure the data is available to the telemetry unit. When selecting a data logger, it is important to choose one that is compatible with the instrument and telemetry equipment in use. However, handheld display units are usually sold in conjunction with the multi or single parameter instruments and work as data loggers. Handheld display units are useful in the field setting and connect to the instrument via a field cable. The field units allow the user to view the turbidity data in situ or via connection in the station shelter.

3.2.3 Calibration and Standardization

Turbidimeter calibration: The operating instructions from the manufacturer should be followed closely. The measuring standards on the turbidimeter should cover the range of interest established. If the instrument is already calibrated in standard turbidity units, this procedure will check the accuracy of the calibration scales.

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Recommended Instrument

A single parameter optical monitoring sonde is recommended for this monitoring plan. Most of these instruments are display and data logger compatible.

Above: *Examples of YSI and Hydrolab single and multiparameter sondes*

Power Supply

The power requirement for a monitoring station shelter varies, depending on the equipment to be used. In urban areas, an electrical supply can be established from the power grid by contacting the power provider. If required, Stations 1 and 2 can have power access from the Auxiliary Terminal facility.

The contractor will be responsible for the shelter installation planning, construction, maintenance, and functionality of the equipment.

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3.3 Suggested Instrument Deployment

3.3.1 Pier Deployment

The general structure for this type of deployment is a PVC or other durable plastic pipe affixed to the vertical column of the pier. The instrument is fed through the piping to the desired depth within the water column (***Figure 4***). At the end of the pipe, 1 inch holes are cut to allow for adequate water flow over the sensors. The instrument can be accessed from the pier by pulling it up through the pipe by the attached aircraft cable.

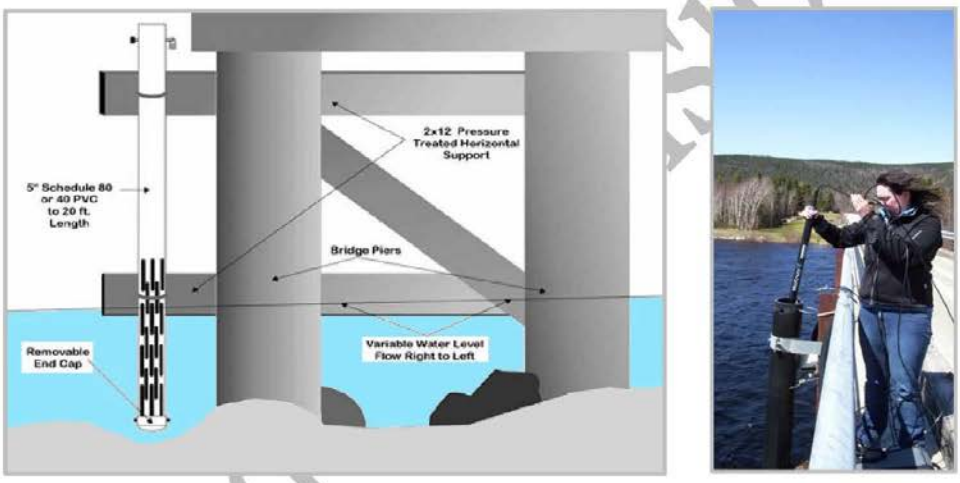

Figure 4: *Suggested pier deployment.*

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3.3.2 Shore Deployment

To avoid impacts to the seagrass beds, a deployment can be built to better position an instrument in seagrass areas. This structure is a series of angled-iron supports driven into the seabed, which supports a length of 2"x12" treated wood (***Figure 5***). A section of PVC piping with a width of 5 inches is attached to the 2"x12" treated wood. This structure holds the instrument at the desired depth above the sand, but is accessible from shore by pulling on the aircraft cable attached to the instrument.

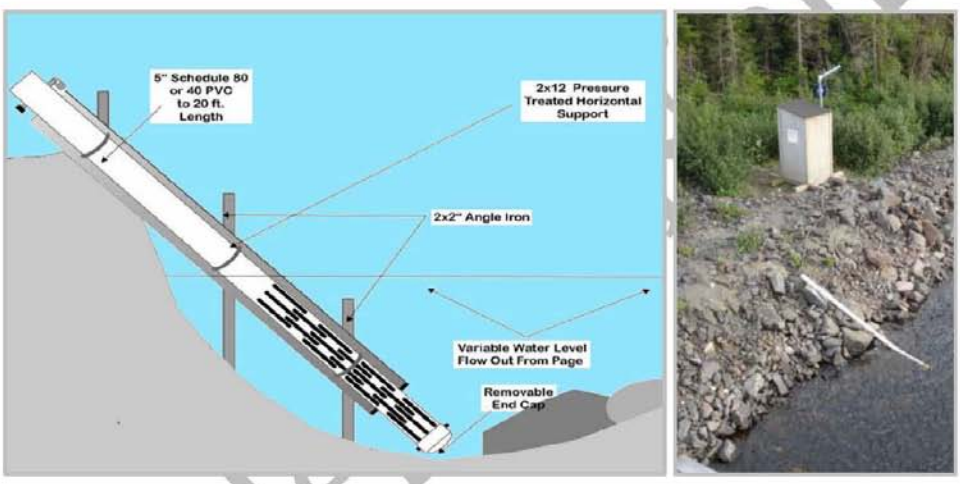


Figure 5 *Suggested shoreline deployment*

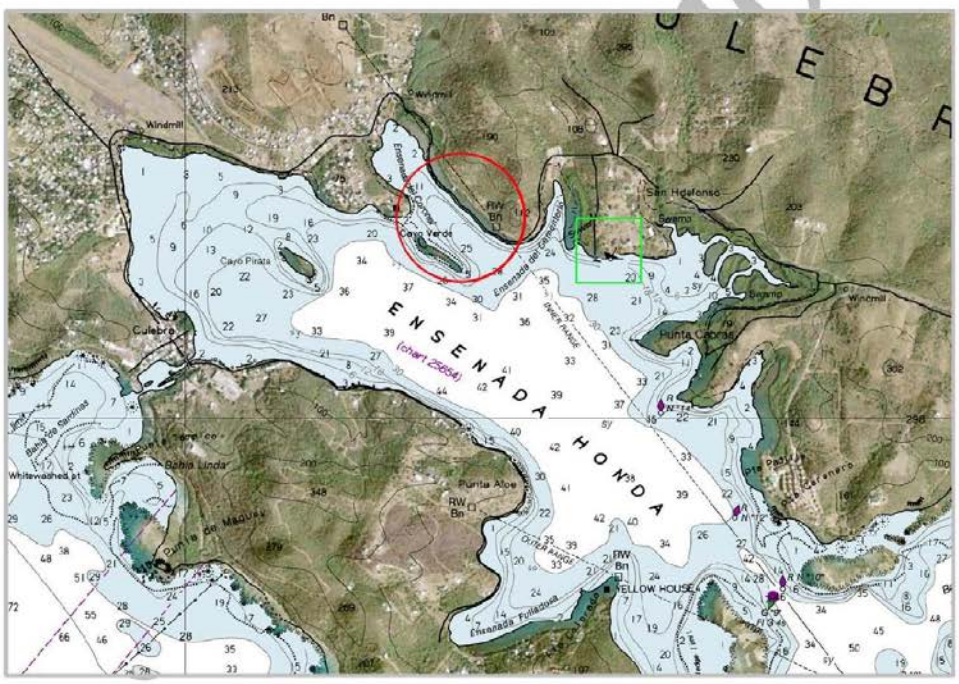
3.4 Turbidity Monitoring Protocol

The contractor will monitor turbidity concentrations at the 3 stations to be located within and outside the operational area. Turbidity monitoring will take place before, during and after docking/undocking maneuvers in San Ildefonso. Reading intervals will be of 5 minutes, starting 15 minutes before docking/undocking maneuvers and culminating 45 minutes after the operation has ended.

Station 1 will be located at the end of the pier in San Ildefonso, **Station 2** will be located at the Seagrass bed near the Auxiliary Facility, and **Station 3** will be located outside the operation area between Ensenada del Cementerio and the Ensenada Coronel area. (***Figure 6***)

The contractor will be responsible for preparing the monitoring protocol documentation which will include the Calibration Protocol, Calibration Log Sheet, and Field Monitoring Data Sheet.

The calibration protocol must establish monitoring frequency at the exact locations, calibration frequency and thresholds for corrective actions in case that the instrument strays during field works.



4.0 Seagrass Monitoring Plan

4.1 Regulatory Frame

The 50 CFR Part 226 designates the waters surrounding Culebra, Puerto Rico as Critical Habitat necessary for the continued survival and recovery of green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) turtles in the region. Seagrasses are the principal dietary component of juvenile and adult green turtles throughout the Wider Caribbean region. The seagrass beds of Culebra consist primarily of turtle grass (*Thalassia testudinum)* and includes waters extending seaward 3 nm (5.6 km) from the mean high water line of the island.

4.2 Seagrass Biological Monitoring

Background

When evaluating seagrass biomass, it is not clear of how bed boundaries are interpreted, but it appears to be correlated with exposure to waves and currents. Seagrasses can reduce erosion and enhance sediment accumulation. Seagrass patterns also change, revealing areas of coverage loss and gain at meter scales within short time periods (months), attesting to the consistent ability of seagrasses to stabilize sediments. Seagrasses and their associated epiphytes are highly productive, produce a structural matrix on which many other species depend on, improve water quality, and stabilize sediments.

Because of their requirements for high light levels, seagrasses are restricted to shallow coastal areas where anthropogenic disturbances that damage or kill them are common. Unfortunately, once seagrasses die, the sediments they helped stabilize may be resuspended into the water column, potentially lowering light levels to intensities that may not allow other seagrasses to recover in the same area unless the entire watershed is managed to improve water clarity.[1]

There are 7 species of seagrass recognized in the Caribbean:

- *Thalassia testudinum* (turtle grass): The most abundant seagrass in the Ensenada Honda region. It forms dense rhizome mats below the sediment, creating extensive meadows on shallow sand or mud substrates from the lower intertidal to a maximum 10 to 12 meters (32 to 40 feet) in depth.

[1] Fonseca, MF, WJ Kenworthy, and GW Thayer. 1998. *Guidelines for the conservation and restoration of seagrasses in the United States and adjacent waters.* NOAA

Under Revision

- *Syringodium filiforme* (manatee grass): Usually grows intermixed with *Thalassia testudinum*, but can grow in monospecific meadows or patches from the upper sublittoral to more than 20 meters.
- *Halodule wrightii* (shoal grass) Found throughout the wider Caribbean region. It is found growing on sand and mud from the intertidal down to 5 meters (15 feet).
- *Ruppia maritima* (widgeon grass): Found throughout the Caribbean. It is a shallow water species found in the brackish waters of bays and estuaries between 0 and 2.5 meters (8.2 feet) in depth. This species was not identified during assessments at San Ildefonso.

The 3 species belonging to the genus *Halophila* are small and delicate:

- *Halophila decipiens*: Typically found in deep water at up to 30 meters (98.4 feet) in depth. During assessments, scattered patches of the species were observed in the area of San Ildefonso.
- *Halophila engelmanni:* Found only down to 5 meters is restricted to the Bahamas, Florida, the Greater Antilles and the western Caribbean. *Halophila engelmanni* generally occurs as an understory species, commonly associated with *Syringodium* and *Halodule*, and only occasionally with *Thalassia*. It is generally a shallow water species in turbid waters. A very small plant, *H. engelmanni* rarely exceeds 10 centimeters in height. Its habitat is generally in sandy and muddy substrates, but it can also be found in areas with gravel or rock bottom. Listed as Near Thretened by the IUCN Red list of Threatened Species due to its decline in population. Was not identified at the site.
- *Halophila baillonii*: In the Caribbean region it is only found in the Lesser Antillies. Rare in Puerto Rico.

An area of 0.8 acres of un-impacted *Thalassia* seagrass bed with a dense growth (100% cover) is located at a distance of approximately 13 feet from the seawall of the Auxiliary Terminal ***(Figure 7)***. Even though potential damages to this area are least probable, its monitoring is vital to prevent any damage to its health, as stated in the 50 CFR 226.

Under Revision

Figure 7: *Seagrass beds near the Auxiliary Terminal*

Above: *General view of the seagrass habitats located west of the proposed Culebra Auxiliary Cargo Terminal at San*

This Monitoring Plan presents the methodology to monitor biological changes to the identified area of impact as result of the operation of the Cargo Ferry at the San Ildefonso Auxiliary Facility.

4.3 Seagrass Monitoring Protocol

4.3.1 Monitoring Frequency

This seagrass bed will be monitored prior to commencing operations at the San Ildefonso Auxiliary Terminal, and then every 3 months until end of operations, when the construction of the Cargo Ramp at Sardinas has been completed. Additional monitoring may be required after the occurrence of extreme weather events, such as storm surge or 100-year raining event.

4.3.2 Methodology

The contractor will plot at least three transects lines on the seagrass meadow aligned parallel to shore (***Figure 8***). Each transect shall be separated from each other by a distance of approximately 10 to 15 feet. Three quadrats of 1 m^2 will be fixed equidistant from each other along each of the three transects, beginning at the nearest point to the operational area down to the farthest point. Each transect and quadrat will be marked with a GPS.

Under Revision

Necessary materials & equipment

- *50m fiberglass measuring tape*
- *Temporary markers (e.g., plastic tent pegs or flags)*
- *9 permanent markers (e.g., 1.5-2' PVC pipe (1/2 in diameter))*
- *Geographic Positioning System (GPS)*
- *Hand held compass*
- *Sketch map for site location*
- *30cm ruler*
- *One 1m² PVC quadrat with 0.1 m grid.*
- *Seagrass datasheet*
- *Notebook and pencil*

Transect establishment

The establishment of transects should be achieved with minimum disturbance of the surrounding seagrass beds. Each transect will be marked with three permanent markers, one at the beginning, one in the middle and other at the end of the transect. These markers will be kept in place throughout the monitoring period.

For the first transect (closer to the shoreline), place a temporary marker or flag in the sediment within the continuous seagrass bed approximately 1 meter inside. A permanent post/ marker, will be hammered or screwed a into the sediment so that only a few centimeters remain above. This will be marked **T1-A**. A GPS waypoint shall be marked in this location.

To establish the end of the transect, from T1-A take a compass bearing in the direction that crossed over the seagrass bed, staying parallel to the shoreline. The transect should not be over 50 meters in length. At the 50 meter mark or at 1 meter before the seagrass bed ends, hammer or screw a permanent post/ marker. This will be the end of the transect, identified as **T1-C**. Once the two ends of the transect are established, proceed to mark the middle point of the transect, which will be identified as **T1-B**.

For the other transects, repeat the directions above starting at a separation of approximately 10 to 15 feet from the previous transect.

Quadrants establishment

Three quadrats should will be located for each to the three cross-transects. The position of the quadrats will be on the shoreline side of the measuring tape or transect line. The location will be at 1 meter in front of the permanent mark, at the beginning and middle of the transect, and at 2 meters before the end permanent mark of the transect. The dimensions of the quadrat will be 1 x 1 meter (1 m^2) with a 0.1 meter grid.

Under Revision

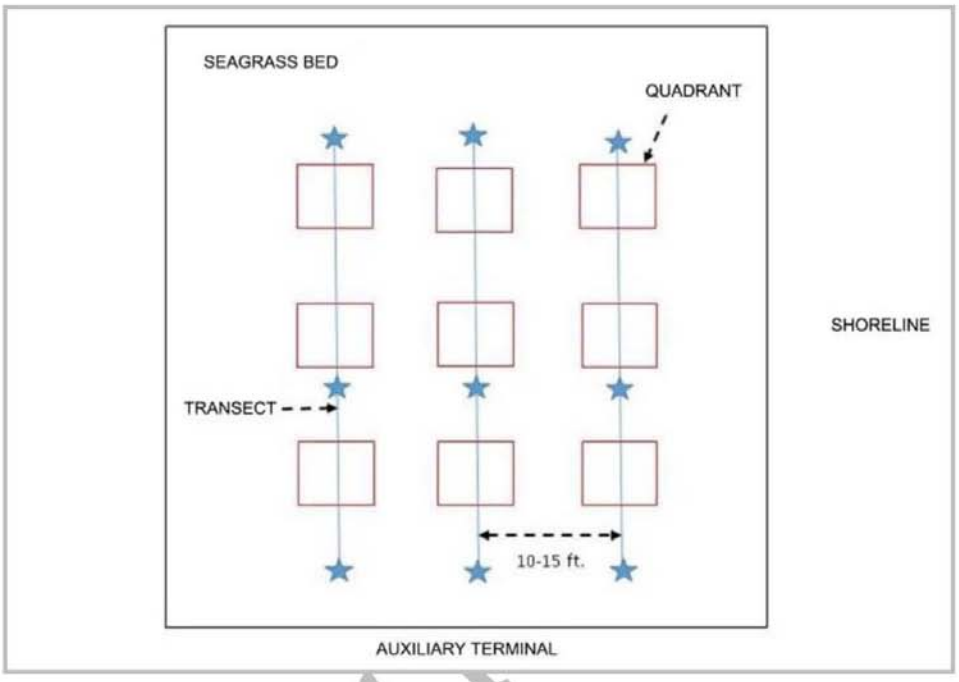


***Figure 8**: Example of transect/quadrant layout*

Parameters to measure for each quadrat

Qualitative observations on seagrass color, epiphytes, percent cover, decay, canopy height and biomass will be noted on the monitoring on each quadrat.

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1. Photographs

Take photographs of the quadrat. Photos are taken first, to avoid re-suspending sediments by walking or swimming in the area, which would affect the photo quality.

- First place the photo quadrat labeler beside the quadrat with the correct transect, cross-transect, and quadrat number on it (e.g., quadrat number is T1-QA; T1 = transect number, QA = quadrat number).

- Take the photograph perpendicular to the bottom, including the entire quadrat frame (if possible), the quadrat label and the tape measure. Try to avoid having any shadows or patches of reflection in the field of view. Ideally, photos should be taken when the seagrasses are exposed at the surface (intertidal plants) and the photographer is standing, or when the seagrasses are submerged (subtidal and flooded intertidal plants) and the photographer is swimming. Intermediate depths make obtaining clear vertical photographs difficult. Mark the "Photograph" box on the datasheet for that quadrat.

- In some instances, such as due to tide levels, you may also need to take another photograph from an oblique angle (e.g., 45 degrees), which includes the entire quadrat frame and the quadrat label. Similarly, try to avoid having any shadows or patches of reflection in the field of view. Mark the Photograph box a second time on the datasheet for that quadrat to indicate a second photo has been taken.

2. ***Percent Cover***

Determine the total cover percentage of seagrasses within each quadrat – use the cover percentage photo guide (***Appendix A***). Attached algae and non-mobile live or dead animals should be included as part of the percent cover estimates as "non-seagrass". Record the cover percentage on your data sheet. If the quadrat lands on an area with no seagrasses, this should be recorded as "zero". If seagrass is present, record the appropriate cover percentage for all species combined within the quadrat under "Total species cover".

3. ***Percent cover by species***

Identify which seagrass species are found inside the quadrat and record each on the datasheet using the species abbreviations (see the *Regional Supplement for species identifications guides)*. Next, determine the percent cover by species of each of the species and record this on the data sheet. We suggest determining the % cover for the species with the lowest % cover first and then working up from there.

4. ***Canopy height and grazing***

Using the ruler, measure in centimeters the height (length of the seagrass leaf blades) for the dominant species (the species with the highest percent cover). Do this randomly by selecting a

Under Revision

clump of seagrass blades from within the quadrat and measuring its height, ignoring the tallest 20% of leaves. Extend the leaves to their maximum length/height, without uprooting, and measure from the substrate to the leaf tip. If seagrass density is very low and a clump of blades cannot be grouped, make measurements on five individual shoots of the dominant species within the quadrat and calculate the average. Record the canopy height (average leaf length) on the data sheet.

Check the seagrass in the quadrat for evidence of grazing, e.g., turtle or manatee feeding trails. Record if there is grazing evidence, and write in the notes what type of grazing you think it is under Comments.

5.0 Monitoring Report

A monitoring report must be submitted to the Puerto Rico Ports Authority after each monitoring event. This should include copy of all data sheets, date of the event, summary of the findings, general condition of the seagrass beds, any concern related to the seagrasses and recommendations.

The report should be submitted 30 days after the monitoring event.

Under Revision

6.0 References

50 CFR § 226. 207-208 (1998) Wildlife and Fisheries Designated Critical Habitat for green turtle and hawksbill turtle.

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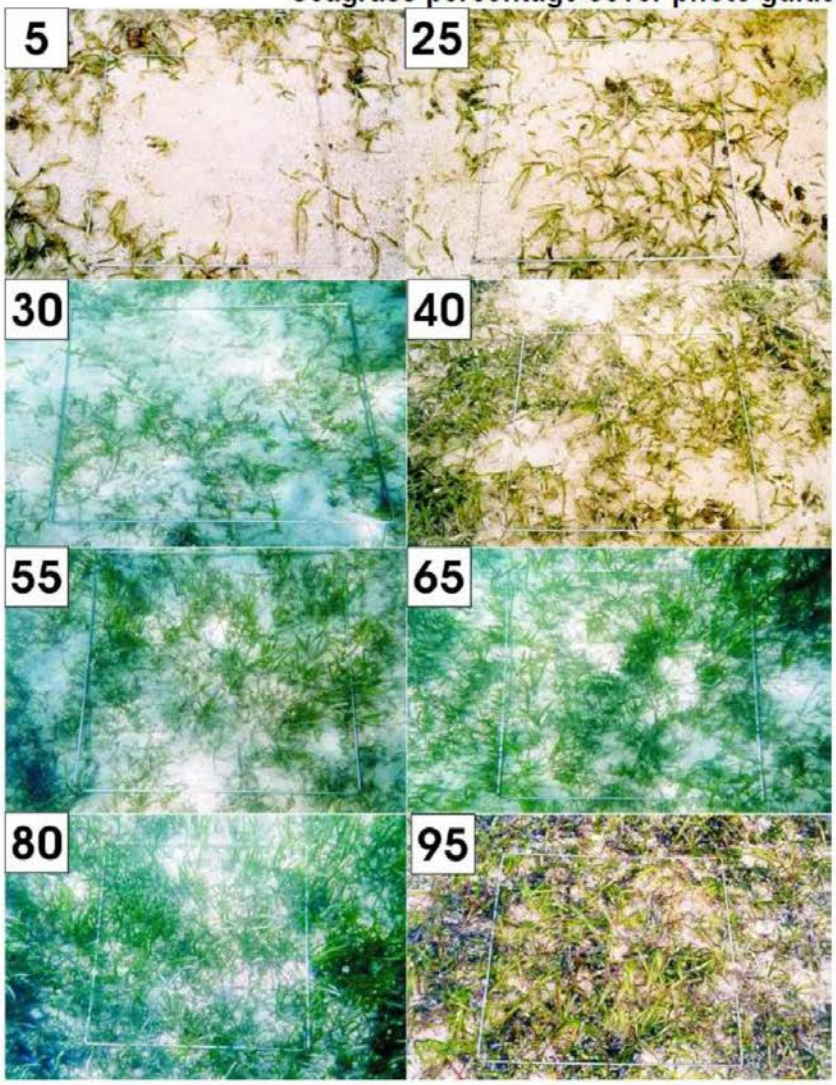
Appendix A

Seagrass percentage cover photo guide



Appendix B

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006
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Appendix C

Vessel Strike Avoidance Measures
and Reporting for Mariners
NOAA Fisheries Service, Southeast Region

Background
The National Marine Fisheries Service (NMFS) has determined that collisions with vessels can injure or kill protected species (e.g., endangered and threatened species, and marine mammals). The following standard measures should be implemented to reduce the risk associated with vessel strikes or disturbance of these protected species to discountable levels. NMFS should be contacted to identify any additional conservation and recovery issues of concern, and to assist in the development of measures that may be necessary.

Protected Species Identification Training
Vessel crews should use an Atlantic and Gulf of Mexico reference guide that helps identify protected species that might be encountered in U.S. waters of the Atlantic Ocean, including the Caribbean Sea, and Gulf of Mexico. Additional training should be provided regarding information and resources available regarding federal laws and regulations for protected species, ship strike information, critical habitat, migratory routes and seasonal abundance, and recent sightings of protected species.

Vessel Strike Avoidance
In order to avoid causing injury or death to marine mammals and sea turtles the following measures should be taken when consistent with safe navigation:

1. Vessel operators and crews shall maintain a vigilant watch for marine mammals and sea turtles to avoid striking sighted protected species.

2. When whales are sighted, maintain a distance of 100 yards or greater between the whale and the vessel.

3. When sea turtles or small cetaceans are sighted, attempt to maintain a distance of 50 yards or greater between the animal and the vessel whenever possible.

4. When small cetaceans are sighted while a vessel is underway (e.g., bow-riding), attempt to remain parallel to the animal's course. Avoid excessive speed or abrupt changes in direction until the cetacean has left the area.

5. Reduce vessel speed to 10 knots or less when mother/calf pairs, groups, or large assemblages of cetaceans are observed near an underway vessel, when safety permits. A single cetacean at the surface may indicate the presence of submerged animals in the vicinity; therefore, prudent precautionary measures should always be exercised. The vessel shall attempt to route around the animals, maintaining a minimum distance of 100 yards whenever possible.

NMFS Southeast Region Vessel Strike Avoidance Measures and Reporting for Mariners; revised February 2008.

6. Whales may surface in unpredictable locations or approach slowly moving vessels. When an animal is sighted in the vessel's path or in close proximity to a moving vessel and when safety permits, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.

Additional Requirements for the North Atlantic Right Whale

1. If a sighted whale is believed to be a North Atlantic right whale, federal regulation requires a minimum distance of 500 yards be maintained from the animal (50 CFR 224.103 (c)).

2. Vessels entering North Atlantic right whale critical habitat are required to report into the Mandatory Ship Reporting System.

3. Mariners shall check with various communication media for general information regarding avoiding ship strikes and specific information regarding North Atlantic right whale sighting locations. These include NOAA weather radio, U.S. Coast Guard NAVTEX broadcasts, and Notices to Mariners. Commercial mariners calling on United States ports should view the most recent version of the NOAA/USCG produced training CD entitled "A Prudent Mariner's Guide to Right Whale Protection" (contact the NMFS Southeast Region, Protected Resources Division for more information regarding the CD).

4. Injured, dead, or entangled right whales should be immediately reported to the U.S. Coast Guard via VHF Channel 16.

Injured or Dead Protected Species Reporting

Vessel crews shall report sightings of any injured or dead protected species immediately, regardless of whether the injury or death is caused by your vessel.

Report marine mammals to the Southeast U.S. Stranding Hotline: 877-433-8299
Report sea turtles to the NMFS Southeast Regional Office: 727-824-5312

If the injury or death of a marine mammal was caused by a collision with your vessel, responsible parties shall remain available to assist the respective salvage and stranding network as needed. NMFS' Southeast Regional Office shall be immediately notified of the strike by email (takereport.nmfsser@noaa.gov) using the attached vessel strike reporting form.

For additional information, please contact the Protected Resources Division at:

NOAA Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701
Tel: (727) 824-5312
Visit us on the web at http://sero.nmfs.noaa.gov

NMFS Southeast Region Vessel Strike Avoidance Measures and Reporting for Mariners; revised February 2008.

Appendix D

OCTOBER 2015

CARGO FERRY PROTOCOL FOR APPROACH AND DEPARTURE MANEUVERS AT THE AUXILIARY TERMINAL IN SAN ILDEFONSO

PART OF THE MITIGATION PLANS FOR THE

IMPACTS ASSOCIATED TO THE RECONSTRUCTION OF THE CULEBRA CARGO FERRY TERMINAL IN SARDINAS BAY

CULEBRA, PUERTO RICO

PREPARED FOR:

AUTORIDAD de los PUERTOS de PUERTO RICO

PREPARED BY:

ATKINS

Contents

1.0 Introduction 2

2.0 Protocol..... 4

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1.0 Introduction

The Puerto Rico Ports Authority (PRPA, State proponent) conducted a structural evaluation at the Culebra Cargo Ferry Terminal on August, 2010, where advanced deterioration was observed in the deck slab and concrete beams, which has probably spread to the entire concrete surface. Said deterioration appears to be a result of storm events, hurricanes and wave action.

As the only heavy commercial cargo transportation port in Culebra, the cargo ferry provides an essential service to the island-municipality residents. An alternatives analysis resulted in the proposed construction of an Auxiliary Cargo Terminal, while the existing cargo terminal is reconstructed. After evaluating potential sites for an Auxiliary Terminal, the San Ildefonso site in Ensenada Honda (***Figure 1***) was chosen for the limited environmental impacts involved, since no dredging is required, the landside is ample, has been previously developed, and has the required power and water service.

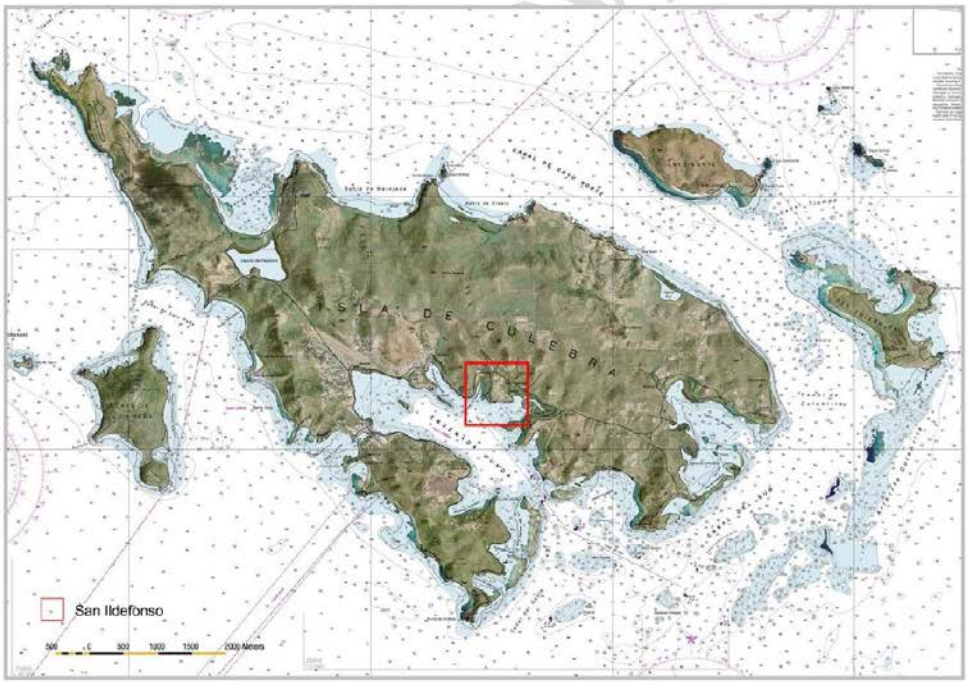

***Figure 1**: Location of the Auxiliary Cargo Ferry Terminal in San Ildefonso.*

There are unavoidable impacts associated with the construction and operation of the proposed action.

Since 2010, Federal and State Agencies, and key stakeholders, have been engaged to thoroughly assess any potential adverse impact to the environment that may be caused by the reconstruction of the Culebra Cargo Terminal, and to recommend attenuation, mitigation and/ or avoidance actions. The Puerto Rico Department of Natural and Environmental Resources (DNER) recommended a protocol for ferry vessel skippers use when approaching/departing the Auxiliary Cargo Ferry Terminal in San Ildefonso. The goal would be to minimize the disturbance and suspension of bottom sediments that create turbid conditions within the marine basin.

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2.0 Protocol

The Puerto Rico Maritime Transportation Authority (MTA) has proposed construction of the terminal as an alternate means for ferry vessels to deliver fuel, food, goods, and passengers to the island of Culebra. The proposed terminal would be located on the north-eastern shores of Ensenada Honda at San Ildefonso (***Figure 1***) as an upgrade to an existing facility. The proposed terminal would improve the existing ramps and piers to accommodate ferry vessels.

Presently, the MTA anticipates that the *Cayo Norte*, the *Cayo Largo*, the *Isleño* and the *Santa María* will be visiting the terminal. These vessels LOA range from 155 to 165-feet with beams from 37.5 to 45-feet. Charted depths of the terminal approach range from 30 to 40 feet. At the proposed berth, depths range from 15 to 25 feet. The ferry boats are RORO/PAX vessels, meaning that they carry cargo that is rolled on/rolled off as well as passengers that walk on/off the vessels. Presently, passenger ferry transfers at the Auxiliary Terminal are not planned. Cargo is stern loaded with gangways from the RORO onto the cargo ramp.

Berthing maneuvers require the approaching vessel to rotate 180 degrees and then back stern on. Vessels would depart in a direct forward movement from the cargo ramp. Upon entering the Ensenada Honda channel, the skipper would engage engines at "slow", no more than 8 to 10 knots. After coming about, stern-to and at final approach to the ramp, the skipper would engage to "dead slow". The minimum speeds must consider how the ship responds to the rudder under extreme wind conditions and adjusted accordingly to assure safe berthing maneuvers. Upon departure, the skipper should utilize only the minimum thrust needed to make way, maintaining "dead slow" speed until clear of the shallow marine basin.

All ferry vessel skippers should attend sensitivity training with annual refreshers to obtain a comprehensive picture of the channel, where the coral, sea grass beds and other natural resources are prevalent and how to operate the ship in a manner that minimizes impacts to them.

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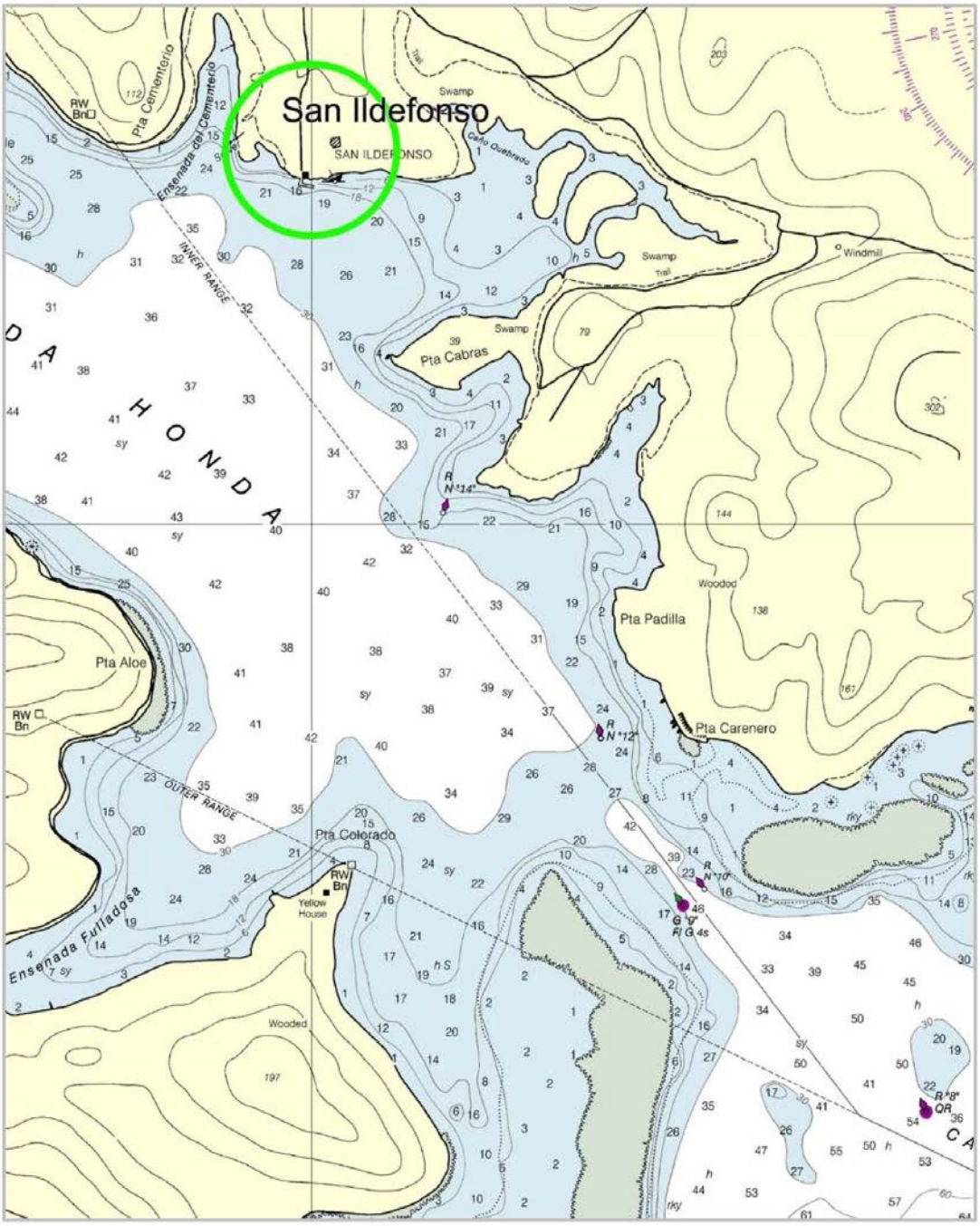

Figure 1: Ensenada Honda and San Ildefonso

Appendix E

OCTOBER 2015

UNDERWATER NOISE MONITORING PLAN FOR USE DURING PILE-DRIVING OPERATIONS USING HYDRAULIC HAMMERS

PART OF THE MITIGATION PLANS FOR THE

IMPACTS ASSOCIATED TO THE RECONSTRUCTION OF THE CULEBRA CARGO FERRY TERMINAL IN SARDINAS BAY

CULEBRA, PUERTO RICO

PREPARED FOR :

AUTORIDAD de los PUERTOS de PUERTO RICO

PREPARED BY:

ATKINS

Contents

1.0 Introduction 3
2.0 Site Description and Number of Piles to be Monitored 5
2.1 Sardinas Bay 5
2.1.1 Number of Piles to be Monitored at Sardinas Bay 5
2.2 San Ildefonso. 7
2.2.1 Number of Piles to be Monitored at San Ildefonso 7
3.0 Hydroacoustic Monitoring 9
3.1 Purpose 9
3.1.1 Recommended Equipment 9
3.2 Hearing Frequency in Species of Interest 10
3.2.1 Sea turtles 10
3.2.2 Manatees 11
4.0 Noise Monitoring Methodology 11
4.1 Calibration 12
4.2 Sound Attenuation Monitoring 13
5.0 Monitoring Report 14
6.0 References 16
Appendix A 17
Appendix B 18
Appendix C 20

Under Revision

1.0 Introduction

The Puerto Rico Ports Authority (PRPA, State proponent) conducted a structural evaluation at the Culebra Cargo Ferry Terminal on August, 2010, where advanced deterioration was observed in the deck slab and concrete beams, which has probably spread to the entire concrete surface. Said deterioration appears to be a result of storm events, hurricanes and wave action.

As the only heavy commercial cargo transportation port in Culebra, the cargo ferry provides an essential service to the island-municipality residents. An alternatives analysis resulted in the proposed construction of an Auxiliary Cargo Terminal, while the existing cargo terminal is reconstructed. After evaluating potential sites for an Auxiliary Terminal, the San Ildefonso site in Ensenada Honda (***Figure 1***) was chosen for the limited environmental impacts involved, since no dredging is required, the landside is ample, has been previously developed, and has the required power and water service. Nevertheless, there are unavoidable impacts associated with the construction and operation of the proposed action.

The National Oceanographic and Atmospheric Administration/National Marine Fisheries Service (NOAA/NMFS) designates the island of Culebra as Critical Habitat for the green turtle (*Chelonia mydas*) and as a Habitat Focus Area. Under provisions of Section 7(a)(2) of the Endangered Species Act, a Federal agency that carries out permits, licenses, funds, or otherwise authorizes activities that may affect a listed species must consult with the US Fish and Wildlife Service to ensure that its actions are not likely to jeopardize the continued existence of any listed species. This same process also applies to the National Marine Fisheries Service and the species under their its jurisdiction.

Federal and State Agencies, and key stakeholders have been engaged since 2010 to thoroughly assess any potentially adverse impacts to the environment that may be caused by the reconstruction of the Culebra Cargo Terminal, and to recommend attenuation, mitigation and/or avoidance actions. Noise caused by pile driving may have detrimental effects upon fish and wildlife at certain levels. Pile driving at San Ildefonso will be conducted using a drilling method that minimizes underwater noise and vibration; however, pile driving in Sardinas Bay is still proposed using a hydraulic hammer, thus, significant noise is expected, which could pose a threat to species protected under the Endangered Species Act.

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Therefore, this Underwater Noise Monitoring Plan has been prepared in accordance with the requirements under the Regulations of the Federal Emergency Management Agency (FEMA) at 44 CFR Part 10, the Department of Homeland Security's Management Directive 5100.1, and the Council on Environmental Quality Regulations at 40 CFR Part 1500-1508 to implement the National Environmental Policy Act requirements for FEMA. It is based upon the California Department of Transportation (2012) Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish (2013). This monitoring plan shows the methodology and equipment required to assess underwater noise values near pile driving using hydraulic hammers.

***Figure 1**: Location of the Sardinas Bay and San Ildefonso Ferry Terminals.*

2.0 Site Description and Number of Piles to be Monitored

2.1 Sardinas Bay

The construction of the Culebra Ferry Terminal Cargo Ramp in Sardinas Bay consists of the demolition of the existing concrete platform, as well as the removal of the 27 existing H-piles, which measure 15 by 15 inches.

Once the demolition has been completed, 25 piles of 20 inches in diameter will be driven over the existing cargo ramp footprint, which will support the new cargo ramp measuring roughly 5,501 square feet. The new cargo facility will have a passenger boarding bridge that will measure approximately 10 feet wide by 100 feet long for passengers to board and disembark the cargo ferries. This boarding bridge will be attached at one end to a mooring dolphin, which will be supported by 4 pilling of 20 inches in diameter. Three pilings of 20 inches in diameter will support the boarding bridge

A mooring dolphin measuring 10 by 10 feet will be installed on the passenger ferry dock to improve docking safety. This mooring will be supported by 4 pilings of 20 inches in diameter. An operation catwalk measuring 4 feet in width by 25 feet in length will connect the passenger ferry terminal with the mooring dolphin, providing access to PRMTA during docking maneuvers. A total of 36 new piles will be driven as part of the Culebra Ferry Terminal reconstruction.

Figure 2 shows the above described construction features and indicates the location of the piles that will be driven for the construction of the cargo platform, the boarding passenger bridge and the two mooring dolphins. There will be a total of 36 piles driven as part of the Culebra Ferry Terminal Reconstruction in Sardinas Bay.

2.1.1 Number of Piles to be Monitored at Sardinas Bay

The number of piles to be monitored depend on a variety of factors such as bathymetry, the total number of piles to be driven, substrate type, depth of water, distance from shore, type of piles (if more than one type is driven), and any other considerations, as appropriate.

All of the piles to be driven in Sardinas Bay are 20 inches diameter concrete filled piles. Nonetheless, the substrate type and depth varies from one construction feature to another. These three main characteristics were key in determining how many and which of the piles struck will be monitored. One pile within each construction feature will be monitored.

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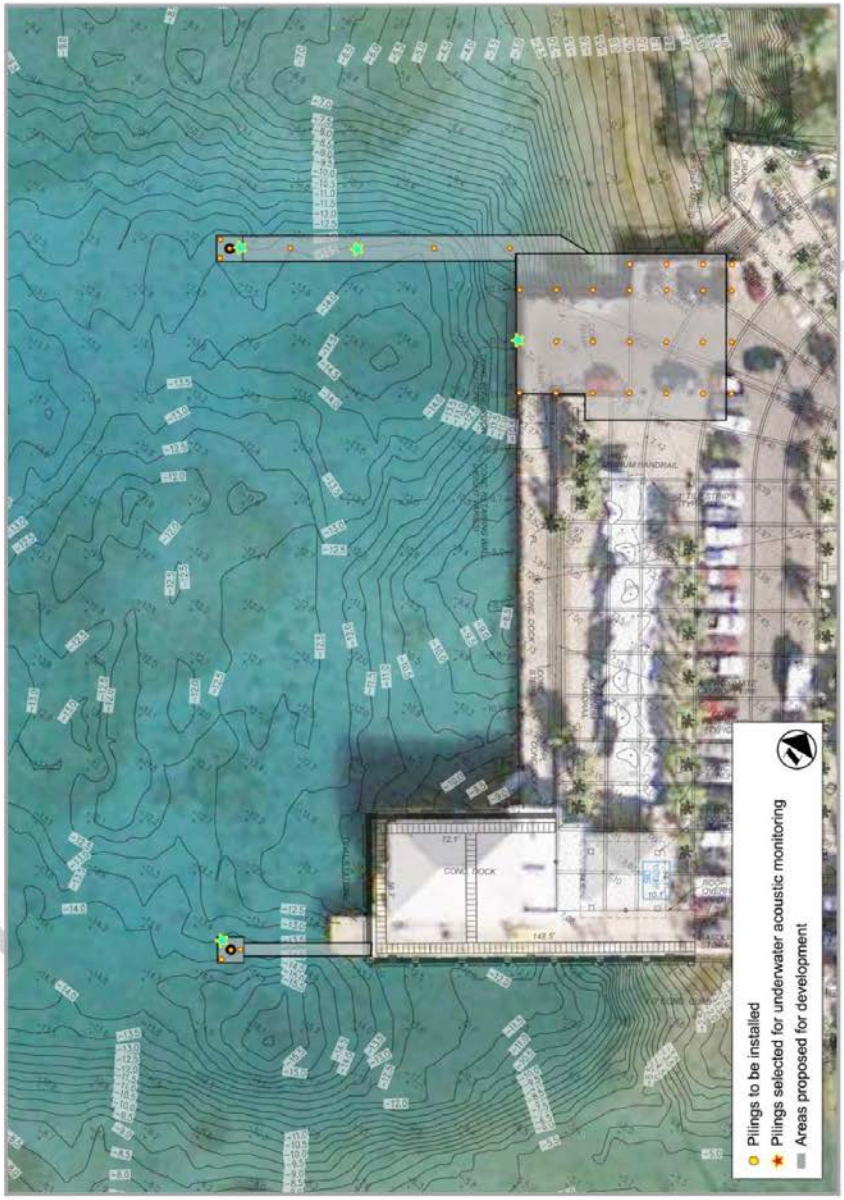

***Figure 2**: Construction Layout showing the location of the piles to be monitored*

Therefore, hydroacoustic monitoring will be conducted for one pile that will be struck with an impact hammer at each construction feature, (for a total of four piles). The piles that were chosen for monitoring are driven in water depths that are representative of depths typically found in the location where they will be driven.

2.2 San Ildefonso.

The proposed Culebra Auxiliary Cargo Ferry Terminal includes the installation of a pre-fabricated floating aluminum platform (pontoon platform) that will match freeboard ferryboat highs and ease loading and unloading activities. This floating pontoon platform will be anchored to the bottom using six round concrete piles with a 30 inch diameter, which will be driven approximately 20 to 30 feet below msl. To protect the floating pontoon platform from the cargo ferry during docking maneuvers, a pile cap and fender measuring approximately 56 feet in length by 6 feet in width (336 square feet, or 31.2 square meters) will be built, supported by eleven round concrete piles with a 30 inch diameter. The stern of the cargo ferry will be tied to the steel bollards in the pile cap. This pile cap beam will be located at an approximate distance of 64 feet from the existing seawall at an approximate depth of -17 feet msl. To protect the existing historical seawall, a pile cap beam measuring feet 29 long by 3 feet wide supported by six concrete piles with a diameter of 18 inches will be constructed at a distance of approximately 5 feet from the existing seawall.

The existing recreational dock will be demolished and replaced with a new dock built out of a prefabricated aluminum platform and supported by 8 steel encased concrete piles 18 inches in diameter. A total of 31 piles will be driven in San Ildefonso, 17 of 30 inches and 14 of 18 inches.

Under Revision

2.2.1 Number of Piles to be Monitored at San Ildefonso

Two piles of 30 inches and two of 18 inches will be monitored in San Ildefonso. Hydroacoustic monitoring will be conducted for one pile that will be struck with an impact hammer at each construction feature, (for a total of four piles). Piles chosen to be monitored are driven in water depths that are representative of typical water depths at the project location where piles will be driven. ***Figure 3*** shows the location of the piles that will be monitored in San Ildefonso.

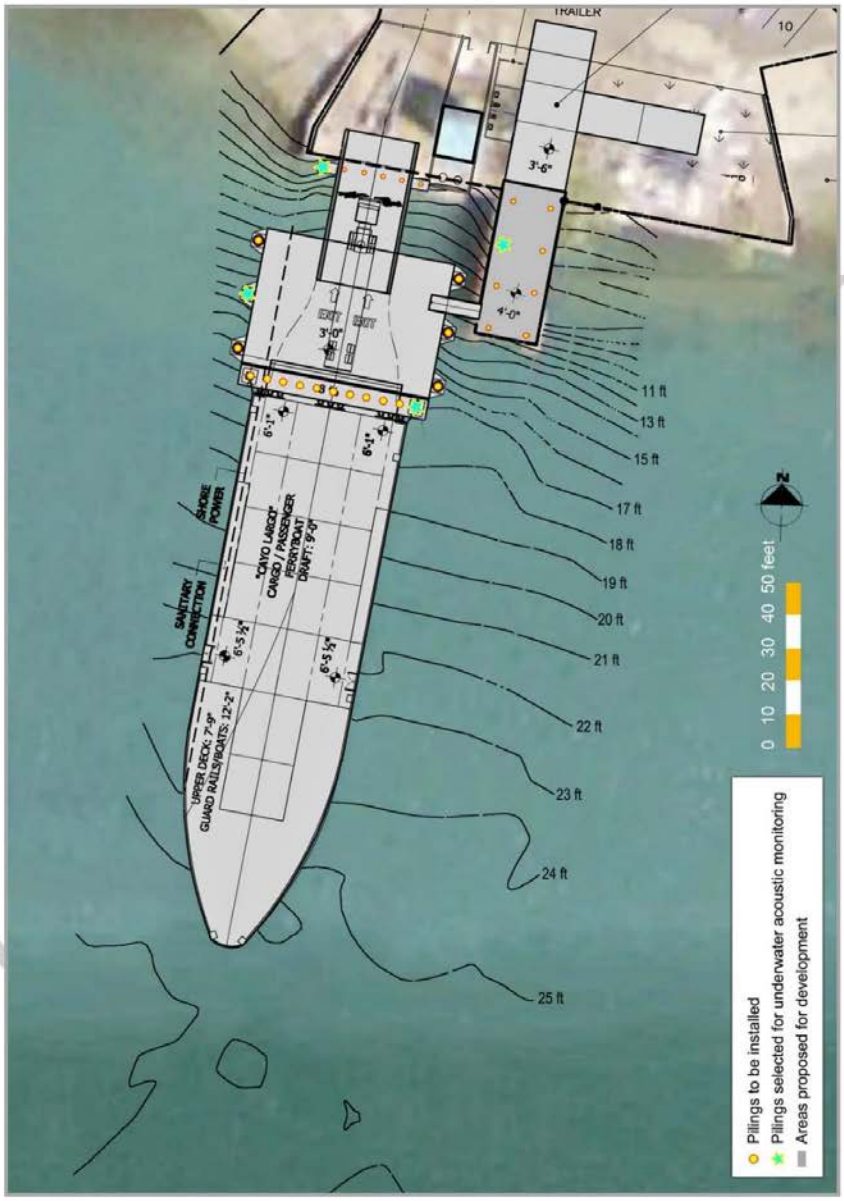

Figure 3: *Construction Layout showing the location of the piles to be monitored.*

3.0 Hydroacoustic Monitoring

3.1 Purpose

Noise vibrations emitted during pile driving operations has an adverse effect on certain marine species. This Hydroacoustic Monitoring Plan has been prepared to comply with recommendations from the National Marine Fishery Services (NMFS) of establishing a hydroacoustic monitoring methodology, sampling frequency, and recommend hydroacoustic equipment and installation sites, if applicable.

3.1.1 Recommended Equipment

A list of the proposed sound level monitoring equipment for the contractor shall be included, along with specifications and a description of the purpose. The measurement range in terms of amplitude (in dB referenced to one micropascal (re: 1 uPa)), sensitivity and frequency shall be stated. A minimum frequency range of 20 Hz to 20 kHz and a minimum sampling rate of 48,000 Hz will be used when monitoring. Sampling rates higher than 48 kHz are preferred. ***Table 1*** describes the minimum requirements of the equipment to be used. In addition to the equipment selection, quality control/quality assurance procedures should be described (e.g., how will system responses be verified and how will data be managed).

Table 1 *Equipment for underwater sound monitoring (hydrophone, signal amplifier, calibrator). All have current National Institute of Standards and Technology (NIST) traceable calibration.*

Item	Specifications	Minimum Quantity	Usage
Hydrophone	*Receiving Sensitivity- -211dB re 1V/µPa*	*1*	*Capture underwater sound pressures near the source and convert to voltages that can be recorded/analyzed by other equipment.*
Hydrophone	*Receiving Sensitivity – -200dB re 1/µPa*	*1*	*Capture underwater sound pressures for background levels and convert to voltages that can be recorded/analyzed by other equipment.*
Signal Conditioning Amplifier	*Amplifier Gain- 0.1 mV/pC to 10 V/pC Transducer Sensitivity Range- 10-12 to 103 C/MU*	*1*	*Adjust signals from hydrophone to levels compatible with recording equipment.*

Under Revision

Calibrator (pistonphone-type)	*Accuracy- IEC 942 (1988) Class 1*	*1*	*Calibration check of hydrophone in the field.*
Digital Signal Analyzer	*Sampling Rate- 48kHz or greater*	*1*	*Analyzes and transfers digital data to laptop hard drive.*
Microphone (free field type)	*Range- 30 – 120 dBA Sensitivity- -29 dB ± 3 dB (0 dB = 1 V/Pa) Wind Screen*	*1*	*Monitoring airborne sounds from pile driving activities (if not raining).*
If water velocity ~> 1m/s, Flow shield	*Open cell foam cover or functional equivalent*	*1/hydrophone*	*Eliminate flow noise contamination.*
Laptop computer or Digital Audio Recorder	*Compatible with digital signal analyzer*	*1*	*Record digital data on hard drive or digital tape.*
Real Time and Post-analysis software	*-*	*1*	*Monitor real-time signal and post-analysis of sound signals.*

To facilitate further analysis of data full bandwidth, the time-series underwater signal shall be recorded as a text file (.txt) or wave file (.wav) or similar format. Recorded data shall not use data compression algorithms or technologies (e.g. MP3, compressed .wav, etc.).

3.2 Hearing Frequency in Species of Interest

3.2.1 Sea turtles

Audiograms were conducted for the green *(Chelonia mydas)*, kemp's ridley (*Lepidochelys kempi*), and loggerhead (*Caretta caretta*) turtles. Audiograms are determined from Auditory Brainstem Responses (ABRs). Sea turtles do not hear well above 1,000 Hz or below 100Hz, they generally hear best between 200 and 700 Hz depending on the species and age of the turtle (*Ketten and Bartol, 2005*).

Sea turtles appear to hear best between 200 and 750 Hz and do not respond well to sounds above 1,000 Hz. To determine the hearing capabilities in an adult green sea turtle (*Chelonia mydas*), researchers obtained a behavioral audiogram for an older female green sea turtle named

Under Revision

Myrtle, housed in the Giant Tank exhibit of the New England Aquarium. Based on her responses, it was concluded that adult green sea turtles hear best between 200Hz-500Hz.[1]

3.2.2 Manatees

Manatees have a functional hearing range from 400 to 46,000 hertz. Their peak sensitivity actually lies between 16,000 and 18,000 hertz, and not 1,000 to 5,000 hertz as previously thought. Below 16,000 hertz, sensitivity decreases approximately 10 decibels per octave, and below 2,000 hertz it drops precipitously (20 decibels per octave) until functional hearing ends at 400 hertz. Unfortunately, the dominant sounds produced by most boats and ships are below 1,000 hertz; these lower frequencies fall outside or overlap the lower fringe of the hearing range of manatees. The audiogram suggests that even in quiet conditions, manatees would have difficulty detecting these sounds at acoustic levels of less than 90 or 100 decibels. All underwater sound levels mentioned are given against a standard underwater reference acoustic pressure of 1 micropascal.[2]

4.0 Noise Monitoring Methodology

This study is proposed to be conducted with at least two hydrophones. The contractor will mark with a GPS the monitoring points from each of the piles struck. One of the hydrophones will be transported with a small vessel from one monitoring point to another to calculate transmission loss over distance, placing the instrument at an approximate water depth of 4 m (13 ft). The second hydrophone will be located near the pile struck at least 3H from the pile, where H is the water depth at the pile and at 0.7 to 0.85H depth from the surface. ***Figures 2*** and ***3*** show the location of the piles to be monitored at each site.

Based on daily weather conditions, the contractor will determine the distance and depth in meters from each pile monitored. If water velocity is 1 meter/second or greater, 1-3 meters off the bottom may be recommended for near field hydrophones and greater than 5 meters off the bottom may be recommended for near field hydrophones and greater than 5 meters from the surface may be recommended for any far field hydrophones. A weighted tape measure will be used to determine the depth of the water. The hydrophone(s) will be attached to a nylon cord, a steel chain, or other

[1] tp://www.dosits.org/animals/soundreception/howtoseaturtleshearsound; retrieved on July 7, 2013.
[2] http://www.americanscientist.org/issues/id.758,y.0,no.,content.true,page.2,css.print/issue.aspx; Manatees, Bioacoustics and Boats-Hearing tests, environmental measurements and acoustics phenomena may together explain why boats and animals collide, Edmund Gerstein, American Scientist, retrieved on October 8, 2015.

Under Revision

proven anti-strum features if the current is swift enough to cause strumming of the line. The nylon cord or chain will be attached to an anchor that will keep the line the appropriate distance from each pile. The nylon cord or chain will be attached to a float or tied to a static line at the surface. The distances will be measured by a tape measure, where possible, or a range-finder. The acoustic path (line of sight) between the pile and the hydrophone(s) should be unobstructed in all cases.

When collecting sound measurements in an area with currents (i.e., in rivers or tidally influenced areas), appropriate measures will be taken, when necessary, to ensure that the flow-induced noise at the hydrophone will not interfere with the recording and analysis of the relevant sounds (NMFS, 2012a). As a general rule, current speeds of 1.5 meters/second or greater are expected to generate significant flow-induced noise, which may interfere with the detection and analysis of low-level sounds such as the sounds from a distant pile driver or background sounds. If such measures are necessary, include a description of those measures.

For example: If it becomes necessary to reduce the flow-induced noise at the hydrophone, a flow shield will be described and installed around the hydrophone to provide a barrier between the irregular, turbulent flow and the hydrophone. If no flow shield is used in these situations, the current velocity will be measured and a correlation between the levels of the relevant sounds (background or pile driving) and current speed will be made to determine whether the data is valid and can be included in the analysis.

Under Revision

4.1 Calibration

The hydrophone calibration(s) will be checked at the beginning of each day of monitoring activity. The method of calibration and calibration equipment used will be described. NIST traceable calibration forms shall be provided for all relevant monitoring equipment. Prior to the initiation of pile driving, the hydrophone will be placed at the appropriate distance and depth as described above.

The contractor will inform the acoustics specialist when pile driving is about to start to ensure that the monitoring equipment is operational. Underwater sound levels will be continuously monitored during the entire duration of each pile being driven with a minimum one-third octave band frequency resolution. The wideband instantaneous absolute peak pressure and Sound Exposure Level (SEL) values of each strike, and daily cumulative SEL should be monitored in real time

during construction to ensure that the project does not exceed its authorized take level. Peak and rms pressures will be reported in dB (re:1 μPa). SEL will be reported in dB (re: 1 μPa2·sec). Wideband time series recording is strongly recommended during all impact pile driving.

Prior to, and during, the pile driving activity, environmental data will be gathered, such as water depth and tidal level, wave height, and other factors that could contribute to influencing the underwater sound levels (e.g. aircraft, boats, etc.). Start and stop time of each pile driving event and the time at which the bubble curtain or functional equivalent is turned on and off will be logged.

The Agency will provide the following information, in writing, to the contractor conducting the hydroacoustic monitoring for inclusion in the final monitoring report: a description of the substrate composition, approximate depth of significant substrate layers, hammer model and size, pile cap or cushion type, hammer energy settings and any changes to those settings during the piles being monitored, depth pile driven, blows per foot for the piles monitored, and total number of strikes to drive each pile that is monitored.

4.2 Sound Attenuation Monitoring

All monitored piles may be tested with the sound attenuation system on and off (or presence and absence) to test its effectiveness. To account for varying resistance as the pile is driven; the sound attenuation device will be turned off and on for determined periods during the beginning, the middle third, and near the end of the drive. After turning off the attenuation system, pile driving should not resume for at least 2 minutes to allow time for air bubbles to completely disperse. For piles that require less than 5 minutes to drive, pile driving should occur for only two periods with the bubbles off, one near the beginning and once near the end of the drive.

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5.0 Monitoring Report

If sound attenuation devices are used during the monitoring, include the following text and analysis:

An analysis of the change in the waveform and sound levels with and without the name type of noise attenuation device for impact driving operating will be conducted.

Preliminary results for the daily monitoring activities, if required, will be submitted/reported to the primary point of contact to be determined by PRPA at each of the Services within 24 hours after monitoring concludes for the day. In addition, a final draft report including data collected and summarized from all monitoring locations will be submitted to the Services within 90 days of the completion of hydroacoustic monitoring. The results will be summarized in graphical form and include summary statistics and time histories of impact sound values for each pile. A final report will be prepared and submitted to the Services within 30 days following receipt of comments on the draft report from the Services. The report shall include:

1. Size and type of piles.
2. A detailed description of the *name type of noise attenuation device*, including design specifications *(if applicable)*.
3. The impact hammer energy rating used to drive the piles, make and model of the hammer.
4. A description of the sound monitoring equipment.
5. The distance between hydrophone*(s) or microphone(s)* and pile.
6. The depth of the hydrophone*(s)* and depth of water at hydrophone locations.
7. The distance from the pile to the water's edge.
8. The depth of water in which the pile was driven.
9. The depth into the substrate that the pile was driven.
10. The physical characteristics of the bottom substrate into which the piles were driven.
11. The total number of strikes to drive each pile and for all piles driven during a 24-hour period.
12. The underwater wideband background sound pressure level reported as the 50% CDF *(if applicable)*.
13. The results of the hydroacoustic monitoring, as described under Signal Processing. An example table is provided in Appendix C for reporting the results of the monitoring.
14. The distance at which peak, cSEL, and rms values exceed the respective threshold values.

Under Revision

15. A description of any observable fish, marine mammal, or bird behavior in the immediate area will and, if possible, correlation to underwater sound levels occurring at that time.

Under Revision

6.0 References

50 CFR § 226. 207-208 (1998) Wildlife and Fisheries Designated Critical Habitat for green turtle and hawksbill turtle.

ATKINS (2014) San Ildefonso Benthic Report.

CALTRANS (2012) Compendium of Pile Driving Sound Data. California Department of Transportation. February, 2012.

Edmund Gerstein (2002) Manatees, Bioacoustics and Boats-Hearing tests, environmental measurements and acoustics phenomena may together explain why boats and animals collide.http://www.americanscientist.org/issues/id.758,y.0,no.,content.true,page.2,css.print/issue.aspx. American Scientist Article March-April 2002 Issue. Retrieved on October 8, 2015.

FHWG (2013) Concurrence and General Instructions on Use of the Underwater Noise Monitoring Plan Template. Fisheries Hydroacoustic Working Group, consisting of the NOAA Fisheries West Coast Region, the US Fish & Wildlife Service Regions 1 and 8, and the California Department of Fish and Wildlife. August 28, 2013.

NEPA (2005) 40 CFR 1500.1, Title40, Volume 24, Parts 790 to End, Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act.

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Appendix A

Calculation of Cumulative SEL

An estimation of individual SEL values can be calculated for each pile strike by calculating the following integral, where T is T90, the period containing 90% of the cumulative energy of the pulse (eq. 1).

$$\textbf{SEL} = 10 \log \left(\int_0^T \frac{P^2(t)}{P_0^2} dt \right) dB \quad \textbf{(eq. 1)}$$

Calculating a cumulative SEL from individual SEL values cannot be accomplished simply by adding each SEL decibel level arithmetically. Because these values are logarithms they must first be converted to antilogs and then accumulated. Note, first, that if the single strike SEL is very close to a constant value (within 1 dB), then cumulative SEL = single strike SEL + 10 times log base 10 of the number of strikes N, i.e, 10Log10(N). However if the single strike SEL varies over the sequence of strikes, then a linear sum of the energies for all the different strikes needs to be computed. This is done as follows: divide each SEL decibel level by 10 and then take the antilog. This will convert the decibels to linear units (or uPa2•s). Next compute the sum of the linear units and convert this sum back into dB by taking 10Log10 of the value. This will be the cumulative SEL for all of the pile strikes.

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Appendix B

Calculation of a Cumulative Distribution Function and Plot for Background Sound Level Analysis

Data from three full 24-hour underwater measurement cycles (minimum) are used to calculate a 30-second Root Mean Square (RMS) value for each 30-second period for the entire dataset. The RMS should be calculated for both the full frequency range recorded as well as a separate dataset which has been passed through a high pass filter thus eliminating those frequencies below 1000 Hz. These datasets are then grouped into 24-hour periods. To determine if the data is approximately log-normal in distribution, each 24-hour period is plotted as a Probability Density Function (PDF). Each 24-hour period can be plotted on the same PDF plot. The plots should be approximately log normal in distribution and thus can be used in the further analysis. Each day of data should have an approximately Gaussian sigmoid shape, the differences between them and the ideal might be hard to spot, but the sigmoid from day to day will show noticeable variation. Data which does not approximate a log normal distribution should be excluded from further analysis.

The Cumulative Distribution Function (CDF) plot is obtained by plotting the normalized cumulative sum vs. the bin location. You can also get the PDF from plotting the normalized bin count vs. the bin location. The normalized bin count is obtained by dividing the count column by (number of data points multiplied by the space between 2 consecutive bins). This provides the integral of the PDF equal to 1. For instructions on creating a histogram in Microsoft Excel, see: http://www.vertex42.com/ExcelArticles/mc/Histogram.html

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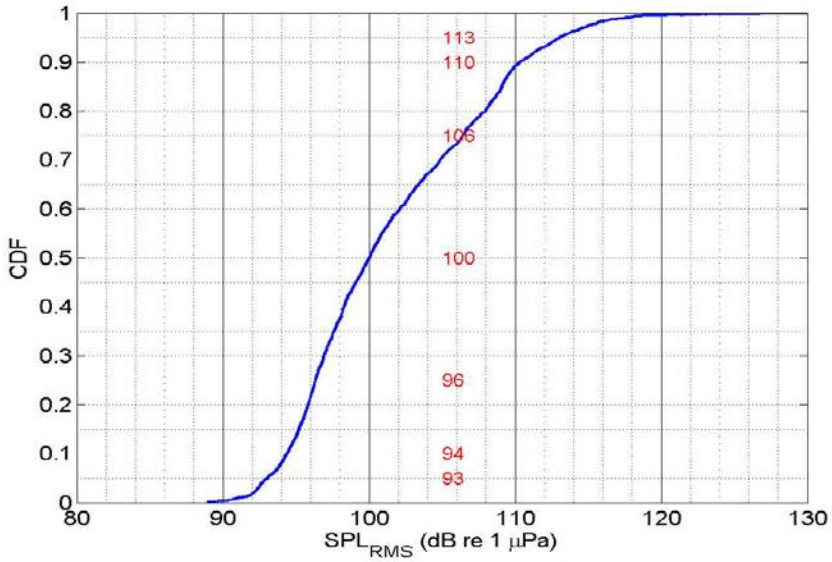

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Appendix C

Example table for information required for reporting the results of hydroacoustic monitoring of pile driving.

Date and Time	Pile ID	Hammer Impact or Vibratory	# Strikes or Vibratory Seconds	Distance to Pile from Hydrophone (m)	Water Depth (m)		Peak (dB)			$SEL_{90\%}$ (dB)				$RMS_{90\%}$ (dB)			Notes
					At Pile	At H-phone	Max	Min	Mean	Max	Min	Mean	$cSEL_{90\%}$	Max	Min	Mean	

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Appendix F

OCTOBER 2015

ENSENADA HONDA NAVIGATIONAL CHANNEL ENTRANCE ESA CORALS & FISH MONITORING PLAN

PART OF THE MITIGATION PLANS FOR THE

IMPACTS ASSOCIATED TO THE RECONSTRUCTION OF THE CULEBRA CARGO FERRY TERMINAL IN SARDINAS BAY

CULEBRA, PUERTO RICO

PREPARED FOR :

AUTORIDAD de los PUERTOS de PUERTO RICO

PREPARED BY:

ATKINS

Contents

1.0 Introduction 2
2.0 Project Description 4
3.0 Background Information 5
3.1 Listed Coral Species 5
3.2 Nassau Grouper 6
4.0 Monitoring Plan 7
5.0 Study Locations and Methodology 8
5.1 First Monitoring Phase 8
5.2 Second Monitoring Phase 9
5.3 Equipment 10
5.4 Personnel 11
6.0 References 12

Under Revision

1.0 Introduction

The National Environmental Policy Act (NEPA) directs federal agencies to thoroughly assess the environmental consequences of "major federal actions significantly affecting the environment." Before the Federal Emergency Management Agency (FEMA) can fund or implement an action that may affect the environment, agency decision-makers must study the potential impacts that the proposed action and alternatives will have on the human and natural environment, and make that information available to the public.

The Puerto Rico Ports Authority (PRPA) conducted a structural evaluation at the Culebra Ferry Terminal on August, 2010, where advanced deterioration was observed in the deck slab and concrete beams, which has probably spread to the entire concrete surface. This appears to be a result of storm events, hurricanes and the wave action. Furthermore, if the repair and reconstruction of the cargo terminal is not conducted promptly, structural failure may occur. The PRPA has since been planning the necessary works, seeking financing and regulatory compliance.

Being the only heavy commercial cargo transportation port in Culebra, the cargo ferry provides an essential service to the residents of the island. The areal constraints prevent the cargo and passenger ferries from docking simultaneously, as the size of the required demolition/construction barge would prevent the Puerto Rico Maritime Transport Authority (MTAPR) passenger ferries from docking, altering the scheduled service.

After evaluating potential sites for an Auxiliary Terminal, the San Ildefonso site in Ensenada Honda (***Figure 1***) was chosen for the limited environmental impacts involved, since no dredging is required, the landside is ample, has been previously developed, and has the required power and water service. There are unavoidable impacts associated with the construction and operation of the proposed action.

Since 2010, Federal and State Agencies, and key stakeholders, have been engaged to thoroughly assess any potential adverse impact to the environment that may be caused by the reconstruction of the Culebra Cargo Terminal, and to recommend attenuation, mitigation and/ or avoidance actions. The following Endangered Species Act (ESA) Listed Corals and Fish Monitoring Plan has been prepared in compliance with the NEPA process. This monitoring plan will evaluate the

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impacts of intensive ferry activities upon the reef located at the entrance of Ensenada Honda during the construction period.

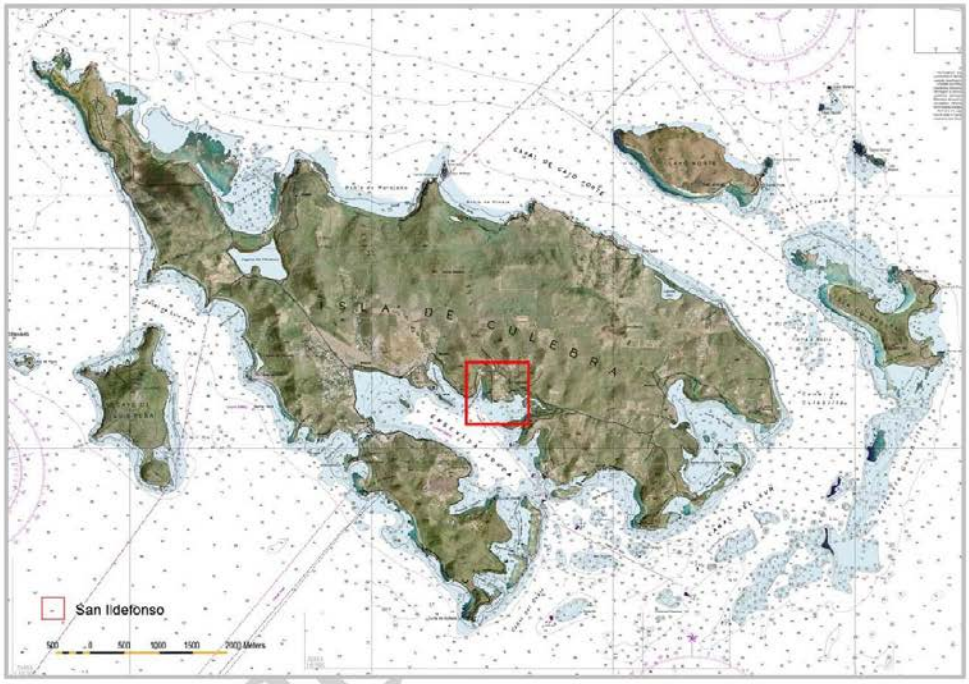

Figure 1: *Location of the Auxiliary Cargo Ferry Terminal in San Ildefonso.*

2.0 Project Description

The Culebra Cargo Ferry will be docking at the San Ildefonso Auxiliary Terminal Facility during the construction of the Culebra Cargo Ramp at Sardinas Bay. To reach the Auxiliary Terminal in San Ildefonso by sea, the cargo ferry would travel south around Punta del Soldado and turn 40° NE in the "Canal del Oeste" between the lighted buoy (R "2", Fl R 4s in the Nautical Chart) that marks "Bajo Amarillo", keeping this heading for approximately 1 nautical mile, where the "Canal

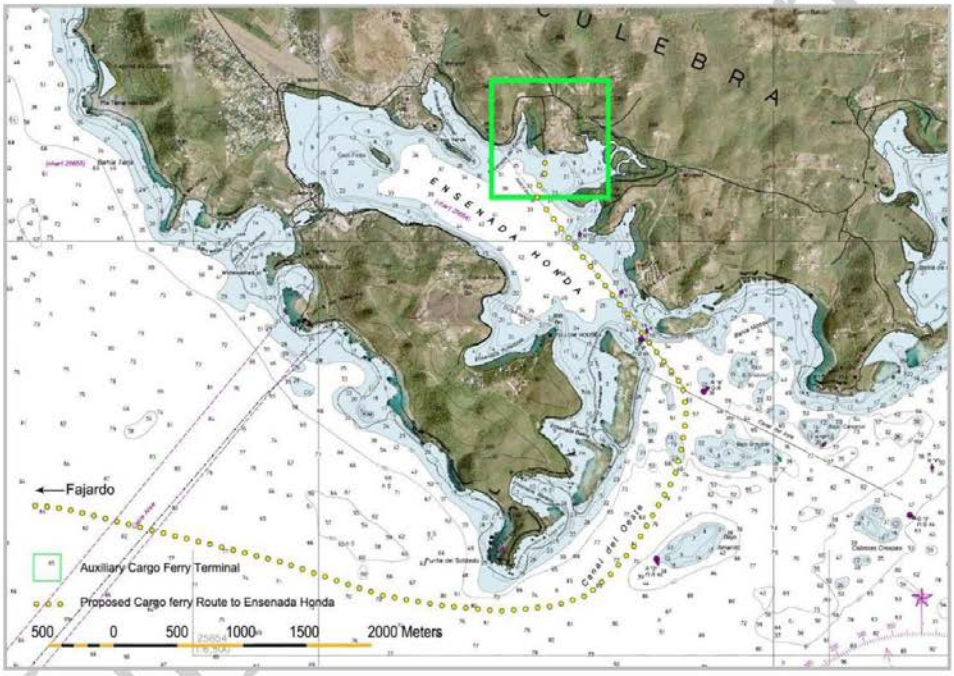

***Figure 2**: Proposed Cargo Ferry Route to San Ildefonso Auxiliary Facility at Ensenada Honda*

del Este" is located. Once reaching Canal del Este, the cargo ferry must turn 325° NW to the entrance of Ensenada Honda, clearly marked by two buoys (G "9", Fl G 4s and RN "10"). Once inside Ensenada Honda, the cargo ferry must travel an additional nautical mile before arriving at San Ildefonso on the northern shoreline (see ***Figure 2***).

Approximately 280 scheduled cargo ferry trips will take place during this period, increasing navigational activities upon the reef located at the entrance to Ensenada Honda.

3.0 Background Information

3.1 Listed Coral Species

On September 10, 2014, the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Office of Protected Resources (OPR) listed seven species of corals under the ESA (= listed species). Two of those species, the elkhorn coral (*Acropora palmata*) and staghorn coral (*Acropora cervicornis*), were previously listed as threatened and retained that listing. Below are the five coral species that have been recently listed as threatened.

- *Dendrogyra cylindrus* - Pillar coral
- *Mycetophyllia ferox* - Rough cactus coral
- *Orbicella annularis* - Lobed star coral
- *Orbicella faveolata* - Mountainous star coral
- *Orbicella franksi* - Boulder star coral

Above, left: *Acropora palmata.* ***Above, right****: Dendrogyra cylindrus*

All of these coral species are found throughout the Caribbean. The *Acropora* spp. and the *Orbicella* spp. complex have historically dominated coral reefs throughout the Caribbean forming dense assemblages of large, hundreds-of-years old colonies interspersed with a few small colonies (Bruckner 2012). Since the decline of *Acropora* spp during the 1980s, the total reduction of coral cover in the Caribbean has been associated with the decline of the star coral (*Orbicella spp.*) (NOAA 2015).

The other coral species – pillar coral (*Dendrogyra cylindrus*) and rough cactus coral (*Mycetophyllia ferox*) – are rare. Pillar coral is uncommon and appears in scattered isolate colonies, though the species is rarely found in aggregations (NOAA 2015). Rough cactus coral is one of the least common species observed in monitoring studies (NOAA 2015).

3.2 Nassau Grouper

The Nassau grouper (*Epinephelus striatus*) is currently listed by NMFS as a species of concern, although it is currently in the process of potentially becoming a listed species. The 12-month finding and listing determination was announced in the Federal Register in September 2014 and the commenting period ended in December 2014.

The Nassau grouper is primarily a shallow-water insular fish found throughout the Caribbean. This species is considered a reef fish; however, it transitions through a series of habitats during its development from a planktonic larva to an adult on the reef. Recently settled juveniles are found in macroalgae, coral clumps, and seagrass beds. As the juveniles grow, they move to progressively deeper areas and offshore reefs. Adult Nassau grouper tend to be relatively sedentary and are generally associated with high relief coral reefs or rocky substrate in clear water to depths of 130 meters (Federal Register 2014).

Above: *Adult Nassau grouper*

The study area represents a transitional habitat for the species. The seagrass and coral habitat within Ensenada Honda provides initial settlement habitat for the early stage juveniles. Nearshore coral habitats represent an area for later stage juveniles and young adult as they transition to progressively deeper offshore coral areas.

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4.0 Monitoring Plan

The primary purpose of the plan is to develop methods that are sensitive in evaluating any potential impacts to coral reefs at the entrance of Ensenada Honda near the navigational channel, including federally listed coral species or Nassau grouper habitat from the intensive cargo ferry activity that may result from the use of the Auxiliary Cargo Ferry Terminal in San Ildefonso. The use of the site will require the ferry to enter Ensenada Honda through the narrow channel between Cayo Quebrado (Green Navigation Marker 9) and Punta Carenero (Red Navigation Marker 10) via Canal del Oeste (west channel) or Canal del Este (east channel) (see ***Figure 3***).

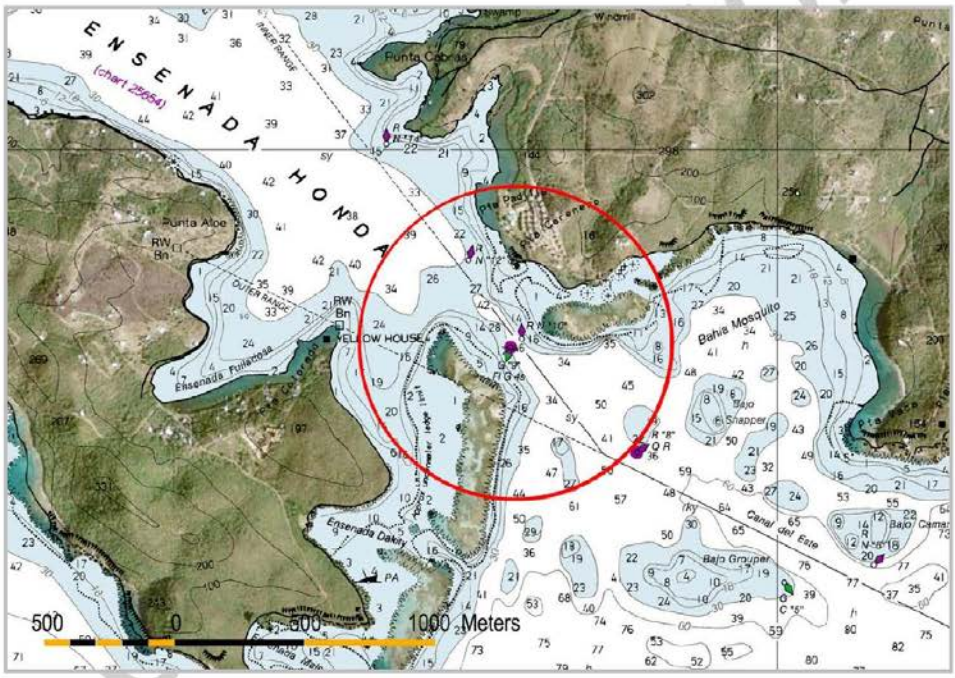

Figure 3: *Location of the Ensenada Honda Entrance Channel and nearby reefs.*

5.0 Study Locations and Methodology

The study locations will ultimately be defined by the operations of the cargo ferry. The critical study location is the narrow channel described above and the selected entry channel (Canal del Oeste or Canal del Este) to reach Ensenada Honda. The proposed study methods are two-phased. This two phased approach follows the recommended survey protocols for *Acropora* spp. in support of Section 7 ESA consultation. The survey protocols for the recently listed coral species are currently being developed, but should be similar to the *Acropora* spp. protocols (NOAA 2007) since the recently listed species have similar problems regarding surveys (i.e. a patchy and potentially clumped distribution and a stratified distribution potentially along a depth gradient or substrate type within the study area).

5.1 First Monitoring Phase

The first phase requires a broad-scale characterization of the hard bottom habitat around the channels including the narrow channel between Cano Quebrado (Green Navigation Marker 9) and Punta Carenero (Red Navigation Marker 10) and the entry channels (Canal del Oeste and Canal del Este). The purpose of this broad-scale characterization is to focus on the general reef geomorphology (structure) and major habitat types to identify the locations of or the potential for the listed coral species. In addition, this phase is also an opportunity to locate and characterize any existing reef damage establishing a baseline for future damage assessment surveys and potentially establishing sensitive locations that will need to be avoided in the ferry route.

First Phase Methodology:

1. The survey will be performed using a series of transects along depth contours from 0 to 6 meter water depth along the channel sides (i.e. representative of potential impact area). The number and length of transects will be determined by the conditions (visibility and safety conditions with multiple divers in the water).

2. The start and stop points of each transect will be recorded using a Global Positioning System (GPS) unit (preferably a unit with sub-meter accuracy such as a Trimble). GPS positions will also be collected at points along the transect where concentrations of listed coral species, potential Nassau Grouper habitat, or significant damage are located.

Under Revision

3. As necessary, these areas - in particular, large colonies of listed coral species, concentrations of smaller colonies of listed coral species, locations of or potential habitat for Nassau grouper, and/or large existing damage areas - will be further delineated after the initial transect survey (see second phase described below). For the listed coral species, survey personnel will also record the size of the aggregation or colony and percentage of living tissue.

4. The result of this broad-scale survey is a survey site map with the locations of concentrations of listed coral species, potential Nassau Grouper habitat, and significant damage areas (if present).

5.2 Second Monitoring Phase

The second phase is a more detailed assessment of the hard bottom/coral habitat along the channel edges in areas identified during Phase I as having concentrations of the targeted species and/or habitat.

Second Phase Methodology:

1. Video transects will be established to specifically characterize the bottom habitat within these areas.

2. The number of transects will follow the *Acropora* spp. protocols within these identified areas.

3. These transects will be established at select locations perpendicular to the channels edges in depths from 0 to 6 meters.

4. The beginning and end of the transect will be recorded using GPS. A fiberglass surveyor's tape will be extended along the bottom, marking the linear extent of the transect.

5. The transect will be videotaped at a specific, constant distance from the bottom. The entire video transect will be reviewed for presence of the targeted species; however, selected non-overlapping frames of the video will be analyzed in a software program to

Under Revision

determine the percent coverage of benthic components (e.g., hard coral, algae, hard bottom) within the hard bottom/coral area.

6. The Phase I results will be used to select the potential bottom elevation (water depth) differences in the habitat, i.e. if the phase one results indicate that the targeted species or habitat does not exist within certain depths, those depths will be eliminated from the phase two analysis.

5.3 Equipment

It is suggested that the work be accomplished using a survey boat and operator and a dive team of 3 to 4 dive personnel. Suggested equipment includes:

- *A survey boat of approximately 6 meters;*
- *Dive equipment and tanks;*
- *Drop buoys and dive buoys;*
- *GPS unit (preferably with sub-meter accuracy such as a Trimble unit);*
- *100 meter fiberglass surveyor's tape;*
- *Data sheets on underwater paper;*
- *Underwater video camera; and*
- *Underwater still camera.*

Under Revision

5.4 Personnel

The scientific dive team must be competent in coral identification, particularly in the identification of the listed coral species. The type of habitat found within the study area may contain small colonies of the listed coral species. At very early stages in colony formation, differentiation of *Orbicella* spp. may be difficult. In addition, the dive team must be able to identify fish species and, in particular, Nassau grouper. For the Nassau grouper, the study area represents transitional habitat (as explained above) so personnel must be able to identify juvenile Nassau grouper.

The boat operator must be competent in working with dive operations in order to properly assist the scientific dive team.

Under Revision

6.0 References

Atkins. 2015. Mitigation plan for the impacts associated to the construction and operations of the Culebra Auxiliary Cargo Ferry Terminal in San Ildefonso, Culebra, Puerto Rico. A report for the Puerto Rico Ports Authority. 13 p.

Bruckner, A. 2012. Factors contributing to the regional decline of *Montastraea annularis* (complex). Yellowlees, D. and Hughes, T. P. (Ed). Proceedings of the 12th International Coral Reef Symposium. James Cook University, Cairns, Australia.

Department of Commerce, National Oceanic and Atmospheric Administration. 2014. Endangered and Threatened Wildlife and Plants: Notice of 12-Month Finding on a Petition to List the Nassau Grouper as Threatened or Endangered under the Endangered Species Act (ESA). Federal Register Vol.79, No. 69, September 2, 2014, 51929-51941.

National Oceanic and Atmospheric Administration, National Marine Fisheries, Office of Protected Resources. 2015. Recovery Outline. Pillar coral, rough cactus coral, lobed star coral, mountainous star coral, and boulder star coral. 5 p.

National Oceanic and Atmospheric Administration, National Marine Fisheries, Office of Protected Resources. 2007. Recommended survey protocol for *Acropora* spp. in support of Section 7 Consultation. 1p.

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Appendix G

JANUARY 2016

TRANSPLANT PLAN FOR SAN ILDEFONSO CORALS-UPDATE

PART OF THE MITIGATION PLANS FOR THE

IMPACTS ASSOCIATED TO THE RECONSTRUCTION OF THE CULEBRA CARGO FERRY TERMINAL IN SARDINAS BAY

CULEBRA, PUERTO RICO

PREPARED FOR:

AUTORIDAD de los PUERTOS de PUERTO RICO

PREPARED BY:

ATKINS

Contents

1.0 Introduction 2

2.0 Project Description 3

3.0 Methodology 4

3.1 Coral Removal 4

3.2 Relocation Site 6

4.0 Coral Monitoring 6

4.1 Monitoring frequency 6

4.2 Methodology 6

5.0 Performance Standard 7

6.0 Monitoring Reports 7

7.0 References 7

1.0 Introduction

The Puerto Rico Ports Authority (PRPA) conducted a structural evaluation at the Culebra Cargo Ferry Terminal on August, 2010, where advanced deterioration was observed in the deck slab and concrete beams, which has probably spread to the entire concrete surface. This appears to be a result of storm events, hurricanes and the wave action. Furthermore, if the repair and reconstruction of the cargo terminal is not conducted promptly, structural failure may occur.

As the only heavy commercial cargo transportation port in Culebra, the cargo ferry provides an essential service to the island-municipality residents. An alternatives analysis resulted in the proposed construction of an Auxiliary Cargo Terminal, while the existing cargo terminal is reconstructed. After evaluating potential sites for an Auxiliary Terminal, the San Ildefonso site in Ensenada Honda (***Figure 1***) was chosen for the limited environmental impacts involved, since no dredging is required, the landside is ample, has been previously developed, and has the required

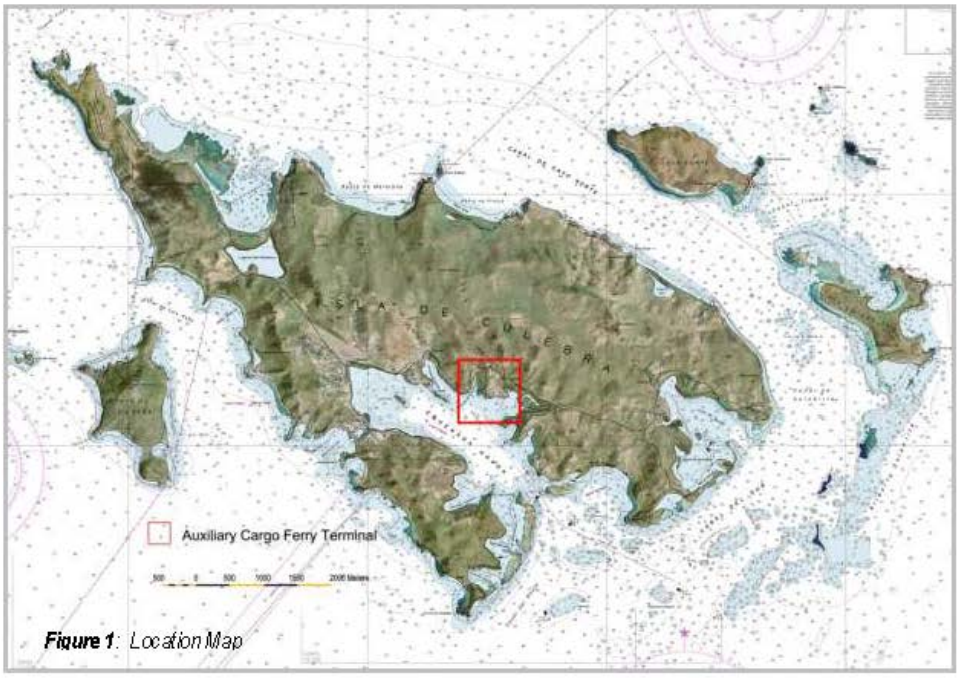

Figure 1: *Location Map*

power and water service. Nevertheless, there are unavoidable impacts associated with the construction and operation of the proposed action.

A survey of existing corals was conducted in the project footprint at the existing San Ildefonso recreational pier area, since some of the structures will be demolished and replaced. The ultimate goal of these mapping efforts was to estimate impacts to the coral community and to determine potential avoidance/minimization and mitigation options.

A total of 10 colonies from 3 species, including 4 colonies of the ESA-listed *Orbicella* coral, were identified in a total of 5 pilings. This Plan has been prepared in order to mitigate for these impacts.

2.0 Project Description

The proposed Culebra Auxiliary Cargo Ferry Terminal includes the installation of a pre-fabricated floating aluminum platform (pontoon platform) that will match freeboard ferryboat highs and ease loading and unloading activities. An aluminum pre-fabricated vehicular bridge-platform will connect the pontoon platform to land.

The existing recreational dock is a reinforced concrete structure supported by 28 steel encased concrete piles with a 14 inch diameter. Due to existing, unsafe structural conditions it will be demolished and replaced with a new dock built out of a prefabricated aluminum platform and supported by eight steel encased concrete piles 18 inches in diameter. The new dock will occupy the same area as the existing one and will be connected to the new replacement pier and the pontoon platform via an aluminum passenger boarding ramp.

Construction of the Auxiliary Terminal is estimated to last 6 months. During this period, one barge will use retrievable spuds to secure itself in position, temporarily impacting the sandy bottom. Once this auxiliary platform is completed, the scheduled cargo ferry service from Fajardo to Culebra will dock at San Ildefonso while the existing cargo platform in Sardinas Bay is demolished and rebuilt.

3.0 Methodology

From a total of 24 pilings assessed, only 5 pilings, identified as **A10**, **B04**, **C04**, **D06** and **D02** (***Figure 2***) had encrusting of coral colonies with a diameter greater than 10 cm, for a total of 10 colonies from 3 species. Most of these colonies had encrusting organisms of their own (sponge growth, tube worms) or had sections covered in detritus. Four colonies of the Endangered Species Act (ESA) listed *Orbicella* (Threatened) were identified, and will be potentially impacted by the construction.

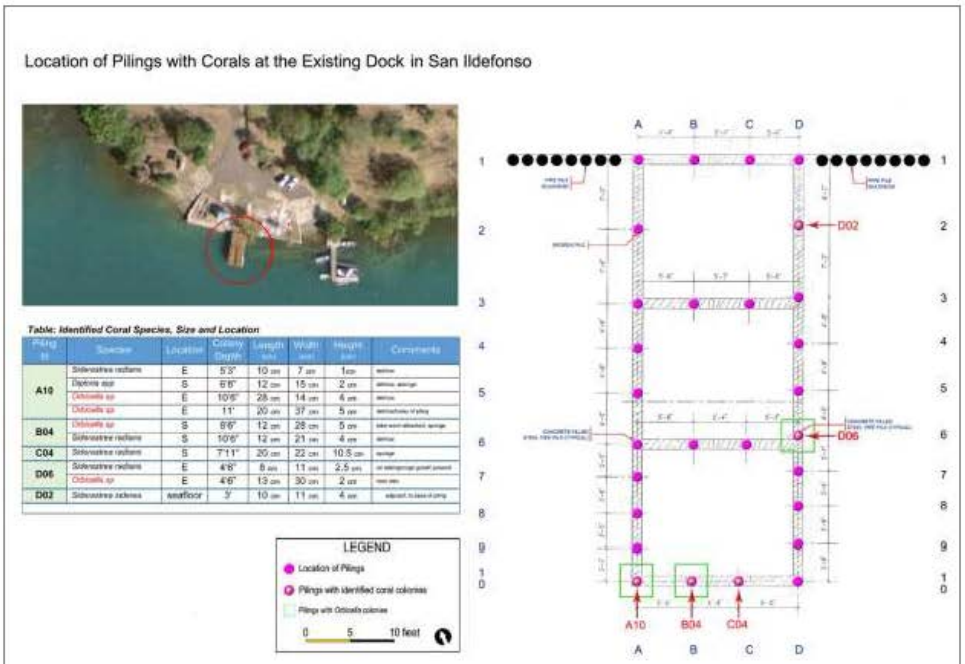

***Figure 2**: Plan view of the existing dock (to be demolished) and the location of its pilings. Pilings identified as A10, B04, C04, D06 and D02 have colonies with diameters greater than 10 centimeters.*

3.1 Coral Removal

Prior to removing the corals, the substrate area for each individual reattachment will be scraped clear of sediment and vegetative cover using spatulae, wire brushes or such to expose clean rock,

concrete or other such suitable substrate. The approximate area to be cleaned for each of the ten colonies will be 10 to 12" in diameter—the approximate diameter of the bottom of a 5-gallon bucket. Each site's location will be documented, so that a "map" of the relocation site can be drawn for future reference.

Divers will locate and remove the target coral colonies identified in this report. New measurements (width, height and depth) and condition (health, growths, etc.) will be collected for each of the colonies. An identification name or number will be designated for each, which will be in a permanent (5 year) label at its final relocation site, PVC with carved letters is recommended. Each coral colony will be detached from the piling using a sledgehammer and chisel; it is preferred that piling fragments be included in the transplant rather than to break (fragment) the colony. Notes will be taken to document the results of the detachment procedure, such as entire colony, partial colony, or number of fragments—all of which will be relocated. Extreme caution will be exercised to prevent contact with the live coral tissue, carefully handling the colonies from the base (the face previously against the piling) or by its edges. Colonies will be promptly placed in plastic bins to minimize direct contact with hands or gloves. Extreme care must be taken to avoid exposure of the detached colonies to air, temperature changes or greater exposure to sunlight than in their former habitat.

Various adhesives are available. Portland cement is suggested, which can be mixed on the surface in a bucket to 3" to 5" high, allowed to begin curing, and then brought to the reattachment site, where the cement bucket is turned upside down and allowed to drop on the clean, hard surface. Once most of the turbidity from the cement has cleared, the colony's base is pressed against the cement "cake". Instead of using the bucket, Portland cement can be mixed and transferred to a gallon zip-lock bag for transfer to the reattachment site. Either way, a permanent tag with the colony's identifier can be placed against (pressed on) the curing cement to ensure a firm, permanent marking.

Following relocation, photos of each transplanted colony will document their setting and permanent marking. A report will provide the transplant details.

3.2 Relocation Site

In accordance with DNER's December 22, 2015 letter, the site where the selected corals will be reattached will be determined soon, prior to construction.

4.0 Coral Monitoring

The monitoring plan will be used to identify compliance with the performance standard. Observing individual coral colonies over time can be a simple way to monitor their health and to identify potential problems in time to remedy them.

The transplant site will be monitored to determine condition for each colony, with parameters such as dimensions, disease, bleaching, predation, sediment smothering, algal overgrowth, etc. Their marker will be replaced if damaged or lost. Each colony will be photographed or videotaped at every monitoring event. These photographs are intended for qualitative, rather than quantitative analysis, due to the difficulty in replicating the distance and camera angle used initially.

4.1 Monitoring frequency

The relocation site will be monitored after transplant, monthly during the first year after relocation and every six months during the following year

4.2 Methodology

1. **Identify the Colony:** Before start any data collection, all the colonies will be identified. Remove encrusting organisms on the tag, replace if necessary.
2. **Identify the species**: Identify the species of each colony.
3. **Record the condition**: Using the information of the following table, describe the colony condition.
4. **Photograph the colony**. Each colony should be photographed or videotaped when its condition is first recorded. Include its tag. Use an angle which best represent the entire colony. The following table lists common conditions for the observations.
5. **Coral Dimensions**. Hight, width and depth, in centimeters.

Conditions Commonly Present in Corals
Bleached coral: white, with tissue remaining
Dead coral: white, cleaned coral skeleton without tissue.
Cleaned coral skeleton without tissue but with algal turf grown over the skeleton.
Dead coral with algal turf: skeleton not visible or conspicuous, older.
Light-colored; bleached but not completely white.
Light ridges
Discolored tissue: unusual color not due to bleaching – purple, pink, bluish, etc.
Freshly grazed coral tissue
Older grazed area, overgrown with algae.
Older grazed area that has been grown over by tissue.
Black band disease
White band disease
Mucus coat, often with adhering sediment or algal growth.
Mustard-colored tissue.
Sediment spot, small sediment-filled spot or hole.

5.0 Performance Standard

A success rate of 80% will be considered satisfactory. Failure to reach this standard may result in additional mitigation efforts to be determined by the regulatory agencies.

6.0 Monitoring Reports

Monitoring reports must be submitted to the Puerto Rico Port Authority after each monitoring event. This should include copy of all data sheets, date of the event, summary of the findings, general condition of the coral colonies, any concern related to the relocation of the corals and recommendation. The report should be submitted within 30 days after the monitoring event.

7.0 References

FF&WCC (2015) Coral Reef Evaluation and Monitoring Project. Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute. Found in: http://myfwc.com/research/habitat/coral/cremp/

FF&WCC (2015) Site Selection and Monitoring Methods. Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute. Found in: http://myfwc.com/research/habitat/coral/cremp/site-selection-monitoring/

Rogers, C.S., Garrison, G., Grober, R., Hillis, Z. & Franke, M. (1994). Coral Reef Monitoring Manual for the Caribbean and Western Atlantic. National Park Services, Virgin Island National Park.

RR (2015) Coral Reef Module, Monitoring and Assessment. Reef Resilience. Found in: http://www.reefresilience.org/coral-reefs/monitoring-and-assessment/