UNITED STATES GOVERNMENT March 20, 2018
MEMORANDUM

To: Public Information (MS 5030)
From: Plan Coordinator, FO, Plans Section (MS 5231)

Subject: Public Information copy of plan

Control #	-	S-07886
Type	-	Supplemental Development Operations Coordinations Document
Lease(s)	-	OCS-G06894 Block - 915 Viosca Knoll Area
Operator	-	Anadarko Petroleum Corporation
Description	-	Subsea Well 007
Rig Type	-	None

Attached is a copy of the subject plan.

It has been deemed submitted as of this date and is under review for approval.

Ronald O'Connor
Plan Coordinator

Site Type/Name	**Botm Lse/Area/Blk**	**Surface Location**	**Surf Lse/Area/Blk**
TLP/A-MARLIN		690 FNL, 7221 FEL	G06894/VK/915
WELL/007	G06894/VK/915	6696 FSL, 2941 FWL	G06894/VK/915

Environmental Impact Analysis

For a

SUPPLEMENTAL DEVELOPMENT OPERATIONS COORDINATION DOCUMENT

Viosca Knoll Block 915

(OCS-G 06894)

Offshore Alabama

January 2018

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(OCS-G 06894)

DOCUMENT NO. CSA-ANADARKO-FL-18-3234-01-REP-01-FIN

VERSION	DATE	DESCRIPTION	PREPARED BY:	REVIEWED BY:	APPROVED BY:
01	01/15/2018	Revised draft	J. Tiggelaar	P. Connelly	J. Tiggelaar
FIN	01/15/2018	Final	J. Tiggelaar	n/a	J. Tiggelaar

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Acronyms and Abbreviations

ADIOS2	Automated Data Inquiry for Oil Spills 2
Anadarko	Anadarko Petroleum Corporation
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BOP	blowout preventer
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CGA	Clean Gulf Associates
DOCD	Development Operations Coordination Document
DP	dynamically positioned
DPS	distinct population segment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIA	Environmental Impact Analysis
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAD	fish aggregating device
GMFMC	Gulf of Mexico Fishery Management Council
GPS	global positioning system
H_2S	hydrogen sulfide
HAPC	Habitat Area of Particular Concern
HOSS	high-volume open sea skimmer
IPF	impact-producing factor
LARS	launch and recovery system
MARPOL	International Convention for the Prevention of Pollution from Ships
MMC	Marine Mammal Commission
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MSRC	Marine Spill Response Corporation
MWCC	Marine Well Containment Company
NAAQS	National Ambient Air Quality Standards
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRDA	Natural Resource Damage Assessment
NTL	Notice to Lessees and Operators
NWR	National Wildlife Refuge
OCS	Outer Continental Shelf
OSRA	Oil Spill Risk Analysis
OSRP	Oil Spill Response Plan
PAH	polycyclic aromatic hydrocarbon
PM	particulate matter
SO_x	sulfur oxides
UME	Unusual Mortality Event
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
VK	Viosca Knoll
WCD	worst-case discharge

Introduction

Anadarko Petroleum Corporation (Anadarko) is submitting a Supplemental Development Operations Coordination Document (DOCD) for Viosca Knoll (VK) Block 915 (VK 915). Under this DOCD, Anadarko proposes to install subsea infrastructure and place the previously permitted VK 915-007 well onto production. The Environmental Impact Analysis (EIA) provides information on potential environmental impacts of Anadarko's proposed activities in VK 915.

The lease area is approximately 66 miles (106 km) from the nearest shoreline (Louisiana), 135 miles (217 km) from the onshore support base at Port Fourchon, Louisiana, and 168 miles (270 km) from the helicopter base at Houma, Louisiana (**Figure 1**). The water depth at the location of the proposed activities is approximately 3,561 ft (1,085 m). The subsea wellhead will be installed with a dynamically positioned (DP) construction vessel. The proposed activities are expected to require a total of 27 days, inclusive of installation operations and placing the well onto production.

The EIA for this DOCD was prepared for submittal to the Bureau of Ocean Energy Management (BOEM) in accordance with applicable regulations, including 30 Code of Federal Regulations (CFR) 550.242(s) and 550.261. The EIA is a project- and site-specific analysis of Anadarko's planned activities under this DOCD. The EIA complies with guidance provided in existing Notices to Lessees and Operators (NTL) issued by BOEM and its predecessors, Minerals Management Service (MMS) and Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), including NTL 2008-G04 (extended by 2015-N02) and NTL 2015-N01. Potential impacts have been analyzed at a broader level in the 2017 to 2022 Programmatic Environmental Impact Statement (EIS) for the Outer Continental Shelf (OCS) Oil and Gas Leasing Program (BOEM, 2016a) and in lease sale EISs for the Western and Central Gulf of Mexico Planning Areas (BOEM, 2012 a,b, 2013a, 2014a, 2015, 2016b, 2017 a,b). The most recent lease sale EISs update environmental baseline information in light of the Macondo (*Deepwater Horizon*) incident and address potential impacts of a catastrophic spill (BOEM, 2012 a,b, 2013a, 2014a, 2015, 2016b, 2017a). The analyses from those documents are incorporated here by reference.

All the proposed activities and facilities discussed in this DOCD are covered by Anadarko's Gulf of Mexico Regional Oil Spill Response Plan (OSRP) last approved on 14 August 2015 for Anadarko and its subsidiary, Anadarko US Offshore LLC (Company Numbers 00981 and 02219 respectively), in accordance with 30 CFR Part 254. The June 2017 biennial updates were acknowledged by the Bureau of Safety and Environmental Envorcement (BSEE) 12 July 2017; and 5 October 2017 updates were acknowledged by BSEE on 2 November 2017. Per BSEE, the OSRP is in compliance with 30 CFR 254.30(a). The OSRP details Anadarko's plan to rapidly and effectively manage oil spills that may result from drilling and production operations. Anadarko has designed its spill response program based on a regional capability of response to spills ranging from small operational spills to a worst-case discharge (WCD) from a well blowout. Anadarko's spill response program meets the response planning requirements of the relevant coastal states and applicable federal oil spill planning regulations. The OSRP also includes information regarding Anadarko's regional oil spill organization and dedicated response assets, potential spill risks, and local environmental sensitivities. It describes personnel and equipment mobilization, incident management team organization, and an overview of actions and notifications to be taken in the event of a spill.

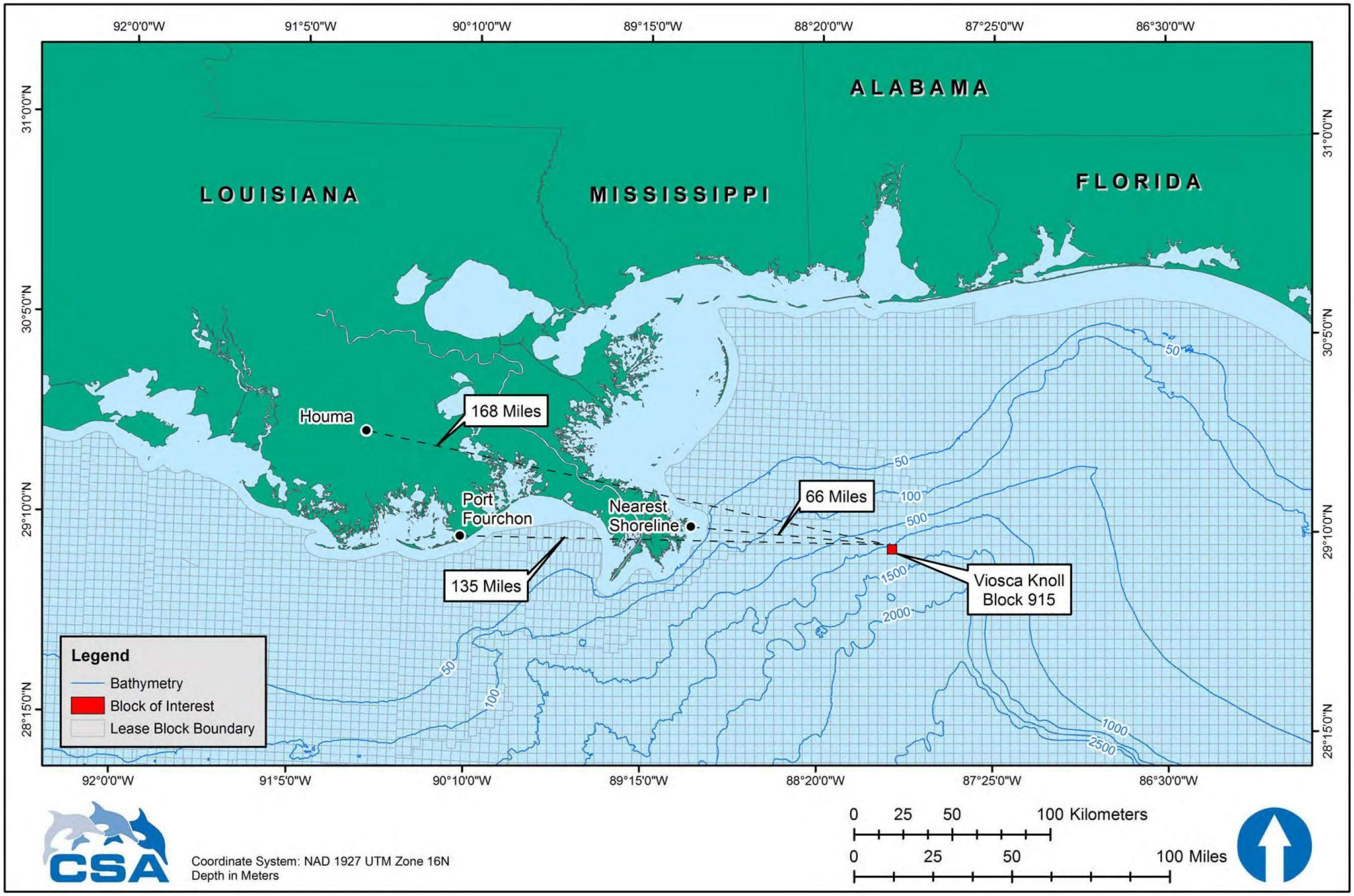

Figure 1. Location of Viosca Knoll Block 915, offshore Alabama.

The EIA is organized into **Sections A** through **I**, corresponding to the information required by NTLs 2008-G04 (extended by NTL 2015-N02) and 2015-N01. The main impact-related discussions are in **Section A** (Impact-Producing Factors) and **Section C** (Impact Analysis). **Table 1** lists and summarizes the NTLs applicable to the EIA.

Table 1. Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and Environmental Enforcement (BSEE) Notices to Lessees and Operators (NTLs) applicable to this Environmental Impact Analysis (EIA).

NTL	Title	Summary
BOEM-2016-G01	Vessel Strike Avoidance and Injured/Dead Protected Species Reporting	Recommends protected species identification training; recommends that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel movement to avoid striking protected species; and requires operators to report sightings of any injured or dead protected species.
BSEE-2015-G03	Marine Trash and Debris Awareness and Elimination	Instructs operators to exercise caution in the handling and disposal of small items and packaging materials; requires the posting of instructional placards at prominent locations on offshore vessels and structures; and mandates a yearly marine trash and debris awareness training and certification process.
BOEM 2015-N02	Elimination of Expiration Dates on Certain Notices to Lessees and Operators Pending Review and Reissuance	Eliminates expiration dates (past or upcoming) of all NTLs currently posted on the BOEM website.
BOEM 2015-N01	Information Requirements for Exploration Plans, Development and Production Plans, and Development Operations Coordination Documents on the OCS for Worst-Case Discharge (WCD) and Blowout Scenarios	Provides guidance regarding information required in WCD descriptions and blowout scenarios.
BOEM 2014-G04	Military Warning and Water Test Areas	Provides contact links to individual command headquarters for the military warning and water test areas in the Gulf of Mexico.
BSEE-2012-N06	Guidance to Owners and Operators of Offshore Facilities Seaward of the Coast Line Concerning Regional Oil Spill Response Plans (OSRP)	Provides clarification, guidance, and information for preparation of regional OSRP; and recommends description of response strategy for WCD scenarios to ensure capability to respond to oil spills is both efficient and effective.
2011-JOINT-G01	Revisions to the List of Outer Continental Shelf (OCS) Blocks Requiring Archaeological Resource Surveys and Reports	Provides new information of which OCS blocks require archaeological surveys and reports; and identifies required survey line spacing in each block. This NTL augments NTL 2005-G07.

Table 1. (Continued).

NTL	Title	Summary
2010-N10	Statement of Compliance with Applicable Regulations and Evaluation of Information Demonstrating Adequate Spill Response and Well Containment Resources	Informs operators using subsea or surface blowout preventers on floating facilities that applications for well permits must include a statement signed by an authorized company official stating that the operator will conduct all activities in compliance with all applicable regulations, including the increased safety measures regulations (75 *FR* 63346). Informs operators that BOEM will be evaluating whether each operator has submitted adequate information demonstrating that it has access to and can deploy containment resources to promptly respond to a blowout or other loss of well control.
2009-G40	Deepwater Benthic Communities	Provides guidance for avoiding and protecting high-density deepwater benthic communities (including chemosynthetic and deepwater coral communities) from damage caused by OCS oil and gas activities in water depths greater than 984 ft (300 m). Prescribes separation distances of 2,000 ft (610 m) from each mud and cuttings discharge location and 250 ft (76 m) from all other seafloor disturbances.
2009-G39	Biologically Sensitive Underwater Features and Areas	Provides guidance for avoiding and protecting biologically sensitive features and areas (i.e., topographic features, pinnacles, low relief live bottom areas, and other potentially sensitive biological features) when conducting OCS operations in water depths less than 984 ft (300 m) in the Gulf of Mexico.
2008-G04	Information Requirements for Exploration Plans and Development Operations Coordination Documents	Provides guidance on information requirements for OCS plans, including EIA requirements and information regarding compliance with the provisions of the Endangered Species Act and Marine Mammal Protection Act.
2005-G07	Archaeological Resource Surveys and Reports	Provides guidance on regulations regarding archaeological discoveries, specifies requirements for archaeological resource surveys and reports, and outlines options for protecting archaeological resources.

A. Impact-Producing Factors

Based on the description of Anadarko's proposed activities, a series of impact-producing factors (IPFs) have been identified. **Table 2** identifies the environmental resources that may be affected in the left column, and identifies sources of impacts associated with the proposed project across the top. **Table 2**, adapted from Form BOEM-0142, has been developed *a priori* to focus the impact analysis on those environmental resources that may be impacted as a result of one or more IPFs. The tabular matrix indicates which of the routine activities and accidental events could affect specific resources. An "X" indicates that an IPF could reasonably be expected to affect a certain resource, and a dash (--) indicates no impact or negligible impact. Where there may be an effect, an analysis is provided in **Section C**. Potential IPFs for the proposed activities are listed below and briefly discussed in the following sections.

- Construction vessel presence (including noise and lights)
- Physical disturbance to the seafloor
- Air pollutant emissions
- Effluent discharges
- Water intake
- Onshore waste disposal
- Marine debris
- Support vessel and helicopter traffic
- Accidents

A.1 Construction Vessel Presence (Including Noise and Lights)

The subsea wellhead will be installed with a DP construction vessel. DP vessels use a global positioning system (GPS), specific computer software, and sensors in conjunction with their own propellers and thrusters to maintain position. The precise location of the vessel is monitored by operators using satellite navigation. Thrusters positioned at various locations around the vessel's hull are activated as needed to maintain position. This process, known as station-keeping, allows operations at sea in water depths or locations where mooring or anchoring is impractical or not feasible. The DP construction vessel will be on site for an estimated 27 days total and will maintain exterior lighting in accordance with applicable federal navigation and aviation safety regulations (International Regulations for Preventing Collisions at Sea, 1972 [72 COLREGS], Part C).

The installation operations and DP construction vessel can be expected to produce noise associated with propulsion machinery that transmits directly to the water during station-keeping, wellhead installation, and maintenance operations. Additional sound and vibration will be transmitted through the hull to the water from auxiliary machinery, such as generators, pumps, and compressors onboard the construction vessel (Richardson et al., 1995). The noise levels produced by DP vessels for station-keeping are largely dependent on the level of thruster activity required to keep position and, therefore, vary based on local ocean currents, sea and weather conditions, and operational requirements. Representative source levels for vessels in DP mode range from 184 to 190 dB re 1 µPa, with a primary amplitude frequency below 600 Hz (Blackwell and Greene Jr., 2003, Kyhn et al., 2011, McKenna et al., 2012).

Table 2. Matrix of impact-producing factors and environmental resources (Modified from: Form BOEM-0142).

