Final
BIOLOGICAL EVALUATION

Ocean Era, Inc. - Velella Epsilon
Marine Aquaculture Facility
Outer Continental Shelf
Federal Waters of the Gulf of Mexico

September 30, 2020

U.S. Environmental Protection Agency
Region 4
Water Protection Division
61 Forsyth Street SW
Atlanta Georgia 30303

NPDES Permit Number
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1.0 Introduction and Federal Coordination

In accordance with the Endangered Species Act (ESA) Section 7, interagency consultation and coordination with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) is required to insure that any action authorized, funded, or carried out by an action agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of any designated critical habitat (Section 7(a)(2)); and confer with the NMFS and USFWS on any agency actions that are likely to jeopardize the continued existence of any species that is proposed for listing or result in the destruction or adverse modification of any critical habitat proposed to be designated (Section 7(a)(4)).[1]

On November 9, 2018, the U.S. Environmental Protection Agency Region 4 (EPA) received a complete application for a National Pollutant Discharge Elimination System (NPDES) permit from Ocean Era (formerly Kampachi Farms) for the point-source discharge of pollutants from a marine aquaculture facility in federal waters of the Gulf of Mexico (Gulf). On November 10, 2018, the U.S. Army Corps of Engineers Jacksonville District (USACE) received a completed Department of Army (DA) application pursuant to Section 10 of the Rivers and Harbors Act for structures and work affecting navigable federal waters from the same marine aquaculture facility.

Given that the action of permitting the proposed project involves more than one federal agency, the EPA has elected to act as the lead agency to fulfill the consultation responsibilities pursuant to the implementing regulations of ESA Section 7.[2] The USACE is a cooperating and co-federal agency for this informal consultation request. The completion of the informal consultation shall satisfy the EPA's and USACE's obligations under ESA Section 7(a)(2).

The EPA and the USACE (action agencies) have reviewed the proposed activity and determined that a biological evaluation (BE) is appropriate. The BE was prepared by the EPA and the USACE to jointly consider the potential direct, indirect, and cumulative effects that the proposed actions may have on listed and proposed species as well as designated and proposed critical habitat, and to assist the action agencies in carrying out their activities for the proposed action pursuant to ESA Section 7(a)(2) and ESA Section 7(a)(4). The EPA and the USACE have provided this BE for consideration by the USFWS and the NMFS in compliance with the ESA Section 7.

The EPA and USACE coordinated the interagency permitting process as required by the interagency Memorandum of Understanding (MOU) for Permitting Offshore Aquaculture Activities in Federal Waters of the Gulf,[3] and conducted a comprehensive analysis of all applicable environmental requirements required by the National Environmental Policy Act (NEPA); however, a consolidated cooperation process under NEPA was not used to satisfy the requirements of ESA Section 7 as described in 50 CFR § 402.06.[4] The NMFS was a cooperating agency for the NEPA analysis and has provided scientific expertise related to the BE and NEPA analysis for the proposed action including information about: site selection, ESA-listed species, marine

[1] The implementing regulations for the Clean Water Act related to the ESA require the EPA to ensure, in consultation with the NMFS and USFWS, that "any action authorized the EPA is not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat" (40 CFR § 122.49(c)).

[2] 50 CFR § 402.07 allows a lead agency: "When a particular action involves more than one Federal agency, the consultation and conference responsibilities may be fulfilled through a lead agency. Factors relevant in determining an appropriate lead agency include the time sequence in which the agencies would become involved, the magnitude of their respective involvement, and their relative expertise with respect to the environmental effects of the action. The Director shall be notified of the designation in writing by the lead agency."

[3] On February 6, 2017, the Memorandum of Understanding for Permitting Offshore Aquaculture Activities in Federal Waters of the Gulf of Mexico became effective for seven federal agencies with permitting or authorization responsibilities.

[4] 50 CFR § 402.06 states that "Consultation, conference, and biological assessment procedures under section 7 may be consolidated with interagency cooperation procedures required by other statutes, such as the National Environmental Policy Act (NEPA) (implemented at 40 CFR Parts 1500 - 1508) or the Fish and Wildlife Coordination Act (FWCA)."

mammal protection, and essential fish habitat. While some information related to the ESA evaluation is within the coordinated NEPA document developed by multiple federal agencies, the attached BE is provided as a stand-alone document to comply with the consultation process under ESA Section 7.

2.0 Proposed Action

Ocean Era, Inc. (applicant) is proposing to operate a pilot-scale marine aquaculture facility (Velella Epsilon) in federal waters of the Gulf. The proposed action is the issuance of permits under the respective authorities of the EPA and the USACE as required to operate the facility. The EPA's proposed action is the issuance of a NPDES permit that authorizes the discharge of pollutants from an aquatic animal production facilityinto federal waters of the United States. The USACE's proposed action is the issuance of a DA permit pursuant to Section 10 of the Rivers and Harbors Act that authorizes anchorage to the sea floor and structures affecting navigable waters.

3.0 Proposed Project

The proposed project would allow the applicant to operate a pilot-scale marine aquaculture facility with up to 20,000 almaco jack (*Seriola rivoliana*) being reared in federal waters for a period of approximately 12 months (total deployment of the cage system is 18 months). Based on an estimated 85 percent survival rate, the operation is expected to yield approximately 17,000 fish. Final fish size is estimated to be approximately 4.4 pounds (lbs) per fish, resulting in an estimated final harvest weight of 80,000 lbs considering a 10% mortality rate. The fingerlings will be sourced from brood stock that are located at Mote Aquaculture Research Park, in Sarasota, Florida, and were caught in the Gulf near Madeira Beach, Florida. As such, only F1 progeny will be stocked into the proposed project.

One support vessel will be used throughout the life of the project. The vessel will always be present at the facility except during certain storm events or times when resupplying is necessary. The support vessel would not be operated during any time that a small craft advisory is in effect for the proposed action area. The support vessel is expected to be a 70 ft long Pilothouse Trawler (20 ft beam and 5 ft draft) with a single 715 HP engine. The vessel will also carry a generator that is expected to operate approximately 12 hours per day. Following harvest, cultured fish would be landed in Florida and sold to federally licensed dealers in accordance with state and federal laws. The exact type of harvest vessel is not known; however, it is expected to be a vessel already engaged in offshore fishing activities in the Gulf.

A fully enclosed and submersible single copper pen that is offshore strength (PolarCirkel-style) will be deployed on an engineered multi-anchor swivel (MAS) mooring system. The engineered MAS will have up to three anchors for the mooring, with a swivel and bridle system. The design drawings provided for the engineered MAS uses three concrete deadweight anchors for the mooring; however, the final anchor design will likely utilize embedment anchors instead. The cage material for the proposed project is constructed with rigid and durable materials (copper mesh net with a diameter of 4-millimeter (mm) wire and 40 mm x 40 mm mesh square). The mooring lines for the proposed project will be constructed of steel chain (50 mm thick) and thick rope (36 mm) that are attached to a floating cage that will rotate in the prevailing current direction; the ocean currents will maintain the mooring rope and chain under tension during most times of operation. The bridle line that connects from the swivel to the cage will be encased in a rigid pipe. Structural information showing the MAS and pen, along with the tethered supporting vessel, is provided in Appendix A. The anchoring system for the proposed project is being finalized by the applicant. While the drawings in Appendix A show concrete deadweight anchors, it is likely that the final design will utilize appropriately sized embedment anchors instead. Both anchor types are included for ESA consultation purposes.

The cage design is flexible and self-adjusts to suit the constantly changing wave and current conditions. As a result, the system can operate floating on the ocean surface or submerged within the water column of the ocean; however, the normal operating condition of the cage is below the water surface. When a storm approaches the area, the entire cage can be submerged by using a valve to flood the flotation system with water. A buoy remains on the surface, marking the net pen's position and supporting the air hose. When the pen approaches the bottom, the system can be maintained several meters above the sea floor. The cage system is able to rotate around the MAS and adjust to currents while it is submerged and protected from storms. After storm events, the cage system is made buoyant again by pumping air back into the flotation system, causing the system to rise to resume normal operational conditions. The proposed project cage will have at least one properly functioning global positioning system device to assist in locating the system in the event it is damaged or disconnected from the mooring system.

In cooperation with the NMFS, a protected species monitoring plan (PSMP) has been developed for the proposed action to protect all marine mammal, reptiles, sea birds, and other protected species. Monitoring will occur throughout the life of the project and represents an important minimization measure to reduce the likelihood of any unforeseen potential injury to all protected species including ESA-listed marine animals. The data collected will provide valuable insight to resource managers about potential interactions between aquaculture operations and protected species. The PSMP also contains important mitigative efforts such as suspending vessel transit activities when a protected species is observed to come within 100 meters (m) of the activity until the animal(s) leave the area. The project staff will suspend all surface activities (including stocking fish, harvesting operations, and routine maintenance operations) in the unlikely event that any protected species is observed to come within 100 m of the activity until the animal leaves the area. Furthermore, should there be activity that results in an injury to protected species, the on-site staff would follow the steps outlined in the PSMP and alert the appropriate experts for an active entanglement.[5]

The below information about chemicals, drugs, cleaning, and solid waste provides supporting details about the proposed project:

Chemicals: The proposed facility has indicated they would not be using toxic chemicals, cleaners, or solvents at the proposed project. The proposed project would use small amounts of petroleum to run the generator. Spills are unlikely to occur; however, if spills did occur, they would be small in nature.

Drugs: The applicant has indicated that FDA-approved antibiotics or other therapeutants will not likely be used (within any feed or dosing the rearing water) during the proposed project. [6] The need for drugs is minimized by the strong currents expected at the proposed action area, the low fish culture density, the cage material being used, and the constant movement of the cage.

Cleaning: The applicant does not anticipate the need to clean the cage for the short duration of the proposed project. Should the cage system need cleaning, divers would manually scrub the cage surfaces with cleaning brushes. No chemicals would be used while cleaning and any accumulated marine biological matter would be returned to sea without alteration.

Solid Wastes: The applicant will dispose of all solid waste appropriately on shore.

[5] A PSMP has been developed by the applicant with assistance from the NMFS Protected Resources Division. The purpose of the PSMP is to provide monitoring procedures and data collection efforts for species (marine mammals, sea turtles, seabirds, or other species) protected under the MMPA or ESA that may be encountered at the proposed project.

[6] The applicant is not expected to use any drugs; however, in the unlikely circumstance that therapeutant treatment is needed, three drugs were provided to the EPA as potential candidates (hydrogen peroxide, oxytetracycline dihydrate, and florfenicol).

4.0 Proposed Action Area

The proposed project will be placed in the Gulf at an approximate water depth of 40 m (130 feet), and generally located 45 miles southwest of Sarasota, Florida. The proposed facility will be placed within an area that contains unconsolidated sediments that are 3 – 10 ft deep (see Table 1). The applicant will select the specific location within that area based on diver-assisted assessment of the sea floor when the cage and anchoring system are deployed. The proposed action area is a 1,000 m radius measured from the center of the MAS.

The facility potential locations were selected with assistance from NOAA's National Ocean Service National Centers for Coastal Ocean Science (NCCOS). The applicant and the NCCOS conducted a site screening process over several months to identify an appropriate project site. Some of the criteria considered during the site screening process included avoidance of corals, coral reefs, submerged aquatic vegetation, hard bottom habitats, and avoidance of marine protected areas, marine reserves, and habitats of particular concern. This siting assessment was conducted using the Gulf AquaMapper tool developed by NCCOS.[7]

Upon completion of the site screening process with the NCCOS, the applicant conducted a Baseline Environmental Survey (BES) in August 2018 based on guidance developed by the NMFS and EPA.[8] The BES included a geophysical investigation to characterize the sub-surface and surface geology of the sites and identify areas with a sufficient thickness of unconsolidated sediment near the surface while also clearing the area of any geohazards and structures that would impede the implementation of the aquaculture operation. The geophysical survey for the proposed project consisted of collecting single beam bathymetry, side scan sonar, sub-bottom profiler, and magnetometer data within the proposed area. The BES report noted that there were no physical, biological, or archaeological features within the surveyed area that would preclude the siting of the proposed aquaculture facility within the area shown in Table 1.

Table 1: Target Area with 3' to 10' of Unconsolidated Sediments

Location	Latitude	Longitude
Upper Left Corner	27° 7.70607' N	83° 12.27012' W
Upper Right Corner	27° 7.61022' N	83° 11.65678' W
Lower Right Corner	27° 6.77773' N	83° 11.75379' W
Lower Left Corner	27° 6.87631' N	83° 12.42032' W

[7] The Gulf AquaMapper tool is available at: https://coastalscience.noaa.gov/products-explorer/

[8] The BES guidance document is available at: http://sero.nmfs.noaa.gov/sustainable_fisheries/Gulf_fisheries/aquaculture/

5.0 Federally Listed and Proposed Threatened and Endangered Species and Critical Habitat

5.1 Federally Listed Threatened and Endangered Species

The action agencies identified the ESA-listed species shown in Table 2 for consideration on whether the proposed action may affect protected species in or near the proposed action area. In summary, the action agencies considered the potential affects to threatened and endangered species from five groups of species: birds (2), fish (4), invertebrates (7), marine mammals (6), and reptiles (5). The action agencies considered the species within this Section of the BE because they may occur within the project footprint or near enough such that there are potential routes of effects. Certain ESA-listed species are not discussed because their behavior, range, habitat preferences, or known/estimated location do not overlap or expose them to the activities within the proposed action area.

Table 2: Federally Listed Species, Listed Critical Habitat, Proposed Species, and Proposed Critical Habitat Considered for the Proposed Action

Species Considered	ESA Status	Critical Habitat Status	Potential Exposure to Proposed Action Area
Birds			
1 Piping Plover	Threatened	Yes	No
2 Red Knot	Threatened	No	No
Fish			
1 Giant Manta Ray	Threatened	No	Yes
2 Nassau Grouper	Threatened	No	Yes
3 Oceanic Whitetip Shark	Threatened	No	Yes
4 Smalltooth Sawfish	Endangered	No	Yes
Invertebrates			
1 Boulder Star Coral	Threatened	No	No
2 Elkhorn Coral	Threatened	No	No
4 Mountainous Star Coral	Threatened	No	No
5 Pillar Coral	Threatened	No	No
7 Staghorn Coral	Threatened	No	No
6 Rough Cactus Coral	Threatened	No	Yes
3 Lobed Star Coral	Threatened	No	Yes
Marine Mammals			
1 Blue Whale	Endangered	No	Yes
2 Bryde's Whale	Endangered	No	Yes
3 Fin Whale	Endangered	No	Yes
4 Humpback Whale	Endangered	No	Yes
5 Sei Whale	Endangered	No	Yes
6 Sperm Whale	Endangered	No	Yes
Reptiles			
1 Green Sea Turtle	Threatened	No	Yes
2 Hawksbill Sea Turtle	Endangered	Yes	Yes
3 Kemp's Ridley Sea Turtle	Endangered	No	Yes
4 Leatherback Sea Turtle	Endangered	Yes	Yes
5 Loggerhead Sea Turtle	Threatened	Yes	Yes

5.1.1 Birds

There are 14 ESA-listed avian species identified as threatened or endangered, previously delisted, or candidate species in the eastern Gulf. Of those species, only two listed species, the piping plover and red knot, are considered in this BE because their migratory range could expose them to activities covered under the proposed action. There are several other listed species whose range includes only inshore and coastal margin waters and are not exposed to the activities covered under the proposed action.

Piping Plover

The piping plover is a threatened shorebird that inhabits coastal sandy beaches and mudflats. Three populations of piping plover are recognized under ESA: Great Lakes (endangered); Great Plains (threatened); and Atlantic (threatened) (BOEM, 2012a). This species nests in sand depressions lined with pebbles, shells, or driftwood. Piping plovers forage on small invertebrates along ocean beaches, on intertidal flats, and along tidal pool edges; therefore, fish from the proposed action are not considered a potential source of food for the piping plover.

Possibly as high as 75% of all breeding piping plovers, regardless of population affiliation, may spend up to eight months on wintering grounds in the Gulf. They arrive from July through September, leaving in late February to migrate back to their breeding sites (BOEM, 2012b). They do not breed in the Gulf. Habitat used by wintering birds include beaches, mud flats, sand flats, algal flats, and washover passes (where breaks in sand dunes result in an inlet). The piping plover is considered a state species of conservation concern in all Gulf coast states due to wintering habitat. The piping plover is a migratory shorebird with no open ocean habitat.

Red Knot

The red knot, listed as threatened in 2014, is a highly migratory shorebird species that travels between nesting habitats in Arctic latitudes and southern non-breeding habitats in South America and the U.S. Atlantic and Gulf coasts (BOEM, 2012a). Red knots forage along sandy beaches, tidal mudflats, salt marshes, and peat banks for bivalves, gastropods, and crustaceans (USFWS, 2015). Horseshoe crab eggs are a critical food resource for this species, and the overharvesting and population declines of horseshoe crabs may be a major reason for the decline of red knot numbers.

Wintering red knots may be found in Florida and Texas (Würsig, 2017). They are considered a State Species of Conservation Concern in Florida and Mississippi. The numbers of wintering and staging red knots using coastal beaches in Gulf coast states other than Florida have declined dramatically (Würsig, 2017). Its population has exhibited a large decline in recent decades and is now estimated in the low ten-thousands (NatureServe, 2019). Critical habitat rules have not been published for the red knot. Within the Gulf region, wintering red knots are found primarily in Florida, but this species has been reported in coastal counties of each of the Gulf states.

5.1.2 Fish

The four species of ESA-protected fish that may occur within the action area are: giant manta ray, nassau grouper, smalltooth sawfish, and oceanic whitetip shark.

Giant Manta Ray

The giant manta ray was listed as threatened under the ESA on February 21, 2018. The giant manta ray is found worldwide in tropical, subtropical, and temperate seas. These slow-growing, migratory animals are circumglobal with fragmented populations. The giant manta ray is the largest living ray, with a wingspan reaching a width of up to 9 m. Manta species are distinguished from other rays in that they tend to be larger with a terminal mouth, and have long cephalic lobes (Evgeny, 2010), which are extensions of the pectoral fins

that funnel water into the mouth. Giant manta rays feed primarily on planktonic organisms such as euphausiids, copepods, mysids, decapod larvae and shrimp, but some studies have noted their consumption of small and moderately sized fishes (Miller and Klimovich, 2017).

Within the Southeast Region of the United States, the giant manta ray is frequently sighted along the east coast and within the Gulf of Mexico. Giant manta rays are seasonal visitors along productive coastlines with regular upwelling, in oceanic island groups, and near offshore pinnacles and seamounts. Given the opportunistic sightings of the species, researchers are still unsure what drives giant manta rays to certain areas and not others (and where they go for the remainder of the time). The timing of these visits varies by region and seems to correspond with the movement of zooplankton, current circulation and tidal patterns, seasonal upwelling, seawater temperature, and possibly mating behavior. Although giant manta rays are considered oceanic and solitary, they have been observed congregating at cleaning sites at offshore reefs and feeding in shallow waters during the day at depths less than 10 m (O'Shea et al., 2010; Marshall et al., 2011; Rohner et al., 2013). The giant manta ray ranges from near shore to pelagic habitats, occurring over the continental shelf near reef habitats and offshore islands. The species can be found in estuarine waters near oceanic inlets, with use of these waters as potential nursery grounds. This species appears to exhibit a high degree of plasticity in terms of their use of depths within their habitat.

Nassau Grouper

The Nassau grouper is a reef fish typically associated with hard structure such as reefs (both natural and artificial), rocks, and ledges. It is a member of the family Serranidae, which includes groupers valued as a major fishery resource such as the gag grouper and the red grouper. These large fish are found in tropical and subtropical waters of southern coastal Florida and the Florida Keys. Nassau grouper are generally absent from the Gulf north and outside of the Florida Keys; this is well documented by the lack of records in Florida Fish and Wildlife Conservation Commission's, Fisheries Independent Monitoring data, as well as various surveys conducted by NOAA Fisheries Southeast Fisheries Science Center. There has been one verified report of the Nassau Grouper in the northwest Gulf at Flower Gardens Bank national marine sanctuary; however, the Flower Gardens Bank is not near the proposed action area.

Oceanic Whitetip Shark

The oceanic whitetip shark is a large, open ocean, highly migratory, apex predatory shark found in subtropical waters throughout the Gulf. It is a pelagic species usually found offshore in the open ocean, on the outer continental shelf, or around oceanic islands in deep water greater than 184 m. The oceanic whitetip shark can be found from the surface to at least 152 m depth. Occasionally, it is found close to land in waters as shallow as 37 m, mainly around mid-ocean islands or in areas where the continental shelf is narrow with access to nearby deep water. Oceanic whitetip sharks have a strong preference for the surface mixed layer in warm waters above 20°C and are therefore mainly a surface-dwelling shark.

Oceanic whitetip sharks are high trophic-level predators in open ocean ecosystems feeding mainly on teleosts and cephalopods (Backus et al., 1956; Bonfil et al., 2008); however, some studies have found that they consume sea birds, marine mammals, other sharks and rays, mollusks, crustaceans, and even garbage (Compagno, 1984; Cortés, 1999).

Smalltooth Sawfish

The smalltooth sawfish was the first marine fish to receive protection as an endangered species under the ESA in 2003. Their current range is poorly understood but believed to have significantly contracted from these historical areas. Today, smalltooth sawfish primarily occur off peninsular Florida from the Caloosahatchee River to the Florida Keys (Würsig, 2017). Historical accounts and recent encounters suggest immature individuals are most common in shallow coastal waters less than 25 m (Bigelow and Schroeder, 1953; Adams

and Wilson, 1995). Smalltooth sawfish primarily live in shallow coastal waters near river mouths, estuaries, bays, or depths up to 125 m. Smalltooth sawfish feed primarily on fish. Mullet, jacks, and ladyfish are believed to be their primary food resources (Simpfendorfer, 2001). Smalltooth sawfish also prey on crustaceans (mostly shrimp and crabs) by disturbing bottom sediment with their saw (Norman and Fraser, 1938; Bigelow and Schroeder, 1953).

5.1.3 Invertebrates

The seven ESA-listed coral species in the Gulf are known to occur near the Dry Tortugas, a small group of islands located approximately 67 miles west of Key West, Florida. Four of the ESA-listed coral species in the Gulf (elkhorn, lobed star, mountainous star, and boulder star) are known to occur in the Flower Banks National Marine Sanctuary, located 70 to 115 miles off the coast of Texas and Louisiana. The most abundant depth ranges for the ESA-listed invertebrates are provided in Table 3. Given the known geographic locations of the considered coral species and their recognized habitat preferences related to water depth, only two invertebrate species (lobed star coral and rough cactus coral) may occur in the proposed action area. Threats to coral communities throughout the Gulf include predation, hurricane damage, and loss of habitat due to algal overgrowth and sedimentation.

Table 3: ESA-listed Coral Depth Ranges

Coral Species	Most Abundant Depth (ft)
Boulder Star Coral	3 - 82 [9]
Elkhorn Coral	3 - 16 [10]
Lobed Star Coral	6 - 130 [11]
Mountainous Star Coral	3 - 30 [11]
Pillar Coral	3 - 90
Rough Cactus Coral	15 - 270 [10]
Staghorn Coral	15 - 60 [10]

5.1.4 Marine Mammals

All the ESA-listed marine mammals considered in this BE are endangered under the ESA. The six species of whales that could occur within the action area are: blue whale, fin whale, Gulf Bryde's whale, humpback whale, sperm whale, and sei whale; however, except for the Gulf Bryde's whale, each ESA-listed whale considered in this BE are not common in the Gulf (Würsig, 2017). Threats to whales from aquaculture facilities include vessel strikes, entanglement, and disturbance (ocean noise).

Blue Whales

Blue whales are found in all oceans except the Arctic Ocean. Currently, there are five recognized subspecies of blue whales. Blue whales have been sighted infrequently in the Gulf. The only record of blue whales in the Gulf are two strandings on the Louisiana and Texas coasts; however, the identifications for both strandings are questionable. In the North Atlantic blue whales are most often seen off eastern Canada where they are present year-round (NMFS, 2016). Blue whales also typically occur in deeper waters seaward of the continental shelf and are not commonly observed in the waters of the Gulf or off the U.S. East Coast (CeTAP, 1982; Wenzel et al., 1988; Waring et al., 2006). Blue whales are not expected to be within the proposed action area that is located in a water depth of approximately 40 m.

[9] www.DCNANature.org, 2016

[10] NMFS, 2016

[11] www.IUCNRedList.org, 2016

Bryde's Whale

The Gulf Bryde's whale was listed as endangered on May 15, 2019. The Gulf Bryde's whales are members of the baleen whale family and are a subspecies of the Bryde's whale. The Gulf Bryde's whales are one of the most endangered whales in the world, with likely less than 100 whales remaining. They are the only resident baleen whale in the Gulf. The Gulf Bryde's whale is one of the few types of baleen whales that do not migrate and remain in the Gulf year-round. The historical range in Gulf waters is not well known; however, scientists believe that the historical distribution of Gulf Bryde's whales once encompassed the north-central and southern Gulf. For the past 25 years, Bryde's whales in U.S. waters of the Gulf have been consistently located in the northeastern Gulf (largely south of Alabama and the western part of the Florida panhandle) along the continental shelf break between the 100 and 400 m depth (Labrecque et al., 2015). This area has been identified as a Biologically Important Area (BIA) for the Gulf Bryde's whale and encompasses over 5.8 million acres. BIAs are reproductive areas, feeding areas, migratory corridors, or areas in which small and resident populations are concentrated. The proposed action area is not located near the areas where the Gulf Bryde's whale is known to be distributed and are not expected to occur at the water depth of the proposed project.

Fin Whales

Fin whales are found in deep, offshore waters of all the world's oceans, primarily in temperate to polar climates. The NMFS has reported that there are about 2,700 fin whales in the North Atlantic and Gulf. There are few reliable reports of fin whales in the northern Gulf. They are most commonly found in North Atlantic waters where they feed on krill, small schooling fish, and squid (NMFS, 2016). Fin whales are generally found along the 100 m isobath with sightings also spread over deeper water including canyons along the shelf break (Waring et al., 2006). Therefore, fin whales are not expected to be found near the proposed action area where the water depth is approximately 40 m.

Humpback Whales

Based on a few confirmed sightings and one stranding event, humpback whales are rare in the northern Gulf (BOEM, 2012a). Baleen whale richness in the Gulf is believed to be less than previously understood (Würsig, 2017). U.S. populations of humpback whales mainly use the western North Atlantic for feeding grounds and use the West Indies during winter and for calving (NMFS, 2016). Given that humpback whales are not a typical inhabitant of the Gulf, they are not expected to be found near the proposed action area. Additionally, the water depth at the proposed action area (40 m) does not overlap the habitat preference of humpback whales for deeper waters.

Sei Whales

The sei whale is rare in the northern Gulf and its occurrence is considered accidental, based on four reliable and one questionable strandings records in Louisiana and Florida (Jefferson and Schiro, 1997; Schmidley, 2004; Würsig, 2017). Sei whales are more commonly found in subtropical to subpolar waters of the continental shelf and slope of the Atlantic, with movement between the climates according to seasons (NMFS, 2016). Sei whales typically occur in deeper waters seaward of the continental shelf and are not commonly observed in the waters of the Gulf (CeTAP, 1982; Wenzel et al., 1988; Waring et al., 2006). Sei whales are not expected to be geographically located near the proposed project.

Sperm Whales

In the northern Gulf, aerial and ship surveys indicate that sperm whales are widely distributed and present in all seasons in continental slope and oceanic waters. Sperm whales are the most abundant large cetacean in the Gulf. Greatest densities of sperm whales are in the central Northern Gulf near Desoto Canyon as well as near the Dry Tortugas (Roberts et al., 2016). They are found in deep waters throughout the world's oceans, but generally in waters greater than 200 to 800 m due to the habit of feeding on deep-diving squid and fish (Hansen et al., 1996; Davis et al., 2002; Mullin and Fulling, 2003; Würsig, 2017). Research conducted since 2000

confirms that Gulf sperm whales constitute a distinct stock based on several lines of evidence (Waring et al., 2006). Sperm whales are not expected to be within the proposed action area due to their known preference for deeper water.

5.1.5 Reptiles

The five ESA-listed sea turtle species that may occur in or near the proposed action area are: green, hawksbill, leatherback, kemp's ridley, and loggerhead. Sea turtles are highly migratory and travel widely throughout the Gulf. Therefore, each sea turtle has the potential to occur throughout the entire Gulf. In general, the entire Gulf coastal and nearshore area can serve as habitat for marine turtles. Florida is the most important nesting area in the United States for loggerhead, green, and leatherback turtles. Several volumes exist that cover the biology and ecology of these species (i.e., Lutz and Musick, 1997; Lutz et al., 2003, Wynekan et al., 2013).

Green sea turtle

Green sea turtle hatchlings are thought to occupy pelagic areas of the open ocean and are often associated with *Sargassum* rafts (Carr, 1987; Walker, 1994). Pelagic stage green sea turtles are thought to be carnivorous. Stomach samples of these animals found ctenophores and pelagic snails (Frick, 1976; Hughes, 1974). At approximately 20 to 25 centimeters (cm) carapace length, juveniles migrate from pelagic habitats to benthic foraging areas (Bjorndal, 1997). As juveniles move into benthic foraging areas, a diet shift towards herbivory occurs. They consume primarily seagrasses and algae, but are also known to consume jellyfish, salps, and sponges (Bjorndal, 1980, 1997; Paredes, 1969; Mortimer, 1981, 1982). The diving abilities of all sea turtle species vary by their life stages. The maximum diving range of green sea turtles is estimated at 110 m (Frick, 1976), but they are most frequently making dives of less than 20 m (Walker, 1994). The time of these dives also varies by life stage.

The NMFS and USFWS removed the range-wide and breeding population ESA listings of the green sea turtle and listed eight distinct population segments (DPSs) as threatened and three DPSs as endangered, effective May 6, 2016. Two of the green sea turtle DPSs, the North Atlantic DPS and the South Atlantic DPS, occur in the Gulf. The proposed action area is within the North Atlantic NPS where the green sea turtle is listed as threatened.

Hawksbill sea turtle

The hawksbill sea turtle's pelagic stage lasts from the time they leave the nesting beach as hatchlings until they are approximately 22 to 25 cm in straight carapace length (Meylan, 1988; Meylan and Donnelly, 1999). The pelagic stage is followed by residency in developmental habitats (foraging areas where juveniles reside and grow) in coastal waters. Little is known about the diet of pelagic stage hawksbills. Adult foraging typically occurs over coral reefs, although other hard-bottom communities and mangrove-fringed areas are occupied occasionally. Hawksbills show fidelity to their foraging areas over several years (van Dam and Diéz, 1998). The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan, 1988). Gravid females have been noted ingesting coralline substrate (Meylan, 1984) and calcareous algae (Anderes, Alvarez, and Uchida, 1994), which are believed to be possible sources of calcium to aid in eggshell production. The maximum diving depths of these animals are unknown, but the maximum length of dives is estimated at 73.5 minutes, more routinely dives last about 56 minutes (Hughes, 1974). Hawksbill sea turtles are not known to regularly nest in Florida but do occur occasionally.

Kemp's Ridley sea turtle

Kemp's ridley sea turtle hatchlings are also pelagic during the early stages of life and feed in surface waters (Carr, 1987; Ogren, 1989). After the juveniles reach approximately 20 cm carapace length they move to relatively shallow (less than 50 m) benthic foraging habitat over unconsolidated substrates (Márquez-M.,

1994). They have also been observed transiting long distances between foraging habitats (Ogren, 1989). Kemp's ridleys feeding in these nearshore areas primarily prey on crabs, though they are also known to ingest mollusks, fish, marine vegetation, and shrimp (Shaver, 1991). The fish and shrimp Kemp's ridleys ingest are not thought to be a primary prey item but instead may be scavenged opportunistically from bycatch discards or discarded bait (Shaver, 1991). Given their predilection for shallower water, Kemp's ridleys most routinely make dives of 50 m or less (Soma, 1985; Byles, 1988). Their maximum diving range is unknown. Depending on the life stage, a Kemp's ridley may be able to stay submerged anywhere from 167 minutes to 300 minutes, though dives of 12.7 minutes to 16.7 minutes are much more common (Soma, 1985; Mendonca and Pritchard, 1986; Byles, 1988). Kemp's ridley turtles may also spend as much as 96 percent of their time underwater (Soma, 1985; Byles, 1988). In the United States, Kemp's ridley turtles inhabit the Gulf and northwest Atlantic Ocean; nesting occurs primarily in Texas, and occasionally in Florida, Alabama, Georgia, South Carolina, and North Carolina.

Leatherback sea turtle

Leatherback sea turtles are the most pelagic of all ESA-listed sea turtles and spend most of their time in the open ocean. They will enter coastal waters and are seen over the continental shelf on a seasonal basis to feed in areas where jellyfish are concentrated. Leatherbacks feed primarily on cnidarians (medusae, siphonophores) and tunicates. Unlike other sea turtles, leatherbacks' diets do not shift during their life cycles. Because leatherbacks' ability to capture and eat jellyfish is not constrained by size or age, they continue to feed on these species regardless of life stage (Bjorndal, 1997). Leatherbacks are the deepest diving of all sea turtles. It is estimated that these species can dive more than 1,000 m (Eckert et al., 1989) but more frequently dive to depths of 50 m to 84 m (Eckert et al. 1986). Dive times range from a maximum of 37 minutes to more routines dives of 4 to 14.5 minutes (Standora et al., 1984; Eckert et al., 1986; Eckert et al., 1989; Keinath and Musick, 1993).

Loggerhead sea turtle

Loggerhead sea turtle hatchlings forage in the open ocean and are often associated with Sargassum rafts (Hughes, 1974; Carr 1987; Walker, 1994; Bolten and Balazs, 1995). The pelagic stage of these sea turtles are known to eat a wide range of things including salps, jellyfish, amphipods, crabs, syngnathid fish, squid, and pelagic snails (Brongersma, 1972). Stranding records indicate that when pelagic immature loggerheads reach 40 to 60 cm straight-line carapace length, they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic (Witzell, 2002). Loggerhead sea turtles forage over hard-bottom and soft-bottom habitats (Carr, 1986).

Benthic foraging loggerheads eat a variety of invertebrates with crabs and mollusks being an important prey source (Burke et al., 1993). Estimates of the maximum diving depths of loggerheads range from 211 m to 233 m (Thayer et al., 1984; Limpus and Nichols, 1988). The lengths of loggerhead dives are frequently between 17 and 30 minutes (Thayer et al., 1984; Limpus and Nichols, 1988; Limpus and Nichols, 1994; Lanyon et al., 1989) and they may spend anywhere from 80 to 94 percent of their time submerged (Limpus and Nichols, 1994; Lanyon et al., 1989). Loggerhead sea turtles are a long-lived, slow-growing species, vulnerable to various threats including alterations to beaches, vessel strikes, and bycatch in fishing nets.

5.2 Federally Listed Critical Habitat In or Near the Action Area

5.2.1 Birds

Onshore critical habitat has been designated for the piping plover including designations for coastal wintering habitat areas in Alabama, Mississippi, and Florida.[12] The proposed project is not expected to impact any onshore habitats.

5.2.2 Reptiles

The only critical habitat designated near the proposed action area is the Northwest Atlantic DPS of loggerhead sea turtles. Specific areas of designated habitat include: nearshore reproductive habitat, winter area, breeding areas, migratory corridors, and Sargassum habitat. The northwest Atlantic loggerhead DPS designated critical habitat portion that occurs in federal waters (*i.e.*, a Sargasso habitat unit) consists of the western Gulf to the eastern edge of the loop current, through the Straits of Florida and along the Atlantic coast from the western edge of the Gulf Stream eastward. Sargassum habitat is home to most juvenile sea turtles in the western Gulf.

5.3 Federal Proposed Species and Proposed Critical Habitat

The action agencies did not identify any Federally-listed proposed species or proposed critical habitat in the proposed action area.

[12] Critical habitat locations for the piping plover are available at: https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=B079

6.0 Potential Stressors to Listed and Proposed Species and Critical Habitat

The action agencies evaluated the potential impacts of the proposed project on ESA-listed species that were identified in Section 5.0 and that may occur in or near the proposed action area. Potential effects considered in this analysis may occur because of a potential overlap between the proposed aquaculture facility location with the species habitat (socialization, feeding, resting, breeding, etc.) or migratory route. Section 6.0 broadly describes the most likely stressors, directly and indirectly, that were considered to potentially impact the species near the proposed facility. The action agencies identified four categories of risks from the proposed project: disturbance; entanglement; vessel collisions; and impacts from water quality. The specific analysis of potential impacts to each species from the proposed project is provided in Section 7.0.

6.1 Disturbance

Disturbance in the context of this BE includes ocean noise (low-frequency underwater noises) and breakage (invertebrates). Underwater noises can interrupt the normal behavior of whales, which rely on sound to communicate. As ocean noise increases from human sources, communication space decreases and whales cannot hear each other, or discern other signals in their environment as they used to in an undisturbed ocean. Different levels of sound can disturb important activities, such as feeding, migrating, and socializing. Mounting evidence from scientific research has documented that ocean noise also causes marine mammals to change the frequency or amplitude of calls, decrease foraging behavior, become displaced from preferred habitat, or increase the level of stress hormones in their bodies. Loud noise can cause permanent or temporary hearing loss. Underwater noise threatens whale populations, interrupting their normal behavior and driving them away from areas important to their survival. Increasing evidence suggests that exposure to intense underwater sound in some settings may cause some whales to strand and ultimately die.

ESA-listed sea turtles, whales, and fish may experience stress due to a startled reaction should they encounter vessels, or vessel noise, at the proposed location or in transit to the proposed project site. The reaction could range from the animal approaching and investigating the activity, to the opposite reaction of flight, where the animal could injure itself while attempting to flee. The most likely source of disturbance from the proposed aquaculture activity would be noise from the vessel engines and barge generator.

6.2 Entanglements

Entanglement, for the purposes of this BE, refers to the wrapping of lines, netting, or other man-made materials around the body of a listed species. Entanglement can result in restrainment and/or capture to the point where harassment, injury, or death occurs. The cage, mooring lines, and bridles from the proposed project may pose an entanglement risk to listed species in the project area; however, entanglement risks to ESA-listed species at any aquaculture operation are mitigated by using rigid and durable cage materials, and by keeping all facility lines taut as slack lines are the primary source of entanglements (Nash et al., 2005).

Past protected species reviews by the NMFS for a similar scale aquaculture project determined that cetacean and sea turtle entanglement is not expected when facility mooring and tether lines are kept under near-constant tension and free of loops (NMFS, 2016). Additionally, the NMFS determined that a similar aquaculture project had the potential to result in interactions with marine mammals; however, the NMFS found that the most likely effect of the project on marine mammals was behavioral interactions (e.g., individuals engaging in investigative behavior around the array or that prey on wild fish accumulated near the facility) as opposed to causing injury or mortality from entanglement.

6.3 Vessel Strike

A vessel strike is a collision between any type of boat and a marine animal in the ocean. All sizes and types of vessels have the potential to collide with nearly any marine species. Strikes can result in death or injury to the

marine animal and may go unnoticed by the vessel operator. Some marine species spend short durations "rafting" at the ocean's water surface between dives which makes them more vulnerable to vessel strikes.

The NMFS estimates collisions between some cetaceans and vessels are relatively rare events based on data from Marine Mammal Stock Assessments for the Atlantic and Gulf (NMFS, 2017). Collisions between marine mammals and vessels can be further minimized when vessels travel at less than 10 knots based on general guidance from the NMFS for vessels transiting areas where there are known populations of whales (HIHWNMS, 2011). Detection of sea turtles by vessel operators may be more difficult because most vessel operators usually sight protected species and avoid them. In past biological opinions in support of similar aquaculture activities, the NMFS has determined that the rate of collisions between sea turtles and vessels was negligible and did not expect sea turtle vessel strikes to occur (NMFS, 2016).

The support vessel used for the proposed project is expected to be vigilant against the possibility of protected species collisions. Piloting of all vessels associated with the proposed project will be done in a manner that will prevent vessel collisions or serious injuries to protected species. Operators and crew will operate vessels at low speeds when performing work within and around the proposed project area and operate only when there are no small craft advisories in effect. All vessels are expected to follow the vessel strike and avoidance measures that have been developed by the NMFS.[13] These operating conditions are expected to allow vessel operators the ability to detect and avoid striking ESA-listed species.

6.4 Water Quality

Although offshore marine cage systems do not generate a waste stream like other aquaculture systems, effluent from the proposed action area can adversely affect water quality, sea floor sediment composition, and benthic fauna though the additions of uneaten feed, ammonia excretions, and fish feces from the increased fish biomass. Water quality in aquaculture is primarily assessed through measures of nitrogen (N), phosphorus (P), solids (total suspended solids, settleable solids, and turbidity), dissolved oxygen (DO), and pH. The increased amount of organic material has the potential to increase N, P, and solids levels in the surrounding waters. The concentration of N (such as total nitrogen, ammonia, nitrate, nitrite) and P (as total phosphorus or orthophosphate) are indicators of nutrient enrichment and are commonly used to assess the impact of aquaculture on water quality. The release of nutrients, reductions in concentrations of DO, and the accumulation of sediments under certain aquaculture operations can affect the local environment by boosting overall productivity in phytoplankton and macroalgal production in marine ecosystems through eutrophication and degradation of benthic communities (Stickney, 2002).

According to *Marine Cage Culture and The Environment* (Price and Morris, 2013), "there are usually no measurable effects 30 meters beyond the cages when the farms are sited in well-flushed water. Nutrient spikes and declines in dissolved oxygen sometimes are seen following feeding events, but there are few reports of long-term risk to water quality from marine aquaculture." Price and Morris (2013) also considered the benthic effects of Marine Cage Culture and found that "well-managed farms may exhibit little perturbation and, where chemical changes are measured, impacts are typically confined to within 100 meters of the cages. Benthic chemical recovery is often rapid following harvest". Conversely, poorly managed farms or heavily farmed areas, can see anaerobic conditions persisting and extending hundreds of meters beyond the aquaculture facility. Changes in water quality associated with commercial scale marine aquaculture facilities can be measurable downstream for approximately 205 m (Nash et al., 2005).

[13] The NMFS has determined that collisions with any vessel can injure or kill protected species (e.g., endangered and threatened species, and marine mammals). The vessel strike avoidance guidelines developed by the NMFS are the standard measures that should be implemented to reduce the risk associated with vessel strikes or disturbance of these protected species to discountable levels. NMFS Southeast Region Vessel Strike Avoidance Measures and Reporting for Mariners; revised February 2008.

The NCCOS reviewed global siting data to identify aquaculture site characteristics that are best suited for water quality protection, concluding that, "Protection of water quality will be best achieved by siting farms in well-flushed waters." (Price, 2013). The hydrology near the proposed action area has powerful and mixing ocean currents that would constantly flush and dilute particulate and dissolved wastes. In addition, the proposed action has other attributes cited in this study that contributes to decreased water quality impacts, including deep waters and a sand bottom type. Neither particulates nor dissolved metabolites are expected to accumulate due to low fish production levels and the near constant flushing of the cage by strong offshore currents that dissipate wastes.

The EPA evaluated the proposed action's potential impacts to water quality, impacts of organic enrichment to the seafloor, and impacts to benthic communities from organic enrichment as required by Sections 402 and 403 of the CWA. The EPA determined that discharges from the proposed facility are not expected to exceed federally recommended water quality criteria; that the discharged material is not sufficient to pose an environmental threat through seafloor bioaccumulation; and the potential for benthic impacts from the proposed project are minimal.[14] Additionally, the EPA considered recent environmental modeling performed by the NMFS for a similar small scale aquaculture facility (Velella Delta).[15] NCCOS concluded that there are minimal risks to water column or benthic ecology functions in the subject area from the operation of the fish cage as described in the applicant's proposal. Furthermore, EPA reviewed the previous and current environmental monitoring data collected from a commercial-scale marine aquaculture facility, Blue Ocean Mariculture (BOM) in Hawaii, raising the same fish species.[16] While the size of the proposed project is significantly smaller than the BOM commercial-scale facility and BOM is in slightly deeper waters, the results show that soluble and particulate nutrients from the BOM facility do not substantially affect the marine environment. Based on EPA's analysis, as well as a review and comparison of representative water quality information, the proposed action would not likely raise particulate and dissolved nutrient concentrations in the proposed action area.

The proposed facility will be covered by a NPDES permit as an aquatic animal production facility with protective conditions required by the Clean Water Act. The NPDES permit will contain conditions that will confirm EPA's determination and ensure no significant environmental impacts will occur from the proposed project. The aquaculture-specific water quality conditions placed in the NPDES permit will generally include a comprehensive environmental monitoring plan. The applicant will be required to monitor and sample certain water quality, sediment, and benthic parameters at a background (up-current) location and near the cage. Additionally, the NPDES permit will include effluent limitations expressed as best management practices (BMPs) for feed management, waste collection and disposal, harvest discharge, carcass removal, materials storage, maintenance, record keeping, and training. Impacts to water quality will be reduced by a range of operational measures through the implementation of project-specific BMPs. For example, feeding will always

[14] Further information about EPA's analysis and determination for impacts to water quality, seafloor, and benthic habitat can be found in the final NPDES permit and the Ocean Discharge Criteria (ODC) Evaluation, as well as other supporting documents for the NPDES permit such as the Essential Fish Habitat Assessment and the NEPA evaluation.

[15] The NCCOS previously produced models to assess the potential environmental effects on water quality and benthic communities for the applicant's Velella Delta project that is similar Velella Epsilon in terms of fish production (approximately 120,000 lbs), operation duration, and cultured species; however, the water depth was dissimilar between the two projects (6,000 ft vs. 130 ft). At maximum capacity, NCCOS determined there were no risks to water quality from the Velella Delta project, and only insignificant effects would occur in the water column down to 100 feet. Because of the great depth, strong currents, and physical oceanographic nature of the Velella Delta site, dissolved wastes would be widely dispersed and assimilated by the planktonic community. Furthermore, the model results showed that benthic impacts and accumulation of particulate wastes would not be detectable through measurement of organic carbon or infaunal community biodiversity.

[16] Water quality information from a Blue Ocean Mariculture (BOM) facility in Hawaii was reviewed as representative data and compared to the proposed project. The BOM farm previously produced approximately 950,000 lbs/yr prior to 2014 and has produced up to 2,400,000 lbs/yr after 2014. The BOM facility is in a similar depth of water as the proposed project with an average depth of 60 m. Over eight years of comprehensive water quality and benthic monitoring, the BOM facility has not adversely impacted water quality outside of the mixing zone at the facility (BOM, 2014).

be monitored to ensure fish are fed at levels just below satiation to limit overfeeding and decrease the amount of organic material that is introduced into the marine environment. Moreover, the Essential Fish Habitat assessment requires certain mitigation measures within the NPDES and Section 10 permits.[17]

The EPA also considered the potential water quality impacts from chemical spills, drugs, cleaning, and solid wastes.

Chemical Spills: Spills are unlikely to occur; however, if spills do occur they are expected to be small in nature and dissipate rapidly due to strong currents in the project area. The terms and conditions of the NPDES permit would require the applicant to follow operational procedures (i.e. BMPs) that minimize the risk of wastes and discharges that may affect any ESA-listed species or habitat. The risk of accidental fuel or oil spills into the marine environment is minimized by the support vessel not being operated during any time that a small craft advisory is in effect at the proposed facility.

Drugs: The applicant indicated that FDA-approved antibiotics or other therapeutants will not likely be used during the proposed project due to the strong currents expected at the proposed action area, the low fish culture density, and the cage material being used. In the unlikely event that drugs/therapeutants are used, administration of drugs will be performed under the control of a licensed veterinarian and only FDA-approved therapeutants for aquaculture would be used as required by federal law. In addition, the NPDES permit will require that the use of any medicinal products be reported to the EPA, including therapeutics, antibiotics, and other treatments. The report will include types and amounts of medicinal product used and the duration they were used. The EPA does not expect the project to a cause a measurable degradation in water quality from drugs that may affect any ESA-listed species.

Cleaning: Another potential source of water quality impacts would be from the cleaning of the cage system. The applicant does not anticipate the need to clean the cage for the short duration of the proposed project. Experience from previous trials by the applicant demonstrated that copper alloy mesh material used for the cage is resistant to fouling. Should the cage system need cleaning, divers would manually scrub the cage surfaces with cleaning brushes. No chemicals would be used while cleaning and any accumulated marine biological matter would be returned to sea without alteration.

Solid Wastes: Multiple federal laws and regulations strictly regulate the discharge of oil, garbage, waste, plastics, and hazardous substances into ocean waters. The NPDES permit prohibits the discharge of any solid material not in compliance with the permit.

[17] The EPA and the USACE will require mitigation measures to be incorporated into the NPDES permit to avoid or limit organic enrichment and physical impacts to habitat that may support associated hardbottom biological communities. The NPDES permit will require facility to be positioned at least 500 meters from any hardbottom habitat; the DA permit will not authorize the anchor system to be placed on vegetated and/or hardbottom habitat.

7.0 Potential Effects of Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR § 402.02). The NMFS and USFWS standard for making a "no effect" finding is appropriate when an action agency determines its proposed action will not affect that ESA-listed species or critical habitat, directly or indirectly (USFWS and NMFS, 1998). Generally, a "no effect" determination means that ESA-listed species or critical habitats will not be exposed to any potentially harmful/beneficial elements of the action (NMFS, 2014).

The applicable standard to find that a proposed action "may affect, but not likely to adversely affect" (NLAA) listed species or critical habitat is that all the effects of the action are expected to be discountable, insignificant, or completely beneficial. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat.

A summary of the potential effects considered and the determination of impact for each listed species and critical habitat is provided in Table 4. Overall, potential impacts to the ESA-listed species considered in this BE are expected to be extremely unlikely and insignificant due to the small size of the facility, the short deployment period, unique operational characteristics, lack of geographic overlap with habitat or known migratory routes, or other factors that are described in the below sections for each species. The federal action agencies used multiple sources to support the determinations described within this section including the analysis of potential impacts that the NMFS used as the basis for its ESA determination for up to 20 commercial scale offshore marine aquaculture facilities in the Gulf (EPA, 2016; NMFS, 2009; NMFS, 2013; NMFS, 2015; NMFS, 2016).

7.1 Federally Listed Threatened and Endangered Species

7.1.1 Birds

The action agencies did not consider any potential threats to ESA-protected birds from the proposed project. The two species of birds considered are not expected to interact with the proposed project due to the distance between the proposed project from shore (approximately 45 miles) to their onshore habitat preferences. The piping plover and red knot are migratory shorebirds. Known migratory routes do not overlap with the proposed project. Both birds primarily inhabit coastal sandy beaches and mudflats of the Gulf; migration and wintering habitat are in intertidal marine habitats such as coastal inlets, estuaries, and bays (USFWS, 2015). Additionally, the normal operating condition of the cage is expected to be below the water surface which will further decrease the likelihood of any bird interaction with the proposed project.

The ESA-listed bird species will not be exposed to any potentially harmful impacts of the proposed action. The action agencies have determined that the activities under the proposed project will have no effect on the threatened species of birds.

7.1.2 Fish

The action agencies considered disturbance, entanglement (for smalltooth sawfish only), and water quality as potential impacts to endangered or threatened fish from the proposed project in the rare event that interaction occurs.

Impacts from disturbance, entanglement, and water quality are highly unlikely for each ESA-listed fish species that was considered given their unique habitat preferences and known proximity to the proposed action area.

The oceanic whitetip shark is not likely to occur near the proposed project given its preference for deeper waters. The action agencies believe that the Nassau grouper will not be present given that it is absent from the Gulf outside of the Florida Keys. Interactions with smalltooth sawfish with the proposed project is extremely unlikely because they primarily occur in the Gulf off peninsular Florida and are most common off Southwest Florida. The giant manta ray may encounter the facility given its migratory patterns; however, disturbance is not expected because the facility is small and will have a short deployment period of approximately 18 months.

Entanglement impacts were considered for smalltooth sawfish because it is the only listed fish species large enough to become entangled within the proposed facility's mooring lines. Entanglement risks to the smalltooth sawfish from the proposed project are minimized by using rigid and durable cage materials and by keeping all lines taut (as described in Section 3.0). The ocean currents will maintain the floating cage, mooring lines, and chain under tension during most times of operation. Additionally, the limited number of vertical mooring lines reduce the risk of potential entanglement by this listed fish species. Furthermore, interactions are anticipated to be highly unlikely given their current range in southwest Florida between Ft Myers and the Florida Keys. Because of the proposed project operations and lack of proximity to the known habitat for the smalltooth sawfish, the action agencies expect that the effects of this entanglement interaction would be discountable.

For water quality impacts, the EPA is proposing NPDES permit conditions required by the Clean Water Act. These permit provisions will contain environmental monitoring (water quality, sediment, and benthic infauna) and conditions that minimize potential adverse impacts to fish from the discharge of effluent from the proposed facility, and prohibit the discharge of certain pollutants (e.g., oil, foam, floating solids, trash, debris, and toxic pollutants). Due to the pilot-scale size of the facility, water quality and benthic effects are not expected to occur outside of 5-10 meters. The discharges authorized by the proposed NPDES permit represent a small incremental contribution of pollutants that are not expected to affect any ESA-listed fish species in or near the proposed action area.

Any potential effects from the proposed action on ESA-listed fish are discountable and insignificant. The action agencies have determined that the activities under the proposed project is NLAA the threatened and endangered species of fish.

7.1.3 Invertebrates

Potential routes of effects to coral from the proposed project include disturbance (breakage of coral structures) and water quality impacts (e.g., increased sedimentation, increased nutrient loading, and the introduction of pollutants).

Regarding disturbance, anthropogenic breakage is extremely unlikely and discountable because the proposed facility will not be in areas where listed corals may occur. Most of the ESA-listed invertebrate species are associated with coral reefs that occur in shallower areas of the Gulf and along the west Florida shelf. Only five species of the invertebrates considered (boulder star, elkhorn, mountainous star, pillar, and staghorn) are not known to occur near the proposed project location or at depths where the proposed facility is located. Only two invertebrate species (lobed star coral and rough cactus coral) may occur in the proposed action area. Moreover, the anchoring system and cage will be placed in an area consisting of unconsolidated sediments, away from potential hardbottom which may contain corals according to the facility's seafloor survey. Given the known geographic locations of the considered coral species and their recognized habitat preferences related to water depth, the disturbance effects of the proposed action is anticipated to be minimal and extremely unlikely.

Regarding impacts from water quality, the discharge from the proposed facility will be covered by a NPDES permit with water quality conditions required by the Clean Water Act. The aquaculture-specific water quality conditions contained in the NPDES permit will generally include an environmental monitoring plan (water quality, sediment, and benthic monitoring) and effluent limitations expressed as BMPs. Water quality effects are not expected to occur outside of 5-10 m due to the small size of the facility and low production levels. Sedimentation from the facility is not expected to occur outside of 1,000 m (assuming a maximum production for the entire duration of the project) with impacts resulting from the proposed facility likely limited to within 300-500 meters from the cage. The NPDES permit will prohibit discharges within 500 m of areas of biological concern, including live bottoms or coral reefs. The impacts from water quality and sedimentation are expected to be minimal or insignificant, and the likelihood that deleterious water quality will contribute to any adverse effects to listed coral species is extremely unlikely.

Any adverse effects from the proposed project on ESA-listed corals are discountable and insignificant. The action agencies have concluded that the proposed project will NLAA on the ESA-listed invertebrate species.

7.1.4 Marine Mammals

Generally, endangered whales are not likely to be adversely affected by any of the threats considered by the action agencies at or near the proposed facility because they are unlikely to overlap geographically with the small footprint of the proposed action area. All whales considered in this BE prefer habitat in waters deeper than the proposed action (40 m) as described in Section 5.1.4. The expected absence of the ESA-listed marine mammals in or near the proposed action area is an important factor in the analysis of whether impacts from the proposed project will have any effect on ESA-listed whales; however, the action agencies have still considered potential threats (disturbance, entanglement, vessel strikes, and water quality) to the six species of marine mammals considered in this BE.

Disturbance to marine mammals from ocean noise generated by the proposed facility is expected to be extremely low given the duration of the project, minimal vessel trips, and scale of the operation. The production cage will be deployed for a duration of approximately 18 months. Opportunities for disturbance from the vessel participating in the proposed project are minimal due to the limited trips to the site. The most likely source of disturbance from the proposed aquaculture activity would be noise from the vessel engines and barge generator. The noise emitted from the engines and generator would not significantly add to the frequency or intensity of ambient sound levels in the proposed action area and are not expected to be different from other vessels operating in federal waters. The action agencies believe that the underwater noise produced by operating a vessel and cage will not interfere with the ability of marine mammals to communicate, choose mates, find food, avoid predators, or navigate. The limited amount of noise from the proposed project would have negligible effect on ESA-listed whales.

Entanglement risks to marine mammals at any aquaculture operation are minimized by using rigid and durable cage materials and by keeping all lines taut. As described in Section 3.0, the cage material for the proposed project is constructed with rigid and durable materials that will significantly decrease the likelihood that ESA-listed species will become entangled. The limited number of vertical mooring lines (3) and the duration of cage deployment (approximately 18 months) will reduce the risk of potential entanglement by marine mammals. When the currents change, the lines would likely remain taut even as the currents shift because the weight of chain and rope create a negative buoyancy on the facility anchorage lines. While it is highly unlikely that ESA-listed whales would become entangled in the mooring lines; if incidental line contact occurs, serious harm to the listed whales or sea turtles is not likely due to the tension in the mooring lines. The cage will be constructed of semi-rigid copper alloy mesh with small openings that will further prevent entanglements.

Additionally, there have been no recorded incidents of entanglement from ESA-listed marine mammal species interacting with a permitted commercial-scale marine aquaculture facility in Hawaii (BOM, 2014). The depth of water and line length used at the proposed project would provide adequate spaces for most marine mammals to pass through. The proposed action would not likely entangle marine mammals as they are likely to detect the presence of the facility and would be able to avoid the gear; however, should entanglement occur, on-site staff would follow the steps outlined in the PSMP and alert the appropriate experts for an active entanglement. Furthermore, because of the location of the proposed project relative to marine mammal habitat, the action agencies anticipate the effects of entanglement are highly unlikely..

Regarding vessel strikes, facility staff will be stationed on one vessel for the duration of the project except during unsafe weather conditions. The probability that collisions with the vessel associated with the proposed project would kill or injure marine mammals is discountable, as the vessel will not be operated at speeds known to injure or kill marine mammals. Given the limited trips to the facility with only one vessel, and the high visibility of whales to small vessels, opportunities for strikes from the vessel participating in the proposed project are expected to be insignificant. Strikes from other vessels not operated by the facility are anticipated to be improbable due to the proximity to shore (~45 miles). Additionally, all vessels are expected to follow the vessel strike and avoidance measures that have been developed by the NMFS. Moreover, should there be any vessel strike that results in an injury to an ESA-protected marine mammal, the on-site staff would follow the steps outlined in the PSMP and alert the appropriate experts for an active entanglement.

Regarding potential impacts from water quality, each ESA-listed whale species considered in this BE is not expected to be affected given their unique habitat preferences and known proximity to the proposed action area. The discharge from the proposed facility will be covered by a NPDES permit with project-specific conditions that includes water quality monitoring and implementation of practices to protect the environment near the proposed action area. The discharge of wastewater from the proposed project are expected to have a minor impact on water quality due to factors concerning the low fish biomass produced; the relatively small amounts of pollutants discharged; depth of the sea floor; and current velocities at the proposed action area. It is anticipated that the proposed activity would add relatively small amounts of nutrient wastes (nitrogen, phosphorus, particulate organic carbon, and solids) to the ocean in the immediate vicinity of the proposed action area. The facility's effluent is expected to undergo rapid dilution from the prevailing current; constituents will be difficult to detect within short distances from the cage. The impacts from water quality are expected to be insignificant, and the likelihood of water quality impacts contributing to any adverse effects to ESA-listed marine mammals is extremely unlikely (see Section 6.4 for more information).

The action agencies believe that any adverse effects from the potential threats considered to ESA-listed marine mammals are extremely unlikely to occur and are discountable. The action agencies have determined that the activities authorized under the proposed permits will NLAA any marine mammals considered in this BE.

7.1.5 Reptiles

The action agencies considered disturbance, entanglement, vessel strike, and water quality as the only potential threats to reptiles within the proposed action area.

Sea turtles may experience disturbance by stress due to a startled reaction should they encounter vessels in transit to the proposed project site. Given the limited trips to the site, opportunities for disturbance from vessels participating in the proposed project are minimal. ESA-listed sea turtles may be attracted to aquaculture facilities as potential sources of food, shelter, and rest, but behavioral effects from disturbance are expected to be insignificant. Additionally, all vessels are expected to follow the vessel strike and avoidance measures that have been developed by the NMFS.[7] Furthermore, there has been a lack of documented observations and records of ESA-listed sea turtles interacting with a permitted commercial-scale marine

aquaculture facility in Hawaii (BOM, 2014); we anticipate that such interactions would be unlikely. As a result, disturbance effects from human activities and equipment operation associated with the proposed action are expected to be insignificant on ESA-listed species.

The risk of sea turtles being entangled in an offshore aquaculture operation is greatly reduced by using rigid cage materials and by keeping all lines taut. Section 3 describes how the cage and mooring material for the proposed project is constructed with rigid and durable materials, and how the mooring lines will be constructed of steel chain and thick rope that will be maintained under tension by the ocean currents during most times of operation. Additionally, the bridle line that connects from the swivel to the cage will be encased in a rigid pipe. Moreover, the limited number of vertical mooring lines (three) and the duration of cage deployment (less than 18 months) will reduce the risk of potential entanglement by sea turtles. Because of the proposed project operations and duration, the action agencies expect that the effects of this entanglement interaction would be discountable; however, should entanglement occur, on-site staff would follow the steps outlined in the PSMP and alert the appropriate experts for an active entanglement.

In regard to vessel strikes, facility staff will use only one vessel for the duration of the project. The vessel will be operated at low speeds that are not known to injure or kill sea turtles; therefore, the probability that collisions with the vessel associated with the proposed project would kill or injure sea turtles is discountable. Opportunities for strikes to reptiles from the vessel participating in the proposed project are expected to be insignificant given the limited number of trips to the facility with one vessel. Strikes from other vessels not operated by the facility are anticipated to be improbable due to the proximity to shore. Additionally, all vessels are expected to follow the vessel strike and avoidance measures that have been developed by the NMFS.

The proposed activity would not add significantly to the volume of maritime traffic in the proposed action area. The number of trips associated with deploying and retrieving the facility components, routine maintenance, stocking, and harvest operations would minimally increase vessel traffic in the proposed action area. The project activities are not expected to result in collisions between protected species and any vessels. Collisions with ESA-listed species during the proposed activity would be extremely unlikely to occur.

Commercial and recreational fishermen are expected to visit the proposed project because it could act as a fish attraction device. While fishermen would be attracted to the project area from other locations, overall fishing efforts by these fishermen in federal fisheries would not increase as these fishermen would have fished elsewhere if the project was not in place. The action agencies do not expect increased fishing activity in the project area since there were no reports or observations of interactions between fishermen and ESA-listed species in previous Velella trials (Velella Beta and Velella Gamma) in Hawaii (NMFS, 2016).

The impacts from water quality are expected to be insignificant, and the likelihood of water quality impacts contributing to any adverse effects to ESA-listed reptiles in or near the proposed action area is extremely unlikely (see Section 6.4 for more information related to water quality impacts). The discharge from the proposed facility will be covered by a NPDES permit with project-specific conditions that includes water quality monitoring and implementation of practices to protect the environment. Water quality effects are not expected to occur outside of 5-10 m due to the low fish production levels and fast ocean currents.

Any adverse effects from the proposed project on ESA-listed reptiles are extremely unlikely to occur and are discountable. The action agencies have determined that the activities under the proposed permit will NLAA the sea turtles considered in this BE.

7.2 Federally Listed Critical Habitat

7.2.1 Reptiles

The action agencies identified vessel strike and water quality as the only potential routes of impacts to the loggerhead turtle DPS critical habitat of the Northwest Atlantic. In the Gulf, designated critical habitat consists of either nearshore reproductive habitat or Sargassum habitat. The proposed project is roughly 45 miles from shore and will not affect nearshore reproductive habitat. Therefore, the essential features of loggerhead turtle critical habitat that the proposed action may affect are foraging habitat for hatchlings and association of hatchlings around Sargassum mats.

Sargassum mats may be impacted by vessel traffic; however, the PSMP that was developed for the proposed project area includes a provision that trained observers will look for Sargassum mats and will inform vessel operators as to their location to avoid the mats to the maximum extent practicable. The proposed project will be sited in the open ocean environment, and Sargassum mats may infrequently drift into the project area; however, it is highly unlikely the proposed facility would impact Sargassum habitat further offshore where the facility will be located. Additionally, the facility will only bring the submerged aquaculture cage to the surface for brief periods to conduct maintenance, feeding, or harvest activities due to the high energy open-ocean environment where the proposed facility will be located.

Sargassum mats are not anticipated to be negatively impacted by water quality due to the conditions in the NPDES permit. Potential impacts on loggerhead critical habitat is expected to be discountable because of active monitoring for Sargassum mats and the extremely low likelihood of impacts from water quality.

The action agencies believe that the adverse effects from the proposed action on the Northwest Atlantic loggerhead DPS critical habitat will be insignificant due to location of the facility and operational methods used while the cage is deployed. The action agencies have determined that the activities under the proposed permit will NLAA the listed sea turtle critical habitat.

7.2.2 Birds

Critical habitat has been designated for the piping plover for coastal wintering habitat areas in Florida; however, the proposed action does not interfere with any nearshore areas. Therefore, critical habitat for the piping plover will not be exposed to any potentially harmful elements of the proposed action. The action agencies have determined that the activities under the proposed project will have no effect to the piping plover's critical habitat.

7.3 Federal Proposed Species and Proposed Critical Habitat

The action agencies did not perform an analysis of impacts because no federally-listed proposed species or proposed critical habitat in or near the proposed action area were identified.

Table 4: Summary of potential impacts considered and ESA determination

Group and Species	Potential Impacts Considered	Potential Effect	Determination
Birds			
1 Piping Plover 2 Red Knot	None	None	No effect
Fish			
1 Giant Manta Ray 2 Nassau Grouper 3 Oceanic Whitetip Shark 4 Smalltooth Sawfish	Disturbance, entanglement, and water quality	Discountable and insignificant	May affect, but not likely to adversely affect
Invertebrates			
1 Boulder Star Coral 2 Elkhorn Coral 3 Mountainous Star Coral 4 Pillar Coral 5 Staghorn Coral 6 Rough Cactus Coral 7 Lobed Star Coral	Disturbance and water quality	Discountable and insignificant	May affect, but not likely to adversely affect
Marine Mammals			
1 Blue Whale 2 Fin Whale 3 Humpback Whale 4 Sei Whale 5 Sperm Whale 6 Bryde's Whale	Disturbance, entanglement, vessel strike, and water quality	Discountable and insignificant	May affect, but not likely to adversely affect
Reptiles			
1 Green Sea Turtle 2 Hawksbill Sea Turtle 3 Kemp's Ridley Sea Turtle 4 Leatherback Sea Turtle 5 Loggerhead Sea Turtle	Disturbance, entanglement, vessel strike, and water quality	Discountable and insignificant	May affect, but not likely to adversely affect
Critical Habitat			
1 Hawksbill Sea Turtle 2 Leatherback Sea Turtle 3 Loggerhead Sea Turtle	Vessel strike and water quality	Discountable and insignificant	May affect, but not likely to adversely affect
4 Piping Plover	None	None	No effect

8.0 Conclusion

The EPA and USACE conclude that the proposed project's potential threats (disturbance, entanglement, vessel strike, water quality) to ESA-listed species and critical habitat are highly unlikely to occur or extremely minor in severity; therefore, the potential effects to ESA protected species and critical habitats are discountable or insignificant.

8.1 Consultation with USFWS

The EPA and USACE have determined that the proposed project will have "no effect" on the listed species and critical habitat under the jurisdiction of the USFWS that may occur in the proposed action area and that may be affected. This determination includes the piping plover and the red knot and critical habitat for the piping plover. No other listed species, proposed species, critical habitats, or proposed critical habitats were considered under the authority of the USFWS because there is no evidence to support that a potential effect from the proposed project may occur. The EPA and USACE request concurrence from the USFWS for this determination under ESA § 7.

On August 13, 2019, EPA and USACE provided the jointly developed BE to USFWS and initiated consultation with USFWS. EPA and USACE determined that the discharges and structures authorized by the NPDES or RHA Section 10 permit will have "no effect" on any federally listed species, proposed species, or critical habitat for sea birds that are under the jurisdiction of the USFWS and within the proposed action area. On August 27, 2019, a USFWS provided notification that the USFWS does not object to the permit issuance for the proposed project and had no additional comments. Completion of the informal consultation with the USFWS satisfies EPA's obligations under ESA § 7(a)(2).

8.2 Consultation with NMFS

The EPA and USACE have determined that the proposed project "may affect, but is not likely to adversely affect" the listed species and critical habitat or designated critical habitat under the jurisdiction of the NMFS. This determination includes: four species of fish, seven species of invertebrates, six species of whales, reptiles from five species, and critical habitat for reptiles. No other listed species, proposed species, critical habitats, or proposed critical habitats were considered under the authority of the NMFS because there is no evidence to support that a potential effect from the proposed project may occur. The EPA and USACE request concurrence from the NMFS for this determination under ESA § 7.

On August 13, 2019, EPA and USACE provided the jointly developed BE to NMFS and initiated consultation with the NMFS. Regarding federally listed species, proposed species, or critical habitat under the jurisdiction of the NMFS, EPA and USACE determined that the proposed project "may affect, but not likely to adversely affect" certain fish, invertebrates, marine mammals, and reptiles within the proposed action area. On September 30, 2019, NMFS concluded "that the proposed action is not likely to adversely affect listed species under NMFS's purview." Completion of the informal consultation with the NMFS satisfies EPA's obligations under ESA § 7(a)(2).

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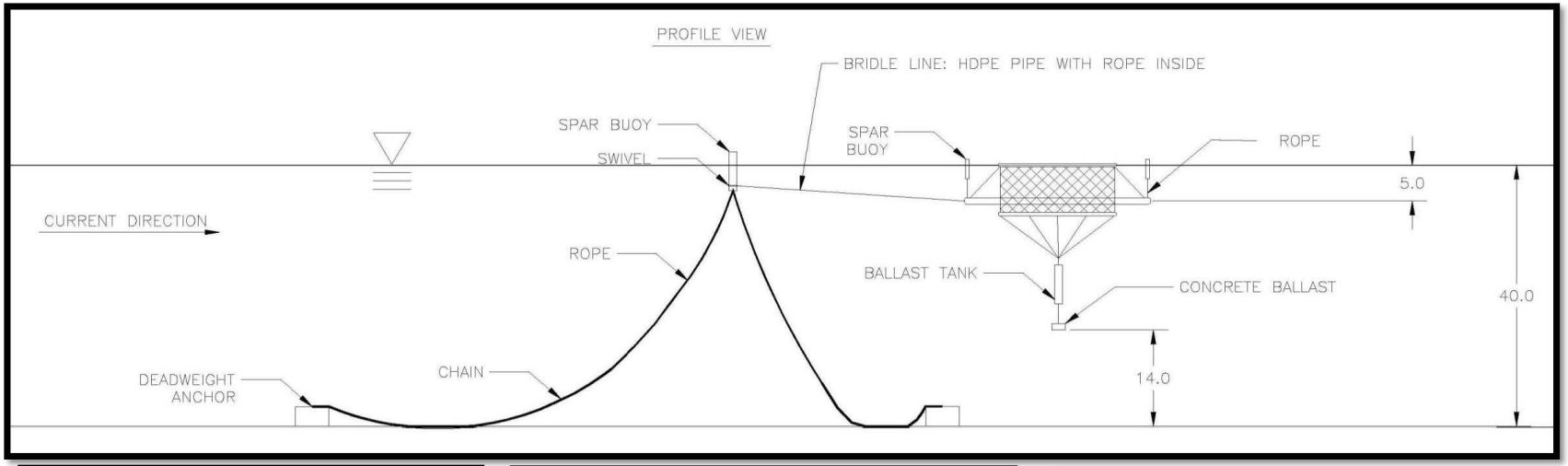
Appendix A – Cage and Mooring Detail



1) Deadweight Anchors (concrete):
- Three (3) anchors equally spaced @:
  - 120m from mooring centerline
  - 120 degrees from each other
- Each @ 3 ton Stevpris Mk-5 drag embedment anchor

2) Mooring Chain (Grade 2 steel):
- 80m length on each anchor
- 50mm (2") thick links
- No load = 70m length of each on seafloor
- Design load = some entirely off seafloor/ others completely on seafloor

3) Mooring Lines (rope):
- 40m length on each chain
- AMSTEEL®-BLUE
- 36mm (1 1/2") thick lines

4) Spar Buoy w/ Swivel (steel):

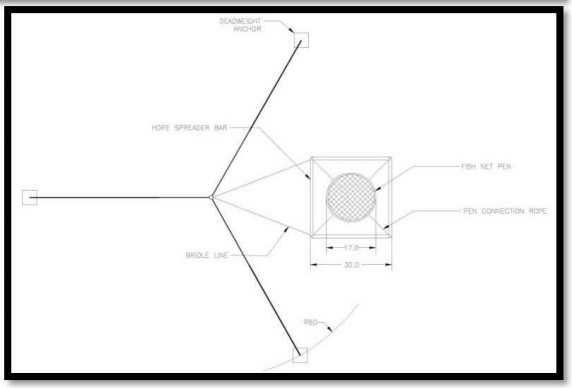
5) Bridle Lines (rope inside HDPE pipe):
- Three (3) ~30m bridle lines (rope) from swivel to spreader bar
- AMSTEEL®-BLUE
- 33.3mm (1 5/16") lines inside HDPE pipe

6) Spreader Bar (HDPE):
- Header Bar (load bearing) connected to Bridle Lines
  - 30m in length
  - 0.36m OD DR 11 HDPE pipe
- Side and Rear Bars (smaller load bearing)
  - 30m in length
  - 0.36m OD DR 17 HDPE pipe
- Four (4) corner spar buoys

7) Net Pen Connection Lines (rope):
- Four (4) ~13m connection lines (rope)
- Connected from Spreader Bar to Net Pen Float Rings
- AMSTEEL®-BLUE
- 33.3mm (1 5/16") lines

8) Net Pen Frame Structure (HDPE):
- Top Frame Structure
  - 18m in diameter
  - One (1) HDPE side-by-side Float Rings
    - On the sea surface
    - ~0.36m OD DR 11 HDPE pipe
  - One (1) HDPE net ring (railing)
    - Connected ~ 1.0m above Float Rings
    - Connected to Net Pen Mesh
    - ~0.15m OD DR 17 HDPE pipe
- Bottom Frame Structure
  - 18m in diameter
  - One (1) HDPE sinker ring
    - 7.0m below Float Rings
    - Connected to Net Ring
    - ~0.36m OD DR 11 HDPE pipe
  - One (1) HDPE net ring
    - 7.0m below float rings
    - Connected to copper alloy mesh
    - ~0.15m OD DR 17 HDPE pipe

9) Net Pen Mesh (copper alloy):
- 17m diameter x 7m depth
- Top connected to top net ring (railing)
- Bottom connected to bottom net ring
  - 4mm wire diameter
  - 40mm x 40mm mesh square
- Effective volume of 1,600m^3

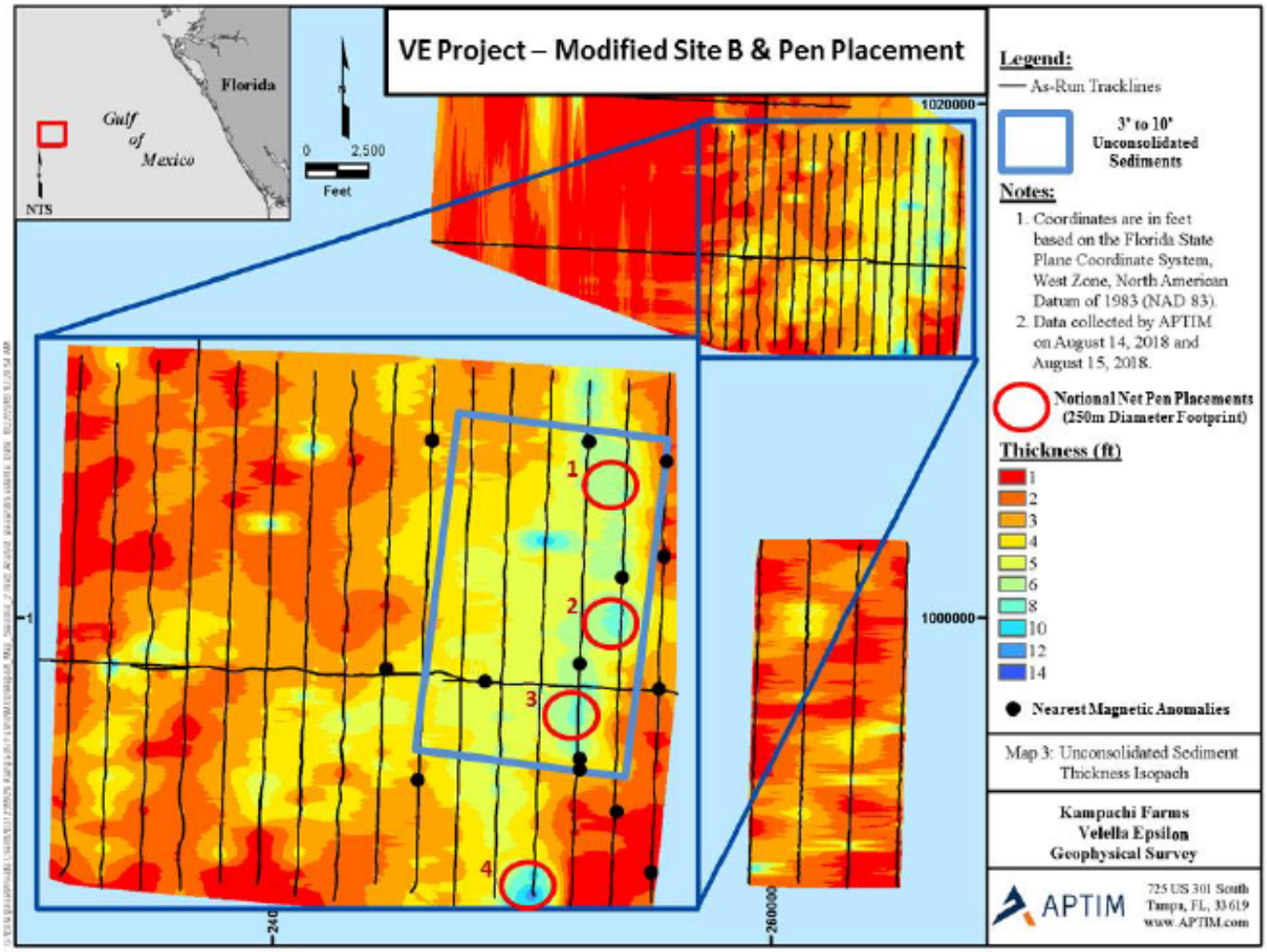


10) Shackle Point Connection (steel):
- One (1) ~0.13m^2 shackle plate
- Four (4) connection lines
  - 12 mm in diameter x 10m in length
  - Connected from shackle plate to HDPE sinker ring
- ~1m Grade 2 steel chain (32mm) connected to Floatation Capsule

11) Floatation Capsule (steel):
- ~1.5m in diameter x ~3.45m in length
- Effective floatation volume = 6m^3
- ~3m Grade 2 steel chain (32mm) connected to Counter Weight

12) Counter Weight (concrete):
- ~1.1m in diameter x ~2.2m in length
- Effective weight of 5 MT

Appendix B – Location Area



Position	° Decimal ' Latitude	° Decimal ' Longitude	Decimal ° Latitude	Decimal ° Longitude	Perimeter (km)	Area (km²)
Modified Site B from BES Report						
Upper Left	27° 7.86863' N	83° 13.45827' W	27.131143° N	83.224303° W		
Upper Right	27° 7.83079' N	83° 11.63237' W	27.130512° N	83.193872° W		
Lower Right	27° 6.43381' N	83° 11.69349' W	27.107230° N	83.194890° W		
Lower Left	27° 6.50261' N	83° 13.52658' W	27.108377° N	83.225442° W		
Center	27° 7.11266' N	83° 12.58604' W	27.118543° N	83.209767° W	11.1571	7.7237
Targeted Subset Area of Modified Site B from BES Report (3' to 10' Unconsolidated Sediments)						
Upper Left	27° 7.70607' N	83° 12.27012' W	27.128445° N	83.204502° W		
Upper Right	27° 7.61022' N	83° 11.65678' W	27.126837° N	83.194278° W		
Lower Right	27° 6.77773' N	83° 11.75379' W	27.112962° N	83.195897° W		
Lower Left	27° 6.87631' N	83° 12.42032' W	27.114605° N	83.207005° W		
Center	27° 7.34185' N	83° 12.02291' W	27.122365° N	83.200382° W	5.2273	1.6435
Notional Net Pen Placements within Modified Site B from BES Report						
1	27° 7.54724' N	83° 11.85393' W	27.125787° N	83.197565° W		
2	27° 7.17481' N	83° 11.82576' W	27.119580° N	83.197095° W		
3	27° 6.93930' N	83° 11.94780' W	27.115655° N	83.199130° W		
4	27° 6.52579' N	83° 12.09175' W	27.108763° N	83.201530° W	0.7854	0.0491