Environmental Resources	Impact-Producing Factors									
	Construction Vessel Presence (including noise and lights)	Physical Disturbance to Seafloor	Air Pollutant Emissions	Effluent Discharges	Water Intake	Onshore Waste Disposal	Marine Debris	Support Vessel/Helicopter Traffic	Accidents	
									Small Diesel Fuel Spill	Large Oil Spill
Physical/Chemical Environment										
Air quality	--	--	**X**(9)	--	--	--	--	--	**X**(6)	**X**(6)
Water quality	--	--	--	**X**	--	--	--	--	**X**(6)	**X**(6)
Seafloor Habitats and Biota										
Soft bottom benthic communities	--	**X**	--	--	--	--	--	--	--	**X**(6)
High-density deepwater benthic communities	--	-- (4)	--	--(4)	--	--	--	--	--	**X**(6)
Designated topographic features	--	-- (1)	--	--(1)	--	--	--	--	--	--
Pinnacle trend area live bottoms	--	-- (2)	--	--(2)	--	--	--	--	--	--
Eastern Gulf live bottoms	--	-- (3)	--	--(3)	--	--	--	--	--	--
Threatened, Endangered, and Protected Species, and Critical Habitat										
Sperm whale (endangered)	**X**(8)	--	--	--	--	--	--	**X**(8)	**X**(6,8)	**X**(6,8)
West Indian manatee (endangered)	--	--	--	--	--	--	--	**X**(8)	--	**X**(6,8)
Non-endangered marine mammals (protected)	**X**	--	--	--	--	--	--	**X**	**X**(6)	**X**(6)
Sea turtles (endangered/threatened)	**X**(8)	--	--	--	--	--	--	**X**(8)	**X**(6,8)	**X**(6,8)
Piping Plover (threatened)	--	--	--	--	--	--	--	--	--	**X**(6)
Whooping Crane (endangered)	--	--	--	--	--	--	--	--	--	**X**(6)
Gulf sturgeon (threatened)	--	--	--	--	--	--	--	--	--	**X**(6)
Beach mouse (endangered)	--	--	--	--	--	--	--	--	--	**X**(6)
Threatened coral species	--	--	--	--	--	--	--	--	--	**X**(6)
Coastal and Marine Birds										
Marine birds	**X**	--	--	--	--	--	--	**X**	**X**(6)	**X**(6)
Shorebirds and coastal nesting birds	--	--	--	--	--	--	--	**X**	--	**X**(6)
Fisheries Resources										
Pelagic communities and ichthyoplankton	**X**	--	--	**X**	**X**	--	--	--	**X**(6)	**X**(6)
Essential Fish Habitat	**X**	--	--	**X**	**X**	--	--	--	**X**(6)	**X**(6)
Archaeological Resources										
Shipwreck sites	--	--(7)	--	--	--	--	--	--	--	**X**(6)
Prehistoric archaeological sites	--	--(7)	--	--	--	--	--	--	--	**X**(6)
Coastal Habitats and Protected Areas										
Barrier beaches and dunes	--	–	--	--	--	--	--	**X**	--	**X**(6)
Wetlands and seagrass beds	--	–	--	--	--	--	--	**X**	--	**X**(6)
Coastal wildlife refuges and wilderness areas	--	–	--	--	--	--	--	--	--	**X**(6)
Socioeconomic and Other Resources										
Recreational and commercial fishing	**X**	--	--	--	--	--	--	--	**X**(6)	**X**(6)
Public health and safety	--	--	--	--	--	--	--	--	--	**X**(5,6)
Employment and infrastructure	--	--	--	--	--	--	--	--	--	**X**(6)
Recreation and tourism	--	--	--	--	--	--	--	--	--	**X**(6)
Land use	--	--	--	--	--	--	--	--	--	**X**(6)
Other marine uses	--	--	--	--	--	--	--	--	--	**X**(6)

X indicates potential impact; dashes (--) indicates no impact or negligible impact; numbers refer to table footnotes.

Table 2 Footnotes and Applicability to this Program:

Footnotes are numbered to correspond to entries in ***Table 2****; applicability to this case is noted by a bullet point following the footnote.*

(1) *Activities that may affect a marine sanctuary or topographic feature. Specifically, if the well, rig site, or any anchors will be on the seafloor within the following:*
   (a) *4-mile zone of the Flower Garden Banks or the 3-mile zone of Stetson Bank;*
   (b) *1,000 m, 1-mile, or 3-mile zone of any topographic feature (submarine bank) protected by the Topographic Features Stipulation attached to an Outer Continental Shelf (OCS) lease;*
   (c) *Essential Fish Habitat (EFH) criteria of 500 ft from any no-activity zone; or*
   (d) *Proximity of any submarine bank (500 ft buffer zone) with relief greater than 2 m that is not protected by the Topographic Features Stipulation attached to an OCS lease.*
   - None of these conditions (a through d) are applicable. The lease is not within or near any marine sanctuary, topographic feature, submarine bank, or no-activity zone.

(2) *Activities with any bottom disturbance within an OCS lease block protected through the Live Bottom (Pinnacle Trend) Stipulation attached to an OCS lease.*
   - The Live Bottom (Pinnacle Trend) Stipulation is not applicable to the lease area.

(3) *Activities within any Eastern Gulf OCS block where seafloor habitats are protected by the Live Bottom (Low-Relief) Stipulation attached to an OCS lease.*
   - The Live Bottom (Low-Relief) Stipulation is not applicable to the lease area.

(4) *Activities on blocks designated by the Bureau of Ocean Energy Management (BOEM) as being in water depths 1,312 ft (400 m) or greater.*
   - No impacts to high-density deepwater benthic communities are anticipated. No high or low positive seafloor amplitude anomalies representing potential benthic communities were noted within 2,000 ft (610 m) of the location of the proposed activities (Geoscience Earth & Marine Services Inc., 2014).

(5) *Exploration or production activities where hydrogen sulfide (H_2S) concentrations greater than 500 parts per million (ppm) might be encountered.*
   - Viosca Knoll Block 915 was classified as H_2S absent under a previously approved Initial Exploration Plan.

(6) *All activities that could result in an accidental spill of produced liquid hydrocarbons or diesel fuel that would potentially impact these environmental resources. If the proposed action is located a sufficient distance from a resource that no impact would occur, the EIA can note that in a sentence or two.*
   - Accidental hydrocarbon spills could affect the resources marked "X" in the table matrix, and potential impacts are analyzed in **Section C**.

(7) *All activities that involve seafloor disturbances, including anchor emplacements, in any OCS block designated by the BOEM as having high probability for the occurrence of shipwrecks or prehistoric sites, including such blocks that will be affected that are adjacent to the lease block in which your planned activity will occur. If the proposed activities are located a sufficient distance from a shipwreck or prehistoric site that no impact would occur, the EIA can note that in a sentence or two.*
   - No impacts on archaeological resources are expected. The lease area is on BOEM's list of archaeology survey blocks (BOEM, 2011); however, the locations of the proposed activities are well beyond the 197 ft (60 m) depth contour used by BOEM as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. A dynamically positioned construction vessel will be used; therefore, seafloor disturbances due to anchoring will not occur. No archaeologically significant side-scan sonar targets are located within 2,000 ft (610 m) of the proposed activities (Geoscience Earth & Marine Services Inc., 2014).

(8) *All activities that you determine might have an adverse effect on endangered or threatened marine mammals or sea turtles or their critical habitats.*
   - Impact-producing factors that may affect marine mammals, sea turtles, or their critical habitats include construction vessel presence, support vessel and helicopter traffic, and accidents. See **Section C**.

(9) *Production activities that involve transportation of produced fluids to shore using shuttle tankers or barges.*
   - Not applicable.

A.2 Physical Disturbance to the Seafloor

There will be minimal disturbance to the seafloor and soft bottom communities during installation of the subsea wellhead. Physical disturbance of the seafloor will be limited to the area immediately surrounding the wellhead.

A.3 Air Pollutant Emissions

Offshore air pollutant emissions will result from construction vessel operations as well as support vessel (both supply and crew vessels) and helicopter transits. These emissions occur mainly from combustion of diesel and aviation fuel (Jet-A). The combustion of fuels occurs in diesel-powered generators, pumps, or motors and from lighter fuel motors. Primary air pollutants typically associated with emissions from internal combustion engines are suspended particulate matter (PM), sulfur oxides (SO_x), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and carbon monoxide (CO).

The Air Quality Emissions Report (see **DOCD Section H**) prepared in accordance with BOEM requirements demonstrates that the projected emissions are below exemption levels set by the applicable regulations in 30 CFR 550.303. Based on this and the distance from shore, it can be concluded that the emissions will not significantly affect the air quality of the onshore area for any of the criteria pollutants. No further analysis or control measures are required.

A.4 Effluent Discharges

Effluent discharges are summarized in **DOCD Section G**. The discharges will include treated sanitary and domestic wastes, deck drainage, desalination unit brine, subsea production control fluid, produced water, non-pollutant completion fluids, uncontaminated ballast and bilge water, noncontact cooling water, and fire water. All offshore discharges will be in accordance with requirements of the National Pollutant Discharge Elimination System (NPDES) General Permit No. GMG290006 issued by the U.S. Environmental Protection Agency (USEPA), including permit compliance terms, discharge volumes, discharge rates, and associated monitoring requirements.

A.5 Water Intake

Seawater will be drawn from the ocean for once-through, non-contact cooling of machinery on the construction vessel. Section 316(b) of the Clean Water Act requires NPDES permits to ensure that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available to minimize adverse environmental impact from impingement and entrainment of aquatic organisms. The current NPDES General Permit No. GMG290006 does not specify requirements for facilities that started construction before 17 July 2006. The construction vessel ultimately selected for this project will be in compliance with all cooling water intake structure requirements.

A.6 Onshore Waste Disposal

Wastes generated during the proposed activities are tabulated in **DOCD Section G**. A total of approximately 12,000 bbl of trash and debris will be generated over the life of the project. Trash will be transported to shore in disposal bags for final disposal by municipal operators in accordance with applicable regulations. Other wastes transported to shore for re-use, recycling, or disposal includes, chemical product waste (well treatment fluids), completion fluids, workover fluids, used oil, and produced sand. All wastes will be transported to shore in containers approved by the U.S. Department of Transportation for re-use, recycling, or disposal in accordance with applicable regulations.

A.7 Marine Debris

Anadarko will comply with all regulations relating to solid waste handling, transporation and disposal, including the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) Annex V requirements as well as USEPA, U.S. Coast Guard (USCG), and BOEM regulations. These regulations include prohibitions and compliance requirements regarding the deliberate discharging of containers and other similar materials (i.e., trash and debris) into the marine environment as well as the protective measures to be implemented to prevent the accidental loss of solid materials into the marine environment. For example, the BSEE regulations 30 CFR 250.300(a) and (b)(6) prohibit operators from deliberately discharging containers and other similar materials (i.e., trash and debris) into the marine environment, and 30 CFR 250.300(c) requires durable identification markings on equipment, tools, containers (especially drums), and other materials. The USEPA and USCG regulations require operators to be proactive in avoiding accidental loss of solid materials by developing waste management plans, posting informational placards, manifesting trash sent to shore, and using special precautions such as covering outside trash bins to prevent accidental loss of solid waste. In addition to the regulations in 30 CFR 250, BSEE issued NTL BSEE-2015-G03, which instructs operators to exercise caution in the handling and disposal of small items and packaging materials, requires the posting of placards at prominent locations on offshore vessels and structures, and mandates a yearly training and certification process for marine trash and debris awareness.

A.8 Support Vessel and Helicopter Traffic

Offshore support vessels associated with the proposed project will contribute to the overall acoustic environment by transmitting noise through both air and water. The support vessels will use conventional diesel-powered screw propulsion. Vessel noise is a combination of narrow-band (tonal) and broadband sound (Richardson et al., 1995, Hildebrand, 2009, McKenna et al., 2012). Tones typically dominate up to approximately 50 Hz, whereas broadband sounds may extend to 100 kHz. The primary sources of vessel noise are propeller cavitation, propeller singing, and propulsion; other sources include auxiliary engine noise, flow noise from water dragging along the hull, and bubbles breaking in the vessel's wake (Richardson et al., 1995). The intensity of noise from support vessels is roughly related to ship size, weight, and speed. Broadband source levels for smaller boats (a category that include supply and other service vessels) are in the range of 150 to 180 dB re 1 µPa m (Richardson et al., 1995, Hildebrand, 2009, McKenna et al., 2012).

The project will be supported by one helicopter that will make an estimated 10 round trips per week between the project area and the heliport in Houma, Louisiana. The helicopter will be used to transport personnel as well as small supplies and will take the most direct route of travel between the heliport and the lease area when air traffic and weather conditions permit. Helicopters typically maintain a minimum altitude of 700 ft (213 m) while in transit offshore, 1,000 ft (305 m) over unpopulated areas or across coastlines, and 2,000 ft (610 m) over populated areas and sensitive habitats such as wildlife refuges and park properties (BOEM, 2012a). Additional guidelines and regulations specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals (BOEM, 2017a). Anadarko will use existing air transportation (helicopter) facilities in Houma, Louisiana. No terminal expansion or construction is planned.

Dominant tones in noise spectra from helicopters are below 500 Hz with a source level of approximately 149 to 151 dB re 1 Pa m (for a Bell 212 helicopter) (Richardson et al., 1995). Levels of noise received underwater from passing aircraft depend on the aircraft's altitude, the aspect (direction and angle) of the aircraft relative to the receiver, receiver depth, water depth, and seafloor type (Richardson et al., 1995). Received level diminishes with increasing receiver depth when an aircraft is directly overhead, but may be stronger at mid-water than at shallow depths when an aircraft is not directly overhead (Richardson et al., 1995). Because of the relatively high expected airspeeds during transits and these physical variables, aircraft-related noise (including both airborne and underwater noise) is expected to be very brief in duration.

A.9 Accidents

The EIA focuses on two potential accidents:

- a small diesel fuel spill, which is the most likely type of spill during OCS activities (discussed in **Section A.9.1**); and
- a large oil spill, up to and including the WCD for this DOCD (as detailed in **DOCD Section I**), which is an oil spill resulting from an uncontrolled blowout (discussed in **Section A.9.2**).

The following subsections summarize details regarding the sizes and fates of these spill scenarios. Impacts are analyzed in **Section C**.

Recent EISs (BOEM, 2014b, 2015, 2016b, 2017 a,b) analyzed other types of accidents relevant to offshore operations that could lead to potential impacts to the marine environment: loss of well control, vessel collision, and chemical spills. These types of accidents, along with a hydrogen sulfide (H_2S) release, are discussed briefly below.

Loss of Well Control. A loss of well control is the uncontrolled flow of a reservoir fluid that may result in the release of gas, condensate, oil, drilling fluids, sand, or water. Loss of well control is a broad term that includes very minor up to the most serious well control incidents, while blowouts are considered to be a subset of more serious incidents with greater risk of oil spill or human injury (BOEM, 2016a, 2017a). Loss of well control may result in the release of drilling fluid or loss of oil. Not all loss of well control events result in blowouts (BOEM, 2017c). In addition to the potential release of gas, condensate, oil, sand, or water, the loss of well control can also resuspend and disperse bottom sediments (BOEM, 2012a, 2017 a,b). BOEM (2016a) noted that most OCS blowouts have resulted in the release of gas.

Anadarko has a robust system in place to prevent loss of well control. Measures to prevent a blowout, reduce the likelihood of a blowout, and conduct effective and early intervention in the event of a blowout are described in the NTL 2015-N01 package submitted with this DOCD, as required by BOEM. The potential for a loss of well control event will be minimized by adhering to the requirements of applicable regulations such as the Well Control Rule (75 *FR* 63365) and NTL 2010-N10, which specify additional safety measures for OCS activities.

Vessel Collisions. BSEE data show that there were 119 OCS-related collisions between 2009 and 2016 (BSEE, 2016). Most collision mishaps are the result of support vessels colliding with platforms or vessel collisions with pipeline risers. Approximately 10% of vessel collisions with platforms in the OCS resulted in diesel spills, and in several collision incidents, fires resulted from hydrocarbon releases. To date, the largest diesel spill associated with a collision occurred in 1979 when an anchor-handling vessel collided with a drilling platform in the Main Pass lease area, spilling 1,500 bbl of diesel fuel. Diesel fuel is the product most frequently spilled, but oil, natural gas, corrosion inhibitor, hydraulic fluid, and lube oil also have been released as a result of vessel collisions. Human error accounted for approximately half of all reported vessel collisions from 2006 to 2010. As summarized by BOEM (2017c), vessel collisions occasionally occur during routine operations. Some of these collisions have caused spills of diesel fuel or chemicals. Anadarko will comply with all USCG- and BOEM-mandated safety requirements to minimize the potential for vessel collisions.

Chemical Spills. Chemicals are stored and used for pipeline hydrostatic testing and during drilling and in well completion operations. The relative quantities of their use is reflected in the largest volumes spilled (BOEM, 2017c). Completion, workover, and treatment fluids are the largest quantity used and comprise the largest releases. Between 2007 and 2014, an average of two chemical spills <50 bbl in volume and three checmical spills >50 bbl in volume occurred each year (BOEM, 2017a).

H_2S Release. VK 915 was classified as H_2S absent under a previously approved Initial Exploration Plan.

A.9.1 Small Diesel Fuel Spill

Spill Size. According to the analysis by BOEM (2017b), the most likely type of small spill (<1,000 bbl) resulting from OCS activities is a failure related to the storage of oil or diesel fuel. Historically, most diesel spills have been ≤1 bbl, and this is predicted to be the most common spill volume in ongoing and future OCS activities in the Western and Central Gulf of Mexico Planning Areas (Anderson et al., 2012). As the spill volume increases, the incident rate declines dramatically (BOEM, 2017a). The median size for spills ≤1 bbl is 0.024 bbl, and the median volume for spills of 1 to 10 bbl is 3 bbl (Anderson et al., 2012). For the EIA, a small diesel fuel spill of 3 bbl is used. Operational experience suggests that the most likely cause of such a spill would be a rupture of the fuel transfer hose resulting in a loss of contents (<3 bbl of fuel) (BOEM, 2012a).

Spill Fate. The fate of a small diesel fuel spill in the lease area would depend on meteorological and oceanographic conditions at the time of the spill as well as the effectiveness of spill response activities. However, given the open ocean location of the lease area and response actions required to be implemented by the responsible party, it is expected that impacts from a small spill would be minimal (BOEM, 2016a).

The water-soluble fractions of diesel are dominated by two- and three-ringed polycyclic aromatic hydrocarbons (PAHs), which are moderately volatile (National Research Council, 2003a). The constituents of these oils are light to intermediate in molecular weight and can be readily degraded by aerobic microbial oxidation. Due to its low density, diesel will not sink to the seafloor. Diesel dispersed in the water column can adhere to suspended sediments, but this generally occurs only in coastal areas with high suspended solids loads (National Research Council, 2003a) and would not be expected to occur to any appreciable degree in offshore waters of the Gulf of Mexico. The National Oceanic and Atmospheric Administration (NOAA) has reported that diesel oil is readily and completely degraded by naturally occurring microbes (NOAA, 2006).

Oil slicks from diesel spills within the marine environment are expected to persist for relatively short periods of time, ranging from minutes (for a <1 bbl spill) to hours (for a 1 to 10 bbl spill) to a few days (for a 10 to 1,000 bbl spill), and will rapidly spread out, evaporate, and disperse into the water column (BOEM, 2012a).

For the purposes of the EIA, the fate of a small diesel fuel spill was estimated using NOAA's Automated Data Inquiry for Oil Spills 2 (ADIOS2) model (NOAA, 2016a). This model uses the physical properties of various oil types in its database to predict the rate of evaporation and dispersion over time as well as changes in the density, viscosity, and water content of the spilled product. Based on model results, it is estimated that more than 90% of a small diesel spill would evaporate or disperse within 24 hours. The area of sea surface exhibiting floating diesel fuel during this 24-hour period would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions.

The ADIOS2 results, coupled with spill trajectory information for a large spill, indicate that a small diesel fuel spill would not impact coastal or shoreline resources because of the distance of the lease area to the nearest shoreline (66 miles [106 km]). Modeling results indicate that a spill in the lease area would have a <0.5% conditional probability of reaching coastal Louisiana within 3 days of a spill and up to a 7% conditional probability within 10 days following a spill. By that time, essentially 100% of a small diesel fuel spill is expected to have dispersed or evaporated through natural processes, without taking into account Anadarko's spill response measures. Because of the lack of persistence of small oil spills in the environment and the project's distance from shore, it is unlikely that a small spill within the project area would make landfall prior to dissipating (BOEM, 2012a, 2017a).

Spill Response. In the unlikely event that shipboard prevention procedures fail to circumvent a fuel spill, response equipment and trained personnel will be activated so that spill effects will be localized and will result only in short-term environmental consequences. **DOCD Section I** provides a detailed discussion of Anadarko's response to a spill.

A.9.2 Large Oil Spill (Worst-Case Discharge)

Spill Size. The WCD scenario for this project is defined as an uncontrollable oil discharge from the subsea wellbore resulting from a blowout incident during installation operations. The scenario assumes that the wellhead fails mechanically and a blowout occurs at the seafloor, allowing the entire wellbore fluid to flow up the existing production string. Based on NTL 2015-N01 guidance, the WCD at the seafloor for the well scenario was estimated to be 20,315 bbl per day.

Blowout Scenario. In accordance with NTL 2015-N01 and as required by 30 CFR 550.213g, a scenario for a potential blowout of a well, and the highest volume of liquid hydrocarbons potentially released, has been detailed and is provided within this DOCD. An estimated 120 days will be required to mobilize equipment and drill a relief well under the blowout scenario. The maximum total volume of liquid hydrocarblons released during a blowout is potentially 2,437,800 bbl, assuming 120 days for the duration of a blowout, multiplied by the worst-case daily uncontrolled volume (20,315 bbl per day).

The detailed analysis of the WCD calculations can be found in **DOCD Section I**, as required by NTL 2015-N01 and 30 CFR 550.219(a)(2)(iv). Descriptions of the measures to be undertaken by Anadarko to prevent a blowout, reduce the likelihood of a blowout, and conduct effective and early intervention in the event of a blowout are included in the analysis. Anadarko will also comply with NTL 2010-N10 and the Well Control Rule (75 *FR* 63365) which specify additional safety measures for OCS activities.

Spill Probability. Holand (1997) estimated a probability of 0.0021 for a deep drilling blowout during exploration drilling based on U.S. Gulf of Mexico data. The International Association of Oil & Gas Producers (2010) conducted an analysis using the SINTEF[1] database and estimated a blowout frequency of 0.0017 per exploratory well for non-North Sea locations. BOEM updated OCS spill frequencies (barrels spilled per barrels produced) to include the Macondo incident. Spill rates for OCS platforms have decreased in recent years as the volume of oil handled has increased with no large spills since the Macondo spill. According to ABS Consulting Inc. (2016), the spill rate for spills >1,000 bbl dropped to 0.22 spills per billion barrels. According to BSEE's Well Control Rule (75 *FR* 63365), issued following the Macondo spill, the baseline risk of a catastrophic blowout is estimated to be once every 26 years.

Spill Trajectory. The fate of a large oil spill in the lease area would depend on meteorological and oceanographic conditions at the time of the spill. The Oil Spill Risk Analysis (OSRA) model is a computer simulation of oil spill transport that uses realistic data for winds and currents to estimate spill trajectory. The OSRA report by Ji et al. (2004) provides conditional contact probabilities for shoreline segments along the Gulf of Mexico.

The results for the 30-day OSRA model for Launch Area 55 (where VK 915 is located) are presented in **Table 3**. The model predicts a <0.5% chance of shoreline contact within 3 days and up to a 7% chance of shoreline contact within 10 days, with the highest probability of shoreline contact occuring in Plaquemines Parish, Louisiana. Shoreline contact is predicted within 30 days of a spill for shorelines ranging from Terrebonne Parish, Louisiana, to Franklin County, Florida. The conditional probability of shoreline contact for all shorelines with predicted contact within 30 days is low (1% to 7%) with the exception of Plaquemines Parish, Louisiana (17% probability within 30 days of a spill) (**Table 3**).

Table 3. Conditional probabilities of a spill in the lease area contacting shoreline segments. From: Ji et al. (2004).

Shoreline Segment	County or Parish, State	Conditional Probability of Contact[1] (%)		
		3 Days	10 Days	30 Days
C17	Terrebonne Parish, Louisiana	--	--	1
C18	Lafourche Parish, Louisiana	--	--	1
C20	Plaquemines Parish, Louisiana	--	7	17
C21	St. Bernard Parish, Louisiana	--	2	7
C22	Hancock and Harrison Counties, Mississippi	--	--	2
C23	Jackson County, Mississippi	--	1	2
C24	Mobile County, Alabama	--	1	2
C25	Baldwin County, Alabama	--	1	3
C26	Escambia County, Florida	--	--	2

[1] Stiftelsen for Industriell og Teknisk Forskning (Foundation for Scientific and Industrial Research, Norwegian Institute of Technology).

C28	Okaloosa County, Florida	--	--	1
C29	Walton County, Florida	--	--	1
C30	Bay County, Florida	--	--	2
C31	Gulf County, Florida	--	--	1
C32	Franklin County, Florida	--	--	1

[1] Conditional probability refers to the probability of contact within the stated time period, assuming that a spill has occurred (-- indicates <0.5%). Values are conditional probabilities that a hypothetical spill in Viosca Knoll Block 915 (represented by OSRA Launch Area 55) could contact shoreline segments within 3, 10, or 30 days.

The 30-day OSRA modeling results reported reported by Ji et al. (2004) did not evaluate the fate of a spill over time periods exceeding 30 days, nor did they estimate the fate of a release that continues over a period of weeks or months. As noted by Ji et al. (2004), the OSRA model does not consider the chemical composition or biological weathering of oil spills, the spreading and splitting of oil spills, or spill response activities. The model does not specify a particular spill size but has been used by BOEM to evaluate contact probabilities for spills of more than 1,000 bbl.

BOEM (2017c) presents additional OSRA modeling to simulate a spill that continues for 90 consecutive days, with each trajectory tracked for 60 days during four seasons. In this updated OSRA model, 60 days was chosen as a conservative estimate of the maximum duration that spilled oil would persist on the sea surface following a spill (BOEM, 2017c). The spatial resolution is limited, with seven launch points in the entire Western, Central, and Eastern Planning Areas of the Gulf of Mexico. These launch points were deliberately located in areas identified as having a high possibility of containing large oil reserves. The launch point most appropriate for modeling a spill in the lease area is Launch Point 2. The 60-day OSRA results for Launch Point 2 are presented in **Table 4**.

Table 4. Shoreline segments with a 1% or greater conditional probability of contact from a spill starting at Launch Point 2 based on the 60-day Oil Spill Risk Analysis. Values are conditional probabilities that a hypothetical spill in the lease area could contact shoreline segments within 60 days.

Season	Spring				Summer				Fall				Winter			
Day	3	10	30	60	3	10	30	60	3	10	30	60	3	10	30	60
County or Parish	Conditional Probability of Contact[1] (%)															
Matagorda, Texas	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Vermilion, Louisiana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Terrebonne, Louisiana	--	--	--	--	--	--	--	1	--	--	--	--	--	--	2	2
Lafourche, Louisiana	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	1
Jefferson, Louisiana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1
Plaquemines, Louisiana	--	2	3	3	2	9	17	19	2	17	24	24	1	12	18	20
St. Bernard, Louisiana	--	5	6	6	1	8	13	14	1	8	10	10	1	5	8	8
Hancock, Mississippi	--	2	3	3	11	2	2	2	1	2	3	3	--	1	2	3
Harrison, Mississippi	2	5	5	5	1	4	5	5	1	2	3	3	2	3	4	4
Jackson, Mississippi	7	13	14	14	3	6	8	8	6	11	12	13	6	10	12	13
Mobile, Alabama	13	18	19	19	4	9	10	10	8	12	12	13	9	12	12	13
Baldwin, Alabama	8	15	18	18	2	8	9	9	1	2	3	3	3	6	7	7
Escambia, Florida	1	6	9	10	1	4	6	6	--	1	1	1	--	2	2	3
Okaloosa, Florida	--	1	2	2	--	1	2	2	--	--	--	--	--	--	--	--
Walton, Florida	--	--	1	1	--	1	1	1	--	--	--	1	--	--	--	--
Bay, Florida	--	2	3	3	--	1	2	3	--	--	--	--	--	--	--	1
Gulf, Florida	--	1	3	4	--	--	2	2	--	--	--	--	--	--	--	--
Franklin, Florida	--	--	1	2	--	--	1	1	--	--	--	--	--	--	--	--
Dixie, Florida	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
Levy, Florida	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
State Coastline	Conditional Probability of Contact[1] (%)															
Texas	--	--	--	--	--	--	--	1	--	--	1	2	--	--	--	2
Louisiana	--	6	8	9	3	17	30	35	3	25	36	36	2	18	29	33
Mississippi	9	20	22	22	5	12	15	15	8	15	18	19	8	15	18	20
Alabama	21	33	37	37	6	17	20	20	9	14	15	15	12	18	20	20
Florida	1	11	19	26	1	7	14	16	--	1	3	3	--	2	4	5

[1] Conditional probability refers to the probability of contact within the stated time period assuming that a spill has occurred (-- indicates <0.5%). Values are conditional probabilities that a hypothetical spill in the lease area could contact shoreline segments within 60 days. Modified from BOEM (2017c).

From Launch Point 2, potential shoreline contacts within 60 days range from Matagorda County, Texas, to Levy County, Florida. Based on statewide contact probabilities within 60 days, Louisiana has the highest likelihood of contact during summer, fall and winter (ranging from 33% to 36% within 60 days), while Alabama has the highest probability of contact in spring (37% within 60 days). The model predicts potential contact with Mississippi shorelines in any season ranging from a 15% probability in summer to a 22% probability in spring (within 60 days of a spill). Texas shorelines are predicted to be potentially contacted only during summer, fall, or winter, with probabilities of contact 2% or less within 60 days. Florida shorelines are predicted to be potentially contacted during any season, with a probability up to 26% in spring. Based on the 60-day trajectories, counties or parishes with greater than 10% contact probability during any season include Plaquemines and St. Bernard Parishes in Louisiana; Hancock and Jackson counties in Mississippi; Mobile and Baldwin counties in Alabama; and Escambia County, Florida (**Table 4**).

OSRA is a preliminary risk assessment model. In the event of an actual oil spill, real-time monitoring and trajectory modeling would be conducted using current and wind data available from the rigs and permanent production structures in the area. Satellite and aerial monitoring of the plume and real-time trajectory modeling using wind and current data would continue on a daily basis to help position equipment and human resources throughout the duration of any major spill or uncontrolled release.

<u>Weathering</u>. Following an oil spill, several physical, chemical, and biological processes, collectively called weathering, interact to change the physical and chemical properties of the oil, influencing potential effects to marine organisms and ecosystems. The most important weathering processes include spreading, evaporation, dissolution, dispersion into the water column, formation of water-in-oil emulsions, photochemical oxidation, microbial degradation, adsorption to suspended particulate matter, and stranding on shore or sedimentation to the seafloor (National Research Council, 2003a).

Weathering decreases the concentration of oil and produces changes in its chemical composition, physical properties, and toxicity (Tarr et al., 2016). The more toxic, light aromatic and aliphatic hydrocarbons are lost rapidly by evaporation and dissolution from a slick on the water surface. For example, the light, paraffinic crude oil spilled during the *Deepwater Horizon* incident lost approximately 55 wt. % to evaporation during the first 3 to 5 days while floating on the sea surface (Daling et al., 2014). Several studies in the aftermath of the Macondo spill concluded that approximately 25% of mass below n-C_8 was lost during the oil's ascent to the surface, before an increased rate of weathering occurred once on the surface due to photo-oxidation (Lewan et al., 2014, Faksness et al., 2015, Stout and Payne, 2016, Stout et al., 2016).

Evaporated hydrocarbons are degraded rapidly by sunlight. Biodegradation of oil on the water surface and in the water column by marine bacteria is a dynamic process; microbes have been shown to first degrade the n-alkanes and then the light aromatics from the oil. Other petroleum components are biodegraded more slowly (Hazen et al., 2016). Photo-oxidation affects mainly the medium and high molecular weight PAHs in the oil on the water surface.

<u>Spill Response</u>. Anadarko's Regional OSRP was last approved on 14 August 2015. The June 2017 biennial updates were acknowledged by BSEE 12 July 12; 5 October 5 2017 updates were acknowledged by BSEE on 2 November 2017. Per BSEE, the OSRP is in compliance with 30 CFR 254.30(a). The OSRP provides a detailed plan that enables Anadarko to respond rapidly and effectively manage response efforts for oil spills that may result from drilling and production operations. The OSRP contains detailed information on "Quick Response" procedures, including:

- responsibilities of all Anadarko and contract personnel to report any observed discharge from known or unknown sources;
- procedures to locate and determine the size of a discharge; and
- contact information for alerting the spill management team, complete with names, phone numbers, and locations.

In the event of a large oil spill up to and including a WCD, Anadarko has access to surface and subsea response/containment capabilities that could be implemented through various organizations under contract. Anadarko's primary spill response equipment provider is Clean Gulf Associates (CGA).

CGA has several skimming vessels capable of operating in shallow waters, nearshore areas, and offshore areas. These vessels have oleophilic brush pack skimming systems operating in troughs built into the hulls; below-deck storage; and marine electronics packages including marine, aircraft, and company-frequency radios, radar, moving map plotters, GPS, satellite phones, and depth finders. CGA also offers Fast Response Systems staged throughout the Gulf of Mexico available for offshore use.

The CGA high-volume open sea skimmer (HOSS) barge consists of a skimming system built into an oil recovery barge. There are four 1,000-bbl recovered oil storage tanks built into the hull where oil can be separated and offloaded. Skimming operations are conducted from the control room overlooking the skimmer deck. The estimated daily recovery capacity for the HOSS barge is approximately 43,000 bbl of surface oil.

CGA is currently adding to its equipment stockpile and has acquired Koseq skimming arms and Aqua Guard skimmers. In addition, an x-band radar/infrared tracking system is installed on the HOSS barge. Additional CGA equipment can be referenced online at http://www.cleangulfassoc.com/equipment.

Anadarko also has a contract with the Marine Spill Response Corporation (MSRC) for additional spill response equipment. MSRC has a dedicated fleet for the Atlantic/Gulf of Mexico region and additional available equipment staged throughout the U.S. MSRC equipment staged throughout the Gulf of Mexico includes oil spill response vessels, ast response vessels, oil spill response barges, platform supply vessels, and shallow water barges. Various equipment is outfitted with x-band radar and infrared technology for detecting surface oil.

MSRC expanded its resources and capability in the Gulf of Mexico with particular focus on deep water, known as "Deep Blue." Additional MSRC capabilities and a complete equipment listing are available online at http://www.msrc.org/.

Anadarko is a member of the Marine Well Containment Company (MWCC). In the event of an incident, MWCC can provide a 15,000-psi single ram capping stack and dispersant injection capability. MWCC can install and operate the interim containment system, including subsea flowlines, manifolds, and risers. The interim system is engineered to be used in depths up to 10,000 ft (3,048 m) and has the capacity to contain 60,000 bbl of liquid per day (and 120 million standard cubic feet per day of gas) with potential for expansion.

Additionally, MWCC offers its members access to equipment, instruments, and supplies for marine environmental sampling and monitoring in the event of an oil spill in the Gulf of Mexico. Members have access to a mobile Laboratory Container, Operations Container, and Launch and Recovery System (LARS) that enable water sampling and monitoring to water depths of 9,843 ft (3,000 m). The two 8 ft × 20 ft (2.4 m × 6.1 m) containers that have been certified for offshore use by Det Norske Veritas and the American Bureau of Shipping. The LARS is a combined winch, A-frame, and 9,843 ft (3,000 m) long cable, customized for the instruments in the containers.

The containers are designed to enable rapid mobilization of required equipment to an incident site, including redundant systems to avoid downtime and supplies for sample handling and storage. Once deployed on a suitable vessel, the mobile containers then act as work spaces for scientists and operations personnel.

See **DOCD Section I** for a detailed description of Anadarko's site-specific spill response measures for the plan.

B. Affected Environment

The lease area is approximately 66 miles (106 km) from the nearest shoreline (Louisiana), 135 miles (217 km) from the onshore support base at Port Fourchon, Louisiana, and 168 miles (270 km) from the helicopter base at Houma, Louisiana (**Figure 1**). The water depth at the location of the proposed activities is approximately 3,561 ft (1,085 m) (**Figure 2**).

The site clearance letter for the wellsite where the proposed activities will occur noted one well, one umbilical, and two pipelines within 2,000 ft (610 m) of the location of the proposed activities (Geoscience Earth & Marine Services Inc., 2014).

The location of the wellsite where the proposed activities will occcur is free of constraining seafloor conditions and is relatively smooth and featureless. No high-density deepwater benthic or chemosynthetic communities or archaeological avoidance zones were noted within 2,000 ft (610 m) of the proposed project location (Geoscience Earth & Marine Services Inc., 2014).

A detailed description of the regionally affected environment, including meteorology, oceanography, geology, air and water quality, benthic communities, threatened and endangered species, biologically sensitive resources, archaeological resources, socioeconomic conditions, and other marine uses is provided by BOEM (2012a, 2013a, 2014a, 2015, 2016b, 2017 a,b). These regional descriptions remain valid and are incorporated by reference. Brief descriptions of each potentially affected resource, including site-specific or new information if available, are presented in **Section C**.

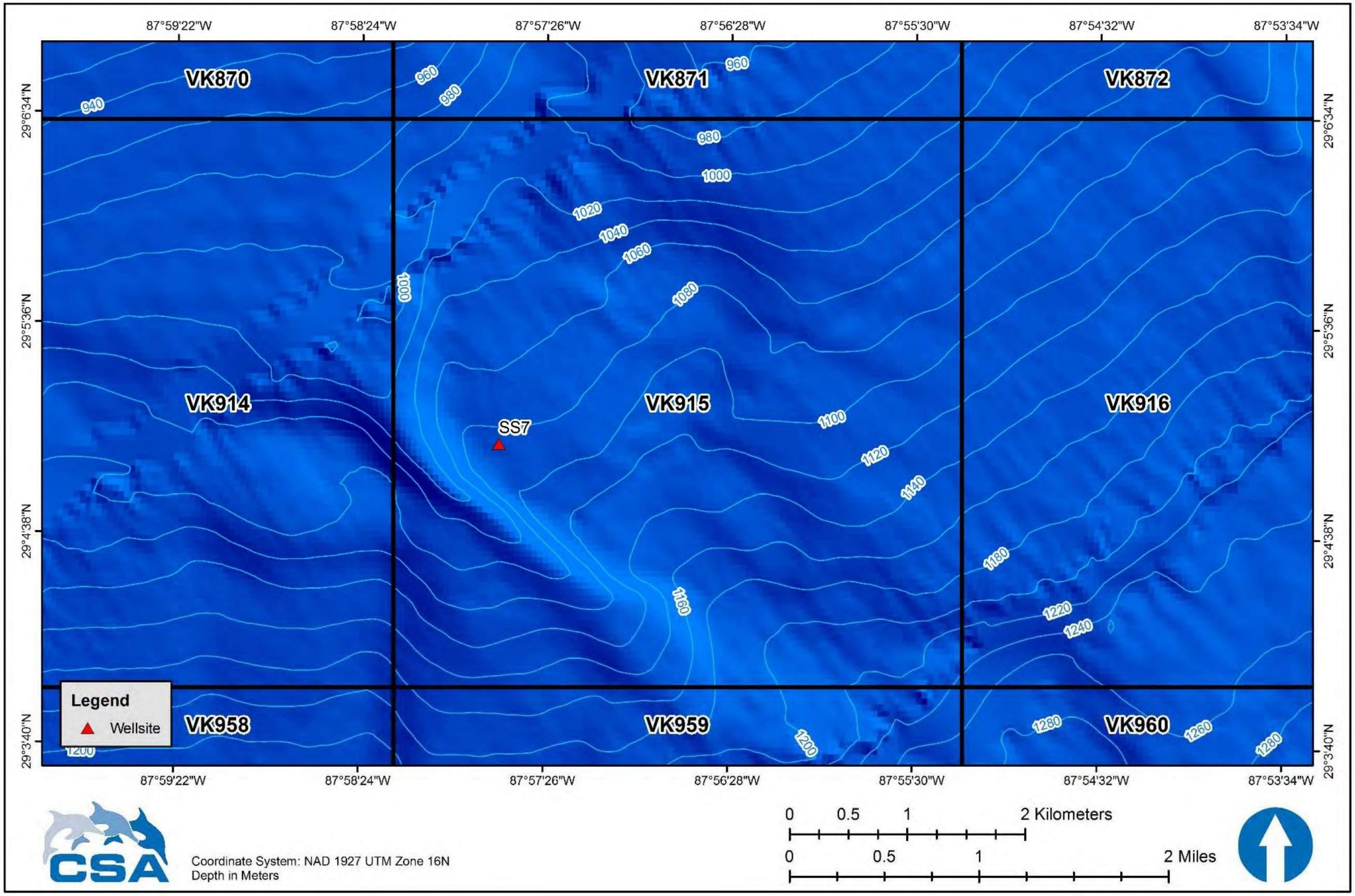

Figure 2. Bathymetric profile of the lease area showing the surface hole location of the wellsite where the proposed installation activities will occur in Viosca Knoll Block 915.

C. Impact Analysis

This section analyzes the potential direct and indirect impacts of routine activities and accidents. Impacts have been analyzed extensively in lease sale EISs for the Western and Central Gulf of Mexico Planning Areas (BOEM, 2012a, 2013b, 2014a, 2015, 2017 a,b). The information in these documents is incorporated by reference. Potential site-specific issues are addressed in this section. The following sections are organized by the Environmental Resources identified in **Table 2**, and address each potential IPF. Potential site-specific issues are addressed in this section.

C.1 Physical/Chemical Environment

C.1.1 Air Quality

There are no site-specific air quality data for the project area due to the distance from shore. However, because of the distance from shore-based pollution sources and the lack of sources of pollutants offshore, air quality at the wellsites is expected to be good. The attainment status of federal OCS waters is unclassified because there is no provision in the Clean Air Act for classification of areas outside state waters (BOEM, 2012a).

In general, the ambient air quality of coastal counties along the Gulf of Mexico is relatively good (BOEM, 2012a). As of December 2017, Mississippi, Alabama, and Florida Panhandle coastal counties are in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants. St. Bernard Parish in Louisiana is a nonattainment area for sulfur dioxide based on the 2010 standard. Houston-Galveston-Brazoria in Texas is a nonattainment area for 8-hr ozone based on the 1997 and 2008 standards, and one coastal metropolitan area in Florida (Tampa) is a nonattainment area for lead based on the 2008 standard (USEPA, 2017).

As noted earlier, based on calculations made pursuant to applicable regulations, emissions from installation activities are not expected to be significant because they are below exemption levels. Therefore, the only potential effects to air quality would be from air pollutant emissions associated with routine operations, and accidental spills (a small diesel fuel spill or a large oil spill). These IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Air Pollutant Emissions

Offshore air pollutant emissions are the only routine IPF likely to affect air quality. Offshore air pollutant emissions will result from construction vessel, helicopter, and support vessel operations. These emissions occur mainly from combustion or burning of diesel fuel and Jet-A aircraft fuel. The combustion of fuels occurs primarily in diesel-powered generators, pumps, or motors as well as from lighter fuel motors. Primary air pollutants typically associated with OCS activities are suspended PM, SO_x, NO_x, VOCs, and CO. As noted by BOEM (2017b), air pollutant emissions from routine activities are projected to have minimal impacts to onshore air quality because of the prevailing atmospheric conditions, anticipated emission rates, anticipated heights of emission sources, and the distance from shore of the proposed activities and associated pollutant concentrations. The Air Quality Emissions Report (**DOCD Section H**) prepared in accordance with BOEM requirements shows that the projected emissions are below exemption levels. Given the levels of expected emissions and the distance of the project from shore, emissions from the proposed activities described in this DOCD are not likely to contribute to violations of any NAAQS on shore. Therefore, according to 30 CFR 550.303, the emissions will not significantly affect the air quality of the onshore area for any of the criteria pollutants.

Greenhouse gas emissions contribute to climate change, with important impacts on temperature, rainfall, frequency of severe weather, ocean acidification, and sea level rise (Intergovernmental Panel on Climate Change, 2014). Greenhouse gas emissions from the proposed project represent a negligible contribution to the total greenhouse gas emissions from reasonably foreseeable activities in the Gulf of Mexico area and would not significantly alter or exceed any climate change impacts evaluated in the Programmatic EIS (BOEM, 2016a). Carbon dioxide (CO_2) and methane (CH_4) emissions from the project would constitute a small incremental contribution to greenhouse gas emissions from all OCS activities. According to Programmatic and OCS lease sale EISs (BOEM, 2012a, 2016a), estimated CO_2 emissions from OCS oil and gas sources represent 0.4% of the U.S. total. Greenhouse gas emissions from the proposed project represent a negligible contribution to the total greenhouse gas emissions from reasonably foreseeable activities in the Gulf of Mexico area and would not significantly alter any climate change impacts evaluated in the Programmatic EIS (BOEM, 2016a).

The Breton Wilderness Area, which is part of the Breton National Wildlife Refuge (NWR), is designated under the Clean Air Act as a Prevention of Significant Deterioration Class I air quality area. BOEM is required to notify the National Park Service and U.S. Fish and Wildlife Service (USFWS) if emissions from proposed projects may affect the Breton Class I area. Additional review and mitigation measures may be required for sources that exceed emission limits agreed upon by the administering agencies within 186 miles (300 km) of the Breton Class I area (National Park Service, 2010). The lease area is approximately 70 miles (113 km) from the Breton Wilderness Area. Based on Anadarko's Air Quality Emissions report (**DOCD Section H**), no significant impacts on coastal air quality are expected, including in the Breton Wilderness Area. Anadarko will comply with all BOEM requirements regarding air emissions.

Impacts of a Small Diesel Fuel Spill

Potential impacts of a small diesel spill on air quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017 a,b). The probability of a small spill occurring would be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Anadarko's Regional OSRP could reduce the potential impacts. **DOCD Section I** includes a detailed discussion of the spill response measures that would be employed. Given the open ocean location of the lease area, the extent and duration of air quality impacts from a small spill would not be significant.

A small diesel fuel spill would affect air quality near the spill site by introducing VOCs into the atmosphere through evaporation. The ADIOS2 model (**Section A.9.1**) indicates that more than 90% of a small diesel spill would evaporate or disperse within 24 hours. The sea surface area covered with small diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions.

A small diesel fuel spill would not affect coastal air quality because the spill would not be expected to make landfall or reach coastal waters prior to natural dispersion (**Section A.9.1**).

Impacts of a Large Oil Spill

Potential impacts of a large oil spill on air quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017 a,b).

A large oil spill could affect air quality by introducing VOCs into the atmosphere through evaporation from the slick. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. Real-time wind and current data from the project area would be available at the time of a spill and would be used to assess the fate and effects of VOCs released. Additional air quality impacts could occur if response measures included *in situ* burning of the floating oil. Burning would generate a plume of black smoke and result in emissions of NO_x, SO_x, CO, and PM as well as greenhouse gases. However, *in situ* burning would occur as a response measure only if authorized by the USEPA.

Based on the 30-day OSRA modeling (**Table 3**), Plaquemines Parish in Louisiana is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Alabama, or Mississippi shorelines may be affected within 10 days, and shorelines in Florida could be affected within 30 days. Based on the 60-day OSRA modeling estimates (**Table 4**), the potential shoreline contacts range from Matagorda County, Texas, to Levy County, Florida. However, due to the lease area's distance from the nearest shoreline, most air quality impacts are likely to occur in offshore waters, and substantial impacts to onshore air quality are not expected.

C.1.2 Water Quality

There are no site-specific baseline water quality data for the lease area. Due to the lease location in deep, offshore waters, water quality is expected to be good, with low levels of contaminants. Deepwater areas in the northern Gulf of Mexico are relatively homogeneous with respect to temperature, salinity, and oxygen (BOEM, 2017a). Kennicutt (2000) noted that the deepwater region has little evidence of contaminants in the dissolved or particulate phases of the water column. However, there are localized occurrences of natural seepage of oil, gas, and brines in near-surface sediments and up through the water column. Based on the site clearance letters for proposed wellsites, no natural seeps were noted in the vicinity of the wellsite where the proposed activities will occur (Geoscience Earth & Marine Services Inc., 2014).

IPFs that could affect water quality are effluent discharges associated with routine operations and two types of accidents (a small diesel fuel spill and a large oil spill). These IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Effluent Discharges

Treated sanitary and domestic wastes, including those from support vessels, may have a slight transient effect on water quality in the immediate vicinity of these discharges. Treated sanitary and domestic wastes may have elevated levels of nutrients, organic matter, and chlorine but should dilute rapidly to undetectable levels within tens to hundreds of meters from the source. All NPDES permit limitations and requirements, as well as USCG regulations (as applicable), will be met; therefore, little or no impact on water quality from the overboard release of treated sanitary and domestic wastes is anticipated.

Deck drainage includes all effluents resulting from rain, deck washings, and runoff from curbs, gutters, and drains, including drip pans in work areas. Rainwater that falls on uncontaminated areas of the construction vessel will flow overboard without treatment. However, rainwater that falls on the other areas such as chemical storage areas and places where equipment is exposed will be collected and oil and water separated prior to discharge to meet NPDES permit requirements. Based on adherence to permit limits and applicable regulations, little or no impact on water quality from deck drainage is anticipated.

Other discharges in accordance with the NPDES permit, such as non-pollutant completion fluids, subsea production control fluid, uncontaminated wash, ballast and bilge water, and non-contact cooling and fire water are expected to dilute rapidly, resulting in little or no impact on water quality.

Impacts of a Small Diesel Fuel Spill

Potential impacts of a small diesel spill on water quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017 a,b). The probability of a small spill occuring would be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfers. In the unlikely event of a spill, implementation of Anadarko's Regional OSRP will help mitigate and thus reduce potential impacts. **DOCD Section I** provides detail on spill response measures in addition to the summary information provided in the EIA.

The water-soluble fractions of diesel are dominated by two- and three-ringed PAHs, which are moderately volatile (National Research Council, 2003a). The molecular weight of diesel oil constituents are light to intermediate and can be readily degraded by aerobic microbial oxidation. Diesel oil is much lighter than water (specific gravity is between 0.83 and 0.88, compared to 1.03 for seawater). When spilled on water, diesel oil spreads very quickly to a thin film of rainbow and silver sheens, except for marine diesel, which may form a thicker film of dull or dark colors. However, because diesel oil has a very low viscosity, it is readily dispersed into the water column when winds reach 5 to 7 knots or with breaking waves (NOAA, 2017a). It is possible for the diesel oil that is dispersed by wave action to form droplets that are small enough be kept in suspension and moved by the currents.

Diesel dispersed in the water column can adhere to suspended sediments, but this generally occurs only in coastal areas with high suspended solid loads (National Research Council, 2003a) and would not be expected to occur to any appreciable degree in offshore waters of the Gulf of Mexico.

The extent and persistence of water quality impacts from a small diesel fuel spill would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. It is estimated that more than 90% of a small diesel spill would evaporate or disperse within 24 hours (**Section A.9.1**). The sea surface area covered with a very thin layer of diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions. In addition to removal by evaporation, constiuents of diesel oil are readily and completely degraded by naturally occurring microbes (NOAA, 2006). Given the open ocean location of the lease area, the extent and duration of water quality impacts from a small spill are not expected to be significant.

A small diesel fuel spill would not substantially affect coastal water quality because the spill would not be expected to make landfall or reach coastal waters due to both response efforts that would be undertaken as well as natural attenuation (**Section A.9.1**).

Impacts of a Large Oil Spill

Potential impacts of a large oil spill on water quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017 a,b). Additional air quality impacts could occur if response measures included *in situ* burning of the floating oil. Burning would generate a plume of black smoke and result in emissions of NO_x, SO_x, CO, and PM as well as greenhouse gases. However, *in situ* burning would occur only if authorized by the USEPA. Most of the spilled oil would be expected to form a slick at the surface, though small droplets in the water may adhere to suspended sediments and be removed from the water column (Operational Science Advisory Team, 2010). Information from the Macondo spill indicates that plumes of submerged oil droplets can be produced when subsea dispersants are applied at the wellhead (Camilli et al., 2010, Hazen et al., 2010, NOAA, 2011a,b,c). Subsea dispersants would be applied only after approval from the USEPA.

Analyses of the full set of samples associated with the Macondo spill have confirmed that the application of subsurface dispersants resulted in subsurface hydrocarbon plumes (Spier et al., 2013). A report by Kujawinski et al. (2011) indicates that chemical components of subsea dispersants used during the Macondo spill persisted for up to 2 months and were detected up to 186 miles (300 km) from the wellsite in water depths of 3,280 to 3,937 ft (1,000 to 1,200 m). Although dispersants were detected by laboratory analysis in 353 of the 4,114 water samples, concentrations were significantly below the chronic screening level for dispersants (BOEM, 2012a).

Hazen et al. (2010) studied the impacts and fate of deepwater oil. Initial studies suggested that the potential exists for rapid intrinsic bioremediation (bacterial degradation) of subsea dispersed oil in the water column by deep-sea indigenous microbial activity without significant oxygen depletion (Hazen et al., 2010), although other studies showed that oil bioremediation caused oxygen drawdown in deep waters (Kessler et al., 2011, Dubinsky et al., 2013). Additional studies investigated the effects of deepwater dissolved hydrocarbon gases (e.g., methane, propane, and ethane) and the microbial response to a deepwater oil spill. Results suggest deepwater dissolved hydrocarbon gases may promote rapid hydrocarbon respiration by low-diversity bacterial blooms, thus priming indigenous bacterial populations for rapid hydrocarbon degradation of subsea oil (Kessler et al., 2011, Du and Kessler, 2012, Valentine et al., 2014). A 2017 study identified water temperature, taxonomic composition of the initial bacterial community, and dissolved nutrient levels as factors that may regulate oil degradation rates by deep-sea indigenous microbes (Liu et al., 2017).

The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. Real-time wind and current data from the project area would be available at the time of a spill and would be used to assess the fate and effects of VOCs released. Weathering processes that affect spilled oil on the sea include adsorption (sedimentation), biodegradation, dispersion, dissolution, emulsification, evaporation, and photo oxidation. Most crude oil blends will emulsify quickly when spilled, creating a stable mousse that presents a more persistent cleanup and removal challenge (NOAA, 2017b).

Because of the lease area's distance from the nearest shoreline, it is expected that most water quality impacts would occur in offshore waters. Depending on the spill trajectory and the effectiveness of spill response measures, coastal water quality could be affected. Based on the 30-day OSRA modeling estimates (**Table 3**), nearshore waters and embayments of Plaquemines Parish, Louisiana are the coastal areas with the most potential for water quality to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Mississippi, and Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. However, the 60-day OSRA model estimates potential shoreline contacts ranging from Matagorda County, Texas, to Levy County, Florida (**Table 4**).

C.2 Seafloor Habitats and Biota

According to BOEM (2016a), existing information for the deepwater Gulf of Mexico indicates that the seafloor is composed primarily of soft sediments; exposed hard substrate habitats and associated biological communities are rare. The water depth at the location of the proposed activities is approximately 3,561 ft (1,085 m). Based on the site clearance letter for wellsite where the installation activities will occur, no high-density deepwater benthic or chemosynthetic communities are located within 2,000 ft (610 m) of the proposed activity location (Geoscience Earth & Marine Services Inc., 2014).

C.2.1 Soft Bottom Benthic Communities

There are no site-specific benthic community data from the lease area. However, data from the Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology Study (Wei, 2006, Rowe and Kennicutt, 2009, Wei et al., 2010, Carvalho et al., 2013) can be used to describe typical baseline benthic communities that occur at similar water depths elsewhere in the region. **Table 5** summarizes data collected at nearby stations in water depths similar to the proposed activities area.

Table 5. Baseline benthic community data from stations near the lease area and in similar water depths sampled during the Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology Study. Adapted from: Wei (2006) and Rowe and Kennicutt (2009).

Station	Faunal Zone	Water Depth (m)	Abundance		
			Meiofauna (individuals m^{-2})	Macroinfauna (individuals m^{-2})	Megafauna (individuals ha^{-1})
S36	2E	1,839	799,963	4,481	359
HiPro	1	1,565	343,118	5,076	--

Meiofaunal and megafaunal abundances from Rowe and Kennicutt (2009); macroinfaunal abundance from Wei (2006). -- = Data not available.

Densities of meiofauna (animals passing through a 0.5-mm sieve but retained on a 0.062-mm sieve) at sampling stations in the vicinity of the lease area typically range from approximately 340,000 to 800,000 individuals m^{-2} (Rowe and Kennicutt, 2009). Nematodes, nauplii (crustacean larvae), and harpacticoid copepods were the three dominant meiofaunal groups, accounting for approximately 90% of total abundance.

The benthic macroinfauna is characterized by small mean individual sizes and low densities, both of which reflect the intrinsically low primary production in surface waters of the Gulf of Mexico continental slope (Wei, 2006). Based on an equation presented by Wei (2006) in which densities decrease exponentially with water depth, the macroinfaunal density at a water depth of 3,561 ft (1,085 m) is expected to be approximately 3,041 individuals m^{-2}; however, actual densities at the proposed project location are unknown (**Table 5**).

Polychaetes typically are the most abundant macroinfaunal group on the northern Gulf of Mexico continental slope, followed by amphipods, tanaids, bivalves, and isopods. Carvalho et al. (2013) found polychaete abundance to be higher in the central region compared to the eastern and western regions. Wei (2006) recognized four depth-dependent faunal zones (1 through 4), two of which are divided horizontally. The lease area is in Zone 1, which includes stations on the upper Texas-Louisiana Slope, the west flank of the upper Mississippi Fan, the head of Mississippi Canyon, and the upper West Florida Terrace. The most abundant species in this zone were the polychaetes *Litocorsa antennata*, *Prionospio cirrifera*, and *Aricidea suecica*; the amphipod *Ampelisca mississippina*; and the bivalve *Heterodonta* sp. A.

Megafaunal density from a nearby station was 359 individuals ha^{-1} (**Table 5**). Common megafauna included motile groups such as decapods, ophiuroids, holothurians, and demersal fishes, as well as sessile groups such as sponges and anemones.

Bacteria also are an important component in terms of biomass and cycling of organic carbon (Cruz-Kaegi, 1998). For example, in deep-sea sediments, Main et al. (2015) observed that microbial oxygen consumption rates increased and bacterial biomass decreased with hydrocarbon contamination. Bacterial biomass at the depth range of the lease area typically is 1 to 2 g C m^{-2} in the top 6 in. (15 cm) of sediments (Rowe and Kennicutt, 2009).

The only IPFs that may affect benthic communities from this project are the physical disturbance to the seafloor where the subsea wellhead will be installed, from seafloor effluent discharges, and potential effects from a large oil spill resulting from a well blowout at the seafloor. Effluent discharges at the surface and a small diesel fuel spill would not affect benthic communities because both would float and dissipate on the sea surface. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Physical Disturbance to the Seafloor

In water depths such as those encountered in the lease area, the areal extent of seafloor impacts will be small compared to the lease area itself. Subsea wellhead and pipeline installation will disturb only the seafloor in the immediate vicinity of the location of placement on the seafloor.

Soft bottom communities are ubiquitous along the northern Gulf of Mexico continental slope (Gallaway, 1988, Gallaway et al., 2003, Rowe and Kennicutt, 2009), and impacts from the physical disturbance of the seafloor during this project will be localized and likely will have no significant impact on soft bottom benthic communities in the region due to distance of the wellsites from these communities.

Impacts of a Large Oil Spill

The most likely effects on benthic communities of a subsea blowout of oil would be within a few hundred meters of the wellsite. BOEM (2012b) estimated that a severe subsurface blowout could resuspend and disperse sediments within a 984 ft (300 m) radius. While coarse sediments (sands) would probably settle at a rapid rate within 1,312 ft (400 m) of the blowout site, fine sediments (silts and clays) could be resuspended for more than 30 days and dispersed over a much wider area. Based on previous studies, surface sediments at the project area are assumed to largely be silt and clay (Rowe and Kennicutt, 2009).

While impacts on benthic communities from large oil spills are anticipated to be confined to the immediate vicinity of the wellhead, depending on the specific circumstances of the incident, additional benthic community impacts could extend beyond the immediate vicinity of the wellhead (BOEM, 2016b). During the Macondo spill, the use of subsea dispersants at the wellhead caused the formation of subsurface plumes (NOAA, 2011c). The subsurface plumes were reported in water depths of approximately 3,600 ft (1,100 m), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface oil plumes apparently resulted from the use of subsea dispersants at the wellhead (NOAA, 2011c, Spier et al., 2013). Montagna et al. (2013) mapped the benthic footprint of the Macondo spill and estimated that the most severe impacts to soft bottom benthic communities (e.g., reduction of faunal abundance and diversity) extended 4.8 miles (3 km) from the wellhead in all directions, covering an area of approximately 9.3 miles^2 (24 km^2). Moderate impacts were observed up to 10.6 miles (17 km) to the southwest and 5.3 miles (8.5 km) to the northeast of the wellhead, covering an area of 57 miles^2 (148 km^2). NOAA (2016b) documented a footprint of over 772 miles^2 (2,000 km^2) of impacts to benthic habitats surrounding the Macondo spill site. The analysis also identified a larger area of approximately 3,552 miles^2 (9,200 km^2) of potential exposure and uncertain impacts to benthic communities (NOAA, 2016b).

While the behavior and impacts of subsurface oil plumes are not well known, the Macondo findings indicate that benthic impacts could extend beyond the immediate vicinity of the wellsite, depending on the extent, trajectory, and persistence of the plume. Baguley et al. (2015) studied the meiofaunal benthic community response to the Macondo spill and noted that while nematode abundance increased with proximity to the Macondo wellhead, copepod abundance, relative species abundance, and diversity decreased. Baguley et al. (2015) hypothesized that the increase in nematode abundance with the proximity to the spill location could potentially represent a balance between organic enrichment and toxicity.

Oil contact could result in smothering or toxicity to benthic organisms. Any affected area would be recolonized by benthic organisms over a period of months to years (National Research Council, 1983).

C.2.2 High-Density Deepwater Benthic Communities

As defined by NTL 2009-G40, high-density deepwater benthic communities are features or areas that could support chemosynthetic communities, deepwater corals, and other associated hard bottom communities. Chemosynthetic communities were discovered in the central Gulf of Mexico in 1984 and have been studied extensively (MacDonald, 2002). Deepwater coral communities are also known from numerous locations in the Gulf of Mexico (Brooke and Schroeder, 2007, CSA International, 2007, Brooks et al., 2012). These communities occur almost exclusively on exposed authigenic carbonate rock created by a biogeochemical (microbial) process.

In water depths such as those encountered in the project area, the DP construction vessel will disturb the seafloor only in the immediate vicinity of the installation activities. Based on the site clearance letter (Geoscience Earth & Marine Services Inc., 2014), there is no evidence of the presence of high-density deepwater benthic or chemosynthetic communities within 2,000 ft (610 m) of the project area. The nearest known high-density deepwater benthic community site is located in Viosca Knoll Block 826, approximately 5 miles (8 km) northwest of the project area (MacDonald et al., 1995, U.S. Geological Survey, 2011, BOEM, nd).

The only IPF identified for this project that could affect high-density deepwater benthic communities is a large oil spill from a well blowout at the seafloor. A small diesel fuel spill would not affect benthic communities because the diesel fuel would float and dissipate on the sea surface. Physical disturbance and effluent discharge are not considered to be IPFs for deepwater benthic communities, because these communities are not known to be present within the area around the location of installation activities.

Impacts of a Large Oil Spill

A large oil spill caused by a seafloor blowout could cause direct physical alteration of the seafloor (e.g., formation of a caldera) within approximately 984 ft (300 m) of the wellhead (BOEM, 2012a). Based on the site clearance letters for the wellsite where the proposed activites will occur (Geoscience Earth & Marine Services Inc., 2014), there is no evidence of the presence of high-density deepwater benthic or chemosynthetic communities within 2,000 ft (610 m) of the installation location. Therefore, this type of impact is expected to be avoided.

Additional benthic community impacts could extend beyond the immediate vicinity of the blowout location, depending on the specific circumstances (BOEM, 2016b). During the Macondo spill, subsurface plumes were reported at a water depth of approximately 3,600 ft (1,100 m), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface plumes apparently resulted from the use of subsea dispersants at the wellhead (NOAA, 2011c). While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could have the potential to contact high-density deepwater benthic communities beyond the 984 ft (300 m) radius estimated by BOEM (2012a), depending on its extent, trajectory, and persistence (Spier et al., 2013). Oil plumes that contact sensitive benthic communities before degrading could potentially impact the resource (BOEM, 2017a). Potential impacts on sensitive resources would be an integral part of the decision and approval process for the use of dispersants, and such approval would be obtained from the USEPA prior to the use of dispersants.

Potential impacts of oil on high-density deepwater benthic communities are discussed in recent EISs (BOEM, 2012a, 2015, 2016b, 2017 a,b). Although chemosynthetic communities live among hydrocarbon seeps, natural seepage is very consistent and occurs at low rates compared to the potential rates of oil release from a blowout. In addition, seep organisms also require unrestricted access to oxygenated water at the same time as exposure to hydrocarbon energy sources (MacDonald, 2002). Oil droplets or oiled sediment particles could come into contact with chemosynthetic organisms or deepwater corals. As discussed by BOEM (2012a, 2017 a,b), impacts could include loss of habitat, biodiversity, and live coral coverage; destruction of hard substrate; change in sediment characteristics; and reduction or loss of one or more commercial and recreational fishery habitats. Sublethal effects could be long-lasting and affect the resilience of coral colonies to natural disturbances (e.g., elevated water temperature and diseases) (BOEM, 2012a, 2015, 2016b, 2017 a,b). Based on information learned from the Macondo spill, a few patches of habitats may be affected by a large oil spill, but the Gulf-wide ecosystem of live bottom communities would not be expected to suffer significant effects (BOEM, 2016b).

The potential for a large spill to affect deepwater corals can also be inferred based on the impacts of the Macondo spill during an October 2010 survey of deepwater coral habitats near the Macondo spill site (BOEMRE, 2010). Government and academic researchers were working at a site 4,600 ft (1,400 m) deep and approximately 7 miles (11 km) southwest of the Macondo wellhead when they observed dead and dying corals with sloughing tissue and discoloration. Much of the soft coral observed in an area measuring approximately 50 ft × 130 ft (15 m × 40 m) was covered by what appeared to be a brown flocculent substance. Of 40 large corals, 90% were heavily affected, showing dead or dying parts and discoloration. Another site 1,312 ft (400 m) farther away had a colony of stony corals similarly affected and partially covered with a similar brown substance. Based on hopanoid petroleum biomarkers from the brown flocculent substance, researchers concluded that the colony contained oil from the Macondo spill. The injured and dead corals were in an area where a subsea plume of oil had been documented during the spill in June 2010. Corals elsewhere in the Gulf of Mexico outside the area affected by the plume did not appear to be experiencing higher mortality. The research team concluded that the observed coral injuries likely resulted from exposure to the subsurface oil plume (White et al., 2012). Apparent recovery of some affected areas by March 2012 correlated negatively with the proportion of the coral covered with flocculent in late 2010 (Hsing et al., 2013). Fisher et al. (2014b) reported two additional coral areas affected by the Macondo spill, one 4 miles (6 km) south of the Macondo wellsite and the other 14 miles (22 km) to the southeast; the authors also hypothesized that other hard bottom sites probably were exposed to deepwater plumes, sinking oil residues from surface burning, or oil and dispersant contained in marine snow. In addition to direct impacts on corals and other sessile epifauna, the spill also affected macroinfauna associated with these hard bottom communities (Fisher et al., 2014a).

C.2.3 Designated Topographic Features

The lease area is not within or near a designated topographic feature or a no-activity zone as identified in NTL 2009-G39. The nearest designated Topographic Feature Stipulation Block is located approximately 96 miles (154 km) west-southwest of the lease area. There are no IPFs associated with routine operations that could cause impacts to designated topographic features.

Due to the distance from the lease area, it is unlikely that designated topographic features would be affected by accidental spills. A small diesel fuel spill would float and dissipate on the surface and would not reach these seafloor features. In the event of an oil spill from a well blowout, a surface slick would not contact these seafloor features. If a subsurface plume were to occur, impacts on these features would be unlikely due to the distance and the difference in water depth. Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and typically would not be expected to carry a plume up onto the continental shelf edge. This assumption is consistent with the deposition patterns inferred by Valentine et al. (2014) for the subsurface plume from the Macondo spill. Felder et al. (2014) hypothesized that the Macondo spill may have affected two topographic features located 96 miles (155 km) and 168 miles (270 km) west of the Macondo site (Sackett Bank and Ewing Bank, respectively), but there was no definitive evidence of Macondo oil from either bank. Although a large oil spill could theoretically result in oil contacting topographic features, it is expected that most of the oil would rise to the surface and that the most heavily oiled sediments would likely be deposited before reaching these features (BOEM, 2012a). In the unlikely event that oil does contact topographic features, any contact with spilled oil would likely cause sublethal effects to benthic organisms because the distance between the spill source and topographic features would prevent concentrated oil from contacting any designated feature.

C.2.4 Pinnacle Trend Area Live Bottoms

The lease area is not covered by the Live Bottom (Pinnacle Trend) Stipulation. As defined by NTL 2009-G39, the nearest Pinnacle Stipulation Block is located approximately 12 miles (19 km) north of the lease area. There are no IPFs associated with routine operations that could cause impacts to pinnacle trend area live bottoms due to the distance from the lease area.

Due to their distance from the lease area, it is unlikely that pinnacle trend live bottom areas would be affected by an accidental spill. A small diesel fuel spill would float on the surface and would not reach these seafloor features. In the event of an oil spill from a well blowout, a surface slick would be unlikely to contact these seafloor features. If a subsurface plume were to occur, impacts on these features would be unlikely due to the difference in water depth. Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and would not be expected to carry a plume up onto the continental shelf edge. This assumption is consistent with the deposition patterns inferred by Valentine et al. (2014) for the subsurface plume from the Macondo spill. Although there are mechanisms that could result in oil contacting these features, it is expected that most of the oil would rise to the surface and thereby reducing potential impacts to these features.

C.2.5 Eastern Gulf Live Bottoms

The lease area is not covered by the Live Bottom (Low-Relief) Stipulation, which pertains to seagrass communities and low-relief hard bottom reefs within the Eastern Gulf of Mexico Planning Area blocks in water depths of 328 ft (100 m) or less and portions of Pensacola and Destin Dome Area blocks in the Central Gulf of Mexico Planning Area. The nearest block covered by the Live Bottom Stipulation, as defined by NTL 2009-G39, is located approximately 20 miles (32 km) north-northeast of the lease area. There are no IPFs associated with routine operations that could cause impacts to eastern Gulf live bottom areas due to the distance from the lease area.

Because of their distance from the lease area, it is unlikely that Eastern Gulf live bottom areas would be affected by an accidental spill. A small diesel fuel spill would float and dissipate on the surface and would not reach these seafloor features. In the event of an oil spill from a well blowout, a surface slick would not likely contact these seafloor features. If a subsurface plume were to occur, impacts on these features would be unlikely due the difference in water depth. Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and typically would not be expected to carry a plume up onto the continental shelf. This assumption is consistent with the deposition patterns inferred by Valentine et al. (2014) for the subsurface plume from the Macondo spill. Although there are mechanisms that could result in oil contacting these features, it is expected that most of the oil would rise to the surface thereby reducing potential impacts to benthic communities.

C.3 Threatened, Endangered, and Protected Species and Critical Habitat

This section discusses species listed as endangered or threatened under the Endangered Species Act (ESA). In addition, it includes all marine mammal species in the region, which are protected under the Marine Mammal Protection Act (MMPA).

Endangered or threatened species that may occur in the project area and along the northern Gulf Coast are listed in **Table 6**. The table also indicates the location of critical habitat (if designated in the Gulf of Mexico). Critical habitat is defined as (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation. The National Marine Fisheries Service (NMFS) has jurisdiction for ESA-listed marine mamamls (cetaceans), sea turtles in the marine environment, and fishes in the Gulf of Mexico. The USFWS has jurisdiction for ESA-listed birds, the West Indian manatee, and sea turtles on their nesting beaches.

Table 6. Federally listed endangered and threatened species that could potentially occur in the lease area and along the northern Gulf Coast.

Species	Scientific Name	Status	Potential Presence		Critical Habitat Designated in Gulf of Mexico
			Lease Area	Coastal	
Marine Mammals					
Sperm whale	*Physeter macrocephalus*	E	X	--	None
Bryde's whale	*Balaenoptera edeni*[a]	P	X	--	None
West Indian manatee	*Trichechus manatus*[b]	T	--	X	Florida (Peninsular)
Sea Turtles					
Loggerhead turtle	*Caretta caretta*	T,E[c]	X	X	Nesting beaches and nearshore reproductive habitat in Mississippi, Alabama, and Florida (Panhandle); *Sargassum* habitat including most of the central and western Gulf of Mexico
Green turtle	*Chelonia mydas*	T	X	X	None
Leatherback turtle	*Dermochelys coriacea*	E	X	X	None
Hawksbill turtle	*Eretmochelys imbricata*	E	X	X	None
Kemp's ridley turtle	*Lepidochelys kempii*	E	X	X	None
Birds					
Piping Plover	*Charadrius melodus*	T	--	X	Coastal Texas, Louisiana, Mississippi, Alabama, and Florida (Panhandle)
Whooping Crane	*Grus americana*	E	--	X	Coastal Texas (Aransas National Wildlife Refuge)
Fishes					
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	--	X	Coastal Louisiana, Mississippi, Alabama, and Florida (Panhandle)
Invertebrates					
Elkhorn coral	*Acropora palmata*	T	--	X	The Florida Keys and the Dry Tortugas
Lobed star coral	*Orbicella annularis*	T	--	X	None
Mountainous star coral	*Orbicella faveolata*	T	--	X	None
Boulder star coral	*Orbicella franksi*	T	--	X	None
Terrestrial Mammals					
Beach mice (subspecies: Alabama, Choctawhatchee, Perdido Key, St. Andrew)	*Peromyscus polionotus*	E	--	X	Alabama and Florida (Panhandle) beaches

E = endangered; P = proposed; T = threatened; X = potentially present; -- = not present.

[a] Gulf of Mexico Bryde's whales are protected by the Marine Mammal Protection Act. There is currently a proposed rule to list this stock as 'endangered' under the Endangered Species Act.

[b] There are two subspecies of West Indian manatee: the Florida manatee (*T. m. latirostris*), which ranges from the northern Gulf of Mexico to Virginia, and the Antillean manatee (*T. m. manatus*), which ranges from northern Mexico to eastern Brazil. Only the Florida manatee subspecies is likely to be found in the northern Gulf of Mexico.

[c] The loggerhead turtle is composed of nine distinct population segments (DPSs). The only DPS that may occur in the project area (Northwest Atlantic DPS) is listed as threatened (76 *FR* 58868; 22 September 2011).

In 2007, NMFS and the USFWS issued a Biological Opinion in response to ESA consultations with MMS for previous EISs (NMFS, 2007). Following the Macondo spill, on 30 July 2010, BOEM reinitiated ESA consultation with NMFS and the USFWS. Currently, BOEM, NMFS, and USFWS are in the process of collecting and awaiting additional information, which is being gathered as part of the Natural Resource Damage Assessment process in order to update the environmental baseline information as needed for this reinitiated Section 7 consultation. Consultation is ongoing at this time, and BOEM is acting as lead agency in the reinitiated consultation with BSEE involvement (BOEM, 2016b). BOEM and BSEE have developed an interim coordination and review process with NMFS and the USFWS for specific activities leading up to or resulting from upcoming lease sales. The purpose of this coordination is to ensure that NMFS and the USFWS have the opportunity to review post-lease exploration, development, and production activities prior to BOEM's approval to ensure that all approved plans and permits contain any necessary measures to avoid jeopardizing the existence of any ESA-listed species or precluding the implementation of any reasonable and prudent alternative measures. This interim coordination program remains in place while formal consultation and the development of a Biological Opinion are ongoing (BOEM, 2016b).

Coastal endangered or threatened species that may occur along the northern Gulf Coast include the West Indian manatee, Piping Plover, Whooping Crane, Gulf sturgeon, and four subspecies of beach mouse. Critical habitat has been designated for all of these species as indicated in **Table 6**, and is discussed for each species in individual sections. The Bald Eagle and Brown Pelican, which are no longer federally listed as endangered or threatened, are discussed in **Section C.4.2**.

The sperm whale and five species of sea turtles are the only endangered or threatened species likely to occur in or near the lease area. The listed sea turtles include the leatherback turtle, Kemp's ridley turtle, hawksbill turtle, loggerhead turtle, and green turtle (Pritchard, 1997). Effective 11 August 2014, NMFS has designated certain marine areas as critical habitat for the northwest Atlantic distinct population segment (DPS) of the loggerhead sea turtle (**Section C.3.4**). No critical habitat has been designated in the Gulf of Mexico for the leatherback turtle, Kemp's ridley turtle, hawksbill turtle, green turtle, or the sperm whale. Five endangered mysticetes (blue whale, fin whale, humpback whale, North Atlantic right whale, and sei whale) have been reported in the Gulf of Mexico, but are considered rare or extralimital (Würsig et al., 2000). These species are not included in the most recent NMFS stock assessment reports (Waring et al., 2016, Hayes et al., 2017) nor in the most recent BOEM multisale EIS (BOEM, 2017a); therefore, they are not considered further in the EIA.

Four threatened coral species are known from the northern Gulf of Mexico: elkhorn coral, lobed star coral, mountainous star coral, and boulder star coral. None of these species are expected to be present in the lease area (**Section C.3.9**).

There are no other endangered animals or plants in the Gulf of Mexico that are reasonably likely to be affected by either routine or accidental events. Other species occurring at certain locations in the Gulf of Mexico such as the smalltooth sawfish (*Pristis pectinata*) and Florida salt marsh vole (*Microtus pennsylvanicus dukecampbelli*) are remote from the lease area and highly unlikely to be affected.

C.3.1 Sperm Whale (Endangered)

The only endangered marine mammal likely to be present in or near the project area is the sperm whale (*Physeter macrocephalus*). Resident populations of sperm whales occur within the

Gulf of Mexico. A species description is presented in the recovery plan for this species (NMFS, 2010a). Gulf of Mexico sperm whales are classified as an endangered species and a "strategic stock" by NMFS (Waring et al., 2016). A "strategic stock" is defined by the MMPA as a marine mammal stock that meets the following criteria:

- The level of direct human-caused mortality exceeds the potential biological removal level;
- based on the best available scientific information, is in decline and is likely to be listed as a threatened species under the ESA within the foreseeable future; or
- is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA.

Current threats to sperm whale populations worldwide are discussed in a final recovery plan for the sperm whale (NMFS, 2010a). Threats are defined as "any factor that could represent an impediment to recovery," and include fisheries interactions, anthropogenic noise, vessel interactions, contaminants and pollutants, disease, injury from marine debris, research, predation and natural mortality, direct harvest, competition for resources, loss of prey base due to climate change and ecosystem change, and cable laying. In the Gulf of Mexico, impacts from many of these threats are identified as either low or unknown (BOEM, 2012a).

In 2013, NMFS conducted a status review to consider designating the Gulf of Mexico population of the sperm whale as a DPS under the ESA. The designation would list the Gulf of Mexico population as a separate endangered or threatened population that is "significant to the species and faces additional unique threats to its survival." On 13 November 2013, NMFS concluded that the designation of a Gulf of Mexico DPS for sperm whales was not warranted (78 *FR* 68032).

The distribution of sperm whales in the Gulf of Mexico is correlated with mesoscale physical features such as eddies associated with the Loop Current (Jochens et al., 2008). Sperm whale populations in the north-central Gulf of Mexico are present throughout the year (Davis et al., 2000a). Results of a multi-year tracking study show female sperm whales are typically concentrated along the upper continental slope between the 656- and 3,280-ft (200- and 1,000m) depth contours (Jochens et al., 2008). Male sperm whales were more variable in their movements and were documented in water depths greater than 9,843 ft (3,000 m). Generally, groups of sperm whales sighted in the Gulf of Mexico during the MMS-funded Sperm Whale Seismic Study consisted of mixed-sex groups comprising adult females with juveniles, and groups of bachelor males. Typical group size for mixed groups was 10 individuals (Jochens et al., 2008). A review of sighting reports from seismic mitigation surveys in the Gulf of Mexico conducted over a 6-year period found a mean group size for sperm whales of 2.5 individuals (Barkaszi et al., 2012). In these mitigation surveys, sperm whales were the most common cetacean encountered. The Sperm Whale Seismic Study results also showed that sperm whales transit through the vicinity of the lease area. Movements of satellite-tracked individuals suggest that this area of the continental slope is within the home range of the Gulf of Mexico population (within the 95% utilization distribution) (Jochens et al., 2008).

IPFs potentially affecting sperm whales include construction vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small diesel fuel spill and a large oil spill). Effluent discharges are likely to have negligible impacts on sperm whales due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of these marine mammals. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the potential for marine debris-related impacts on sperm whales. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Construction Vessel Presence, Noise, and Lights

Noise from routine installation activities has the potential to disturb sperm whales or mask the sounds whales would normally produce or hear. However, noise associated with subsea installation activities is relatively weak in intensity, and an individual animal's noise exposure would be transient. As discussed in **Section A.1**, sounds generated by an offshore vessel maximum broadband (10 Hz to 10 kHz) energy of about 190 dB re 1 µPa m (Hildebrand, 2005).

Southall et al. (2007) lists sperm whales in the same hearing group (i.e., mid-frequency cetaceans) as dolphins, toothed whales, beaked whales, and bottlenose whales (estimated hearing range from 150 Hz to 160 kHz). Therefore, vessel-related noise is likely to be heard by sperm whales. Generally, most of the acoustic energy produced by sperm whales is present at frequencies below 10 kHz, although diffuse energy up to and past 20 kHz is common, with source levels up to 236 dB re 1 µPa m (Møhl et al., 2003). Other studies indicate sperm whales' wideband clicks contain energy between 0.1 and 20 kHz (Weilgart and Whitehead, 1993, Goold and Jones, 1995). Most observations of behavioral responses of marine mammals to anthropogenic sounds, in general, have been limited to short-term behavioral responses, which included the cessation of feeding, resting, or social interactions (NMFS, 2009a).

Animals can determine the direction from which a sound arrives based on cues, such as differences in arrival times, sound levels, and phases at the two ears. Thus, an animal's directional hearing capabilities have a bearing on its vulnerability to masking (National Research Council, 2003b). Behavioral changes for marine mammals such as the sperm whale to auditory masking sounds may include producing more calls, longer calls, or shifting the frequency of the calls (Holt et al., 2009, NMFS, 2009a).

It is expected that, due to the relatively stationary nature of the proposed activities, sperm whales would move away from the proposed operations area, and noise levels that could cause auditory injury would be avoided. However, observations of sperm whales near offshore oil and gas operations suggest an inconsistent response to anthropogenic marine sound (Jochens et al., 2008). Measurements of non-impulsive sources with DP thrusters in use during installation, anchor handling, and construction operations have shown that received levels of 160 dB re 1 µPa are not exceeded beyond 20 m from the operation (NOAA, 2016b).

There are other OCS facilities and activities near the lease area, and the region as a whole has a large number of similar noise sources. Noise associated with this project will contribute to an increase in the ambient noise environment of the Gulf of Mexico, but it is not expected in amplitudes sufficient to cause auditory injuries to sperm whales. The proposed activity may cause disturbance effects; primarily avoidance or temporary displacement from the project area. Vessel lighting and presence are not identified as IPFs for sperm whales (NMFS, 2007, BOEM, 2012a, 2016b, 2017a).

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb sperm whales, and there is a risk of vessel strikes, which are identified as a threat in the recovery plan for this species (NMFS, 2010a). To reduce the potential for vessel strikes, BOEM issued BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. When whales are sighted, vessel operators and crews are required to attempt to maintain a distance of 300 ft (91 m) or greater whenever possible. Vessel operators are required to reduce vessel speed to 10 knots or less, when safety permits, when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel. Compliance with this NTL will minimize the likelihood of vessel strikes as well as reduce the chance of disturbing sperm whales.

NMFS (2007) analyzed the potential for vessel strikes and harassment of sperm whales. With implementation of the mitigation measures in NTL BOEM-2016-G01, NMFS concluded that the likelihood of collisions between vessels and sperm whales would be reduced to insignificant levels. NMFS concluded that the observed avoidance of passing vessels by sperm whales is an advantageous response to avoid a potential threat and is not expected to result in any significant effect on migration, breathing, nursing, breeding, feeding, or sheltering to individuals, or have any consequences at the population level. With implementation of the vessel strike avoidance measures requirement to maintain a distance of 300 ft (91 m) from sperm whales, NMFS concluded that the potential for harassment of sperm whales would be reduced to discountable levels.

Dependent on flight altitude, helicopter traffic also has the potential to disturb sperm whales. Smultea et al. (2008) documented responses of sperm whales offshore Hawaii to a fixed-wing aircraft flying at an altitude of 800 ft (245 m). A reaction to the initial pass of the aircraft was observed during 3 of 24 sightings (12%). All three reactions consisted of a hasty dive and occurred at less than 1,180 ft (360 m) lateral distance from the aircraft. Additional reactions were seen when the aircraft circled certain whales to make further observations. Based on other studies of cetacean responses to sound, the authors concluded that the observed reactions to brief overflights by the aircraft were short-term and limited to behavioral disturbances.

Helicopters used in support operations maintain a minimum altitude of 700 ft (213 m) while in transit offshore, 1,000 ft (305 m) over unpopulated areas or across coastlines, and 2,000 ft (610 m) over populated areas and sensitive habitats such as wildlife refuges and park properties. In addition, guidelines and regulations issued by NMFS under the authority of the MMPA specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals. In the event that a whale is seen during transit, the helicopter will not approach or circle the animal. Although responses are possible, Smultea et al. (2008) and NMFS (2007) concluded that this altitude would minimize the potential for disturbing sperm whales. Therefore, no significant impacts are expected.

Impacts of a Small Diesel Fuel Spill

Potential spill impacts on marine mammals, including sperm whales, are discussed by NMFS (2007) and BOEM (2017 a,b). Oil impacts on marine mammals are discussed by (Geraci and St. Aubin, 1990) and by the Marine Mammal Commission (MMC) (2011). For proposed activities in this DOCD, there are no unique site-specific issues with respect to spill impacts on sperm whales that were not analyzed in the previous documents.

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Anadarko's OSRP could mitigate and lessen the potential for impacts on sperm whales. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small diesel fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small diesel fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. Results of an ADIOS2 model run (**Section A.9.1**) indicate that the area of the sea surface with diesel fuel on it would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions.

Direct physical and physiological effects to sperm whale due to exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (MMC, 2011). However, due to the limited areal extent and short duration of water quality impacts from a small diesel fuel spill, as well as the mobility of sperm whales, no significant impacts are expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine mammals, including sperm whales, are discussed by NMFS (2007) and BOEM (2017 a,b). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990) and by the MMC (2011). For this DOCD, there are no unique site-specific issues with respect to spill impacts on sperm whales.

Impacts of oil spills on sperm whales can include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants) (MMC, 2011). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil (and dispersants) directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft. The level of impact of oil exposure depends on the amount, frequency, and duration of exposure; route of exposure; and type or condition of petroleum compounds or chemical dispersants (Hayes et al., 2017). Complications from the previously listed exposures may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat, disruption of social structure, changing prey availability and foraging distribution or patterns, changing reproductive behavior/productivity, and changing movement patterns or migration (MMC, 2011). Ackleh et al. (2012) hypothesized that sperm whales may have temporarily relocated away from areas near the Macondo spill in 2010.

In the event of a large spill, the increased level of vessel and aircraft activity associated with spill response operations could disturb sperm whales and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL BOEM-2016-G01 (**Table 1**) to reduce the potential for striking or disturbing these animals.

C.3.2 West Indian Manatee (Threatened)

Most of the Gulf of Mexico West Indian manatee (*Trichechus manatus*) population is located in peninsular Florida (USFWS, 2001). Critical habitat has been designated in southwest Florida in Manatee, Sarasota, Charlotte, Lee, Collier, and Monroe Counties. Manatee sightings in Louisiana have increased as the species extends its presence farther west of Florida in the warmer months (Wilson, 2003). A species description is presented in the recovery plan for this species (U.S. Fish and Wildlife Service, 2001).

IPFs that could affect manatees include support vessel and helicopter traffic and a large oil spill. A small diesel fuel spill in the lease area would be unlikely to affect manatees due to the distance from the nearest shoreline. As explained in **Section A.9.1**, a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the potential for marine debris-related impacts on manatees. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb manatees, and there is a risk of vessel strikes, which are identified as a threat in the recovery plan for this species (USFWS, 2001). Manatees are expected to be limited to inner shelf and coastal waters, and impacts are expected to be limited to transits of vessels and helicopters through these waters. To reduce the potential for vessel strikes, BOEM issued NTL BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. Compliance with this NTL will minimize the likelihood of vessel strikes, and no significant impacts on manatees are expected.

Dependent on flight altitude, helicopter traffic also has the potential to disturb manatees. Rathbun (1988) reported that manatees were disturbed more by helicopters than by fixed-wing aircraft; however, the helicopter was flown at relatively low altitudes of 66 to 525 ft (20 to 160 m). Helicopters used in support operations maintain a minimum altitude of 700 ft (213 m) while in transit offshore, 1,000 ft (305 m) over unpopulated areas or across coastlines, and 2,000 ft (610 m) over populated areas and sensitive habitats such as wildlife refuges and park properties. In addition, guidelines and regulations issued by NMFS under the authority of the MMPA specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals. This mitigation measure will minimize the potential for disturbing manatees, and no significant impacts are expected.

Impacts of a Large Oil Spill

The OSRA results summarized in **Table 3** predict that Plaquemines Parish in Louisiana is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Mississippi, and Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. There is no manatee critical habitat designated in these areas, and the number of manatees potentially present is a small fraction of the population residing in peninsular Florida. The 60-day OSRA modeling (**Table 4**) predicts that shorelines between Matagorda County, Texas, and Levy County, Florida, may be contacted within 60 days of a spill. This range does not include any areas of manatee critical habitat.

In the event that manatees are exposed to oil, effects could include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants) (MMC, 2011). Direct physical and physiological effects can include asphyxiation, acute poisoning, lowering of tolerance to other stress, nutritional stress, and inflammation of infection (BOEM, 2017a). Indirect impacts include stress from the activities and noise of response vessels and aircraft. Complications from oil exposure may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat, disruption of social structure, change in prey availability and foraging distribution or patterns, change in reproductive behavior/productivity, and change in movement patterns or migration (MMC, 2011).

In the event that a large spill reaches coastal waters where manatees are present, the increased level of vessel and aircraft activity associated with spill response could disturb manatees and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL BOEM-2016-G01 (**Table 1**) to reduce the potential for striking or disturbing these animals, and therefore no significant impacts are expected.

C.3.3 Non-Endangered Marine Mammals (Protected)

Excluding the two endangered marine mammal species that were discussed in **Sections C.3.1** and **C.3.2**, there are 21 additional species of marine mammals that may be found in the Gulf of Mexico including one species of mysticete whale, the dwarf and pygmy sperm whales, four species of beaked whales, and 14 species of delphinid whales and dolphins. All marine mammals are protected species under the MMPA. The most common non-endangered cetaceans in the deepwater environment are odontocetes such as the pantropical spotted dolphin, spinner dolphin, and rough-toothed dolphin. A brief summary is presented in the following subsections; additional information on these groups is presented by BOEM (2017a).

Bryde's Whale. The Bryde's whale (*Balaenoptera edeni*) is the only year-round resident baleen whale in the northern Gulf of Mexico. In 2014, a petition was submitted to designate the northern Gulf of Mexico population as a DPS and list it as endangered under the ESA (Natural Resources Defense Council, 2014). This petition received a 90-day positive finding by NMFS in 2015 and is currently under consideration for listing. The Bryde's whale is most frequently sighted along the 328-ft (100-m) isobath (Davis and Fargion, 1996, Davis et al., 2000a). Most sightings have been made in the DeSoto Canyon region and off western Florida, although there have been some in the west-central portion of the northeastern Gulf. Based on the available data, it is possible that Bryde's whales could occur in the lease area.

Dwarf and Pygmy Sperm Whales. At sea, it is difficult to differentiate dwarf sperm whales (*Kogia sima*) from pygmy sperm whales (*Kogia breviceps*), and sightings are often grouped together as *Kogia* spp. Both species have a worldwide distribution in temperate to tropical waters. In the Gulf of Mexico, both species occur primarily along the continental shelf edge and in deeper waters off the continental shelf (Mullin et al., 1991, Mullin, 2007, Waring et al., 2016). Either species could occur in the lease area.

Beaked Whales. Four species of beaked whales are known to occur in the Gulf of Mexico: Blainville's beaked whale (*Mesoplodon densirostris*), Sowerby's beaked whale (*Mesoplodon bidens*), Gervais' beaked whale (*Mesoplodon europaeus*), and Cuvier's beaked whale (*Ziphius cavirostris*). Stranding records (Würsig et al., 2000) as well as passive acoustic monitoring in the Gulf of Mexico (Hildebrand et al., 2015) suggest that Gervais' beaked whale and Cuvier's beaked whale are the most common. Sowerby's beaked whale is considered extralimital, with only one documented stranding in the Gulf of Mexico (Bonde and O'Shea, 1989). Blainville's beaked whales are rare, with only four documented strandings in the northern Gulf of Mexico (Würsig et al., 2000).

Due to the difficulties of at-sea identification, beaked whales in the Gulf of Mexico are identified either as Cuvier's beaked whales or are grouped into an undifferentiated species complex (*Mesoplodon* spp.). In the northern Gulf of Mexico, they are broadly distributed in water depths greater than 3,281 ft (1,000 m) over lower slope and abyssal landscapes (Davis et al., 2000a). Any of these species could occur in the lease area (Waring et al., 2016).

Delphinids. Fourteen species of delphinids are known to occur in the Gulf of Mexico: Atlantic spotted dolphin (*Stenella frontalis*), Clymene dolphin (*Stenella clymene*), pantropical spotted dolphin (*Stenella attenuata*), spinner dolphin (*Stenella longirostris*), striped dolphin (*Stenella coeruleoalba*), bottlenose dolphin (*Tursiops truncatus*), false killer whale (*Pseudorca crassidens*), killer whale (*Orcinus orca*), pygmy killer whale (*Feresa attenuata*), melon-headed whale (*Peponocephala electra*), short-finned pilot whale (*Globicephala macrorhynchus*), Risso's dolphin (*Grampus griseus*), Fraser's dolphin (*Lagenodelphis hosei*), and rough-toothed dolphin (*Steno bredanensis*). Any of these species could occur in the lease area (Waring et al., 2016). The most common non-endangered cetaceans in the deepwater environment of the northern Gulf of Mexico are the pantropical spotted dolphin, spinner dolphin, and rough toothed dolphin (Waring et al., 2016).

The bottlenose dolphin (*Tursiops truncatus*) is a common inhabitant of the northern Gulf of Mexico, particularly within continental shelf waters. There are two ecotypes of bottlenose dolphins, a coastal form and an offshore form, which are genetically isolated from each other (Waring et al., 2016). The offshore form of the bottlenose dolphin may occur within the lease area. Inshore populations of coastal bottlenose dolphins in the northern Gulf of Mexico are separated into 31 geographically distinct population units, or stocks, for management purposes by NMFS (Hayes et al., 2017).

IPFs that could affect non-endangered marine mammals include construction vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small diesel fuel spill and a large oil spill). Effluent discharges are likely to have negligible impacts due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of these marine mammals. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the potential for marine debris-related impacts. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Construction Vessel Presence, Noise, and Lights

The presence of the DP construction vessel presents an attraction to pelagic food sources that may attract cetaceans. Some odontocetes have shown increased feeding activity around lighted platforms at night (Todd et al., 2009). Therefore, prey congregation could pose an attraction to protected species that exposes them to higher levels or longer durations of noise that might otherwise be avoided. Installation and support vessel presence and lighting are not considered as IPFs for marine mammals (BOEM, 2017b)

Noise from installation operations has the potential to disturb marine mammals. As discussed in **Section A.1**, noise impacts would be expected at greater distances when DP thrusters are in use than with vessel noise alone and are dependent on variables relating to sea state conditions, thruster type and usage. Three functional hearing groups are represented in the 21 non-endangered cetceans found in the Gulf of Mexico (NMFS, 2016). Eighteen of the 20 odonotocete species are considered to be in the mid-frequency functional hearing group, two species (*Kogia*) are in the high frequency functional hearing group, and one species (Bryde's whale) is in the low frequency functional hearing group (NMFS, 2016). Thruster noise will affect each group differently depending on the frequency bandwiths produced by operations.

For mid-frequency cetaceans exposed to a non-impulsive source (such as installation operations), permanent threshold shifts are estimated to occur when the mammal has received a cumulative exposure level of 198 dB re 1 $\mu Pa^2 \cdot s$ over a 24-hour period. Similarly, temporary threshold shifts are estimated to occur when a mammal has received a cummulative noise exposure level of 178 dB re 1 $\mu Pa^2 \cdot s$ over a 24-hour period. For low frequency cetaceans, specifically the Brydes whale, permanent and temporary threshold shift onset is estimated to occur at 199 dB re 1 $\mu Pa^2 \cdot s$ and 179 dB re 1 $\mu Pa^2 \cdot s$, repectively. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters in use during offshore operations are not expected to produce received levels greater than 160 dB re 1 µPa beyond 25 m from the source. Due to the short propagation distance of high sound pressure levels, the transient nature of marine mammals, and the stationary nature of the proposed activites, it is not expected that any marine mammals will receive exposure levels necessary for the onset of auditory threshold shifts.

Behaviorial criteria are currently being updated; therefore, the NOAA (2005) criteria are used in the interim to determine behavioral disturbance thresholds for marine mammals and are applied equally across all functional hearing groups. Received sound pressure levels of 120 dB re 1 µPa from a non-impulsive source are considered high enough to illicit a behaviorial reaction in some marine mammal species (NOAA, 2005). The 120 dB isolpleth may extend tens to hundreds of kilometers from the source depending on the propagation environment. There are other OCS facilities and activities near the lease area, and the region as a whole has a large number of similar sources. Marine mammal species in the northern Gulf of Mexico have been exposed to noise from anthropogenic sources for a long period of time and over large geographic areas and likely do not represent a naïve population with regard to sound (National Research Council, 2003b). Due to the limited scope, timing, and geographic extent of proposed activities, this project would represent a small, temporary contribution to the overall noise regime, and any short-term behaviorial impacts are not expected to be biologically significant to marine mammal populations.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb marine mammals, and there is a risk of vessel strikes. Data concerning the frequency of vessel strikes are presented by BSEE (2016). To reduce the potential for vessel strikes, BOEM issued NTL BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. Vessel operators and crews are required to attempt to maintain a distance of 300 ft (91 m) or greater when whales are sighted and 150 ft (45 m) when small (non-whale) cetaceans are sighted. When cetaceans are sighted while a vessel is underway, vessels must attempt to remain parallel to the animal's course and avoid excessive speed or abrupt changes in direction until the cetacean has left the area. Vessel operators are required to reduce vessel speed to 10 knots or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel, when safety permits. These mitigation measures are only effective during daylight hours, or in sea and weather conditions where cetaceans are sighted. Compliance with NTL BOEM-2016-G01 (**Table 1**) will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing marine mammals during these periods. If collisions occur during periods of poor visibility or at night, it is likely that it may result in the death of the cetacean. Impacts to non-listed cetaceans are not significant at the population (stock) level.

Aircraft traffic also has the potential to disturb marine mammals (Würsig et al., 1998). However, while flying offshore, helicopters maintain altitudes above 700 ft (213 m) during transit to and from the working area. In addition, guidelines and regulations issued by NMFS under the authority of the MMPA specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals. Maintaining this altitude will minimize the potential for disturbing marine mammals, and no significant impacts are expected (BOEM, 2017a).

Impacts of a Small Diesel Fuel Spill

Potential spill impacts on marine mammals are discussed by BOEM (2017 a,b). Oil impacts on marine mammals, in general, are discussed by Geraci and St. Aubin (1990). For this DOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Anadarko's OSRP is expected to lessen the potential for impacts on marine mammals. **DOCD Section I** provides detail on spill response measures. Given the open ocean location of the lease area, the limited duration of a small spill and response efforts, it is expected that any impacts on marine mammals would be brief and minimal.

A small diesel fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. Direct physical and physiological effects of exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (MMC, 2011). The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. As **Section A.9.1** discusses, a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up. Therefore, due to the limited areal extent and short duration of water quality impacts from a small diesel fuel spill as well as the mobility of marine mammals, no significant impacts are expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine mammals are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues.

Impacts of oil spills on marine mammals can include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants) (MMC, 2011, Takeshita et al., 2017). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil (and dispersants) directly or via contaminated prey. Complications of the above may lead to dysfunction of immune (DeGuise et al., 2017) and reproductive systems (Kellar et al., 2017), physiological stress, declining physical condition, and death (MMC, 2011). Indirect impacts can include stress from the activities and noise of response vessels and aircraft. Behavioral responses can include displacement of animals from prime habitat (McDonald et al., 2017), disruption of social structure, change in prey availability and foraging distribution or patterns, change in reproductive behavior/productivity, and change in movement patterns or migration (MMC, 2011).

Data from the Macondo spill, as analyzed and summarized by NOAA (2016b) indicate the scope of potential impacts from a large spill. Tens of thousands of marine mammals were exposed to oil, where they likely inhaled, aspirated, ingested, physically contacted, and absorbed oil components (NOAA, 2016b). Nearly all of the marine mammal stocks in the northern Gulf of Mexico were affected. The oil's physical, chemical, and toxic effects damaged tissues and organs, leading to a constellation of adverse health effects, including reproductive failure, adrenal disease, lung disease, and poor body condition (NOAA, 2016b). According to the National Wildlife Federation (2016a), nearly all of the 21 species of dolphins and whales that live in the northern Gulf of Mexico had demonstrable, quantifiable injuries. NMFS (2014a) documented 13 dolphins and whales stranded alive, and over 150 dolphins and whales were found dead during the oil spill response. Other affected species included dwarf and pygmy sperm whales, melon-headed whales, and spinner dolphins. Because of known low detection rates of carcasses (Williams et al., 2011), it is possible that the number of marine mammal deaths was significantly underestimated. Also, necropsies to confirm the cause of death could not be conducted for many of these marine mammals. Schwacke et al. (2014) reported that one year after the spill, many dolphins in Barataria Bay, Louisiana, had evidence of disease conditions associated with petroleum exposure and toxicity, including a decline in pregnancy success rate (Lane et al., 2015).

In the aftermath of the Macondo spill, an occurrence of an "unusual mortality event" (UME) of unprecedented size and duration that affectedmarine mammal stock areas in the Gulf of Mexico. The UME began in April 2010 and ended in July 2014 (NOAA, 2016c). Carmichael et al. (2012) hypothesized that the unusual number of bottlenose dolphin strandings in the northern Gulf of Mexico in 2010 and 2011 may have been associated with environmental perturbations including sustained cold weather and the Macondo spill in 2010 as well as large volumes of cold freshwater discharge in the early months of 2011. Venn-Watson et al. (2015) performed histological studies to examine contributing factors and causes of deaths for stranded common bottlenose dolphins from Louisiana, Mississippi, and Alabama and found that the dead dolphins from the UME were more likely than those from other areas to have primary bacterial pneumonia and thin adrenal cortices. The adrenal gland and lung diseases were consistent with exposure to petroleum compounds, and the exposure to petroleum compounds during and after the Macondo spill are proposed as a cause.

In the event of a large spill, response activities that may impact marine mammals include increased vessel traffic, use of dispersants, and remediation activities (e.g., controlled burns, skimmers, boom) (BOEM, 2017 a,b). The increased level of vessel and aircraft activity associated with spill response could disturb marine mammals, potentially resulting in behavioral changes. The large number of response vessels could result in vessel strikes, entanglement, injury, or stress. Response vessels would operate in accordance with NTL BOEM-2016-G01 to reduce the potential for striking or disturbing these animals, and therefore no significant impacts are expected. The application of dispersants is likely to reduce the chances of harmful impacts as the dispersants would remove oil from the surface, thereby reducing the risk of contact and rendering it less likely to adhere to skin, baleen plates, or other body surfaces (BOEM, 2017a). The use of trained observers during remediation activities will reduce the likelihood of capture and/or entrainment (BOEM, 2017 a,b). It is expected that impacts to non-listed marine mammals from a oil spill response activities resulting in the death of individuals would be adverse but not significant at a population level.

C.3.4 Sea Turtles (Endangered/Threatened)

Five species of endangered or threatened sea turtles may be found near the lease area. Endangered species include the leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempii*), and hawksbill (*Eretmochelys imbricata*) turtles, while the North Atlantic DPS of the green turtle (*Chelonia mydas*) is listed as threatened (81 *FR* 20057). The DPS of loggerhead turtles (*Caretta caretta*) that occurs in the Gulf of Mexico is listed as threatened, although other DPSs are endangered.

Critical habitat has been designated for the loggerhead turtle in the Gulf of Mexico as shown in **Figure 3**. Critical habitat in the northern Gulf of Mexico includes nesting beaches in Mississippi, Alabama, and the Florida Panhandle; nearshore reproductive habitat within 1 mile (1.6 km) seaward from these beaches; and a large area of *Sargassum* habitat that includes most of the Western and Central Planning Areas of and parts of the southern portion of the Eastern Planning Area (NMFS, 2014b).

Loggerhead turtles in the Gulf of Mexico are part of the Northwest Atlantic Ocean DPS (76 *FR* 58868). In July 2014, NMFS and the USFWS designated critical habitat for this DPS. The USFWS designation (79 *FR* 39756) includes nesting beaches in Jackson County, Mississippi; Baldwin County, Alabama; and Bay, Gulf, and Franklin Counties in the Florida Panhandle as well as several counties in southwest Florida and the Florida Keys (and other areas along the Atlantic coast). The NMFS designation (79 *FR* 39856) includes nearshore reproductive habitat within 1 mile (1.6 km) seaward of the mean high water line along these same nesting beaches. NMFS also designated a large area of shelf and oceanic waters, termed *Sargassum* habitat, in the Gulf of Mexico (and Atlantic Ocean) as critical habitat. *Sargassum* is a brown alga (Class Phaeophyceae) and species in the Gulf of Mexico (*S. natans and S. fluitans*) have a fully pelagic lifecycle. Rafts of *Sargassum* serve as important foraging and developmental habitat for numerous fishes, and young sea turtles, including loggerhead turtles. NMFS designated three other categories of critical habitat as well; of these, two (migratory habitat and overwintering habitat) are along the Atlantic coast and the third (breeding habitat) is found in the Florida Keys and along the Florida east coast (NMFS, 2014b). The closest designated nearshore reproductive critical habitat for loggerhead sea turtles is approximately 76 miles (122 km) from the lease area. The lease area is located 54 miles (87 km) from the designated *Sargassum* critical habitat for loggerhead sea turtles (**Figure 3**).

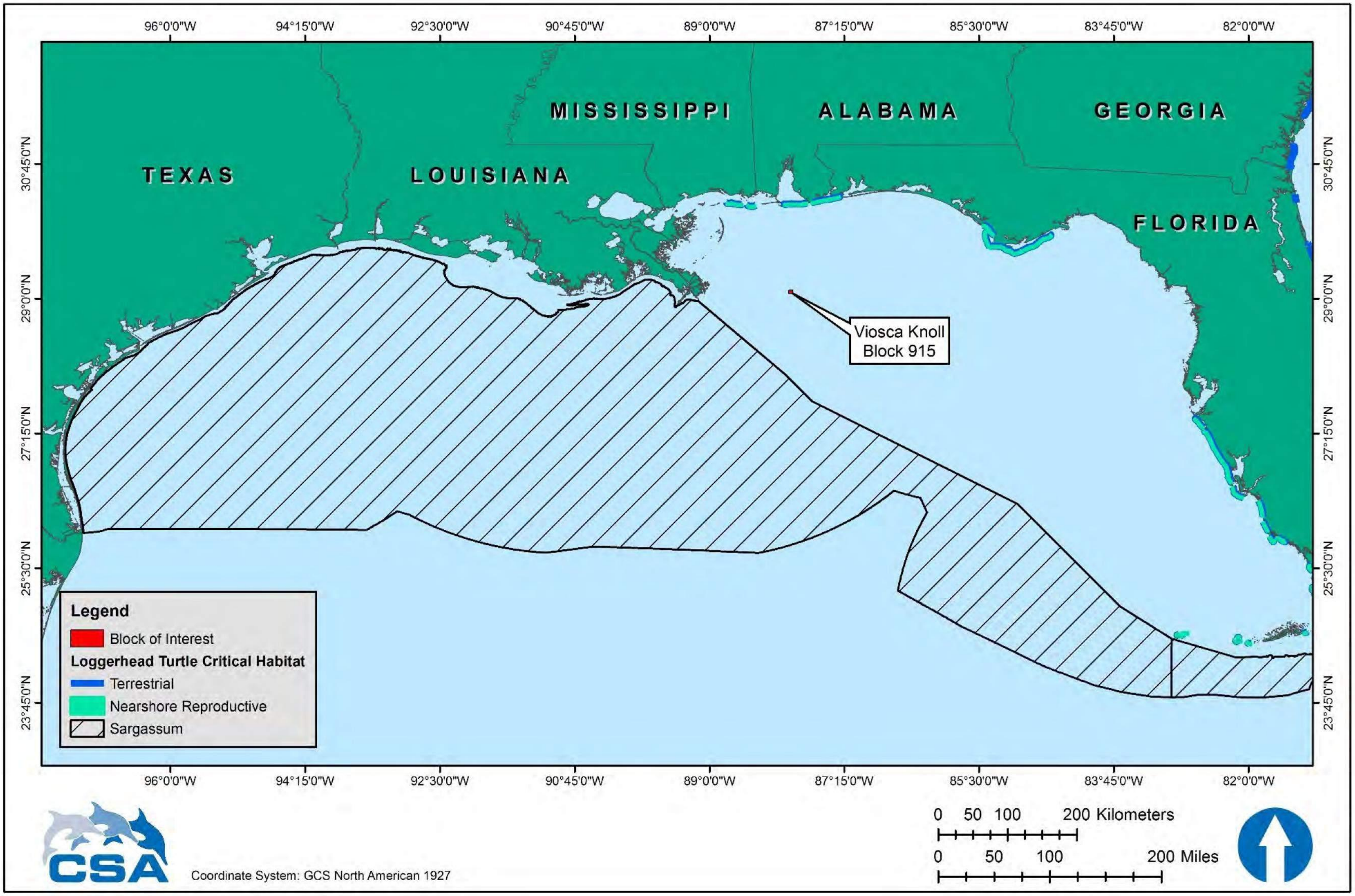

Figure 3. Location of loggerhead turtle designated critical habitat in relation to the lease area.

Leatherback and loggerhead turtles are the most likely species to be present near the lease area as adults. Green, hawksbill, and Kemp's ridley turtles are typically inner shelf and nearshore species, unlikely to occur near the lease area as adults. Hatchlings or juveniles of any of the sea turtle species may be present in deepwater areas, including the lease area, where they may be associated with *Sargassum* and other flotsam.

All five sea turtle species in the Gulf of Mexico are migratory and use different marine habitats according to their life stage. These habitats include high-energy beaches for nesting females and emerging hatchlings and pelagic convergence zones for hatchling and juvenile turtles. As adults, green, hawksbill, and loggerhead turtles forage primarily in shallow, benthic habitats. Leatherback turtles are the most pelagic of the sea turtles, feeding primarily on jellyfish.

Sea turtle nesting on the northern Gulf of Mexico coast can be summarized by species as follows:

- Loggerhead turtles – Nest in significant numbers along the Florida Panhandle (Florida Fish and Wildlife Conservation Commission, 2017a) and, to a lesser extent, from Texas through Alabama (NMFS and USFWS, 2008).
- Green and leatherback turtles – Infrequently nest on Florida Panhandle beaches (Florida Fish and Wildlife Conservation Commission, 2017b, c).
- Kemp's ridley turtles – The main nesting site is on a 16 mile (26 km) stretch of coastline near Rancho Nuevo in the Mexican state of Tamaulipas (NMFS et al., 2011). A much smaller, but growing, population nests in Padre Island National Seashore, Texas, mostly as a result of reintroduction efforts (NMFS et al., 2011). A total of 353 Kemp's ridley turtle nests were counted on Texas beaches in 2017, an increase from the 185 counted in 2016, 159 counted in 2015, and 118 counted in 2014 (Turtle Island Restoration Network, 2017). Padre Island National Seashore along the coast of Willacy, Kenedy, and Kleberg Counties in southern Texas, is the most important nesting location for this species in the United States, although there have been occasional reports of Kemp's ridleys nesting in Alabama (Share the Beach, 2016).
- Hawksbill turtles – Typically, do not nest anywhere near the project area, with most nesting in the region located in the Caribbean Sea and on the beaches of the Yucatán Peninsula (USFWS, 2016a).

IPFs that could affect sea turtles include construction vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small diesel fuel spill and a large oil spill). Effluent discharges are likely to have negligible impacts on sea turtles due to rapid dispersion, the small area of ocean affected, and the intermittent nature of the discharges. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the potential for marine debris-related impacts on sea turtles. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Construction Vessel Presence, Noise, and Lights

Subsea installation activities produce a broad array of sounds at frequencies and intensities that may be detected by sea turtles (Samuel et al., 2005, Popper et al., 2014). Potential impacts may include behavioral disruption and temporary or permanent displacement from the area near the sound source. There is scarce information regarding hearing and acoustic thresholds for marine turtles. The currently accepted hearing and response estimates are derived from fish hearing data rather than from marine mammal hearing data in combination with the limited experimental data available (Popper et al., 2014). A NMFS Biological Opinion (NMFS, 2015) lists sea turtle underwater acoustic injury and behavioral thresholds at 207 dB re 1 µPa and 166 dB re 1 µPa, respectively. No distinction is made between impulsive and continuous sources for these thresholds. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters are not expected to produce received levels greater than 160 dB re 1 µPa beyond 82 ft (25 m) from the source. Certain sea turtles, especially loggerheads, may be attracted to offshore structures (Lohoefener et al., 1990, Gitschlag et al., 1997) and, thus, may be more susceptible to impacts from sounds produced during routine operations. The most likely impacts would be short-term behavioral changes such as diving and evasive swimming, disruption of activities, or departure from the area. Due to the small impact area around the activties, limited number of sources, and short duration of activities, these short-term impacts are not expected to be biologically significant to sea turtle populations.

Artificial lighting can disrupt the nocturnal orientation of sea turtle hatchlings (Witherington, 1997, Tuxbury and Salmon, 2005). However, hatchlings may rely less on light cues when they are offshore than when they are emerging on the beach (Salmon and Wyneken, 1990). NMFS (2007) concluded that the effects of lighting from offshore structures on sea turtles are insignificant.

Impacts of Support Vessel and Helicopter Traffic

Noise generated from support vessel traffic has the potential to disturb sea turtles, and there is a risk of vessel strikes. Data show that vessel strike is one cause of sea turtle mortality in the Gulf of Mexico (Lutcavage et al., 1997). While adult sea turtles are visible at the surface during the day and in clear weather, they can be difficult to spot from a moving vessel when resting below the water surface, during nighttime, or during periods of inclement weather. To reduce the potential for vessel strikes, BOEM issued NTL BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for sea turtles and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. When sea turtles are sighted, vessel operators and crews are required to attempt to maintain a distance of 150 ft (45 m) or greater whenever possible. Compliance with this NTL (**Table 1**) will minimize the likelihood of vessel strikes during periods of daylight and during sea and weather conditions that permit sighting of turtles on the sea surface. If a project-related vessel strikes a sea turtle, it is likely that it will result in the death of the individual turtle. Lethal ship strike to these listed species is not likely but, if it occurs, is significant to the population (NMFS, 2007).

Noise generated from support helicopter traffic also has the potential to disturb sea turtles. However, while flying offshore, helicopters maintain altitudes above 700 ft (213 m) during transit to and from the working area. This altitude will minimize the potential for disturbing sea turtles, and no significant impacts are expected (NMFS, 2007, BOEM, 2012a).

Impacts of a Small Diesel Fuel Spill

Potential spill impacts on sea turtles are discussed by NMFS (2007) and BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to spill impacts on sea turtles.

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Anadarko's OSRP is expected to minimize potential impacts on sea turtles. **DOCD Section I** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts on turtles to occur would be brief.

A small diesel fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. Direct physical and physiological effects of exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (NMFS, 2014a). The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time of the spill as well as the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small diesel fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The sea surface area covered with diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions. Therefore, due to the limited areal extent and short duration of water quality impacts from a small diesel fuel spill, no significant impacts to sea turtles from direct or indirect exposure are expected.

<u>Loggerhead Critical Habitat – Nesting Beaches</u>. A small diesel fuel spill in the lease area would be unlikely to affect sea turtle nesting beaches due to the distance from the nearest shoreline. Loggerhead turtle nesting beaches and nearshore reproductive habitat designated as critical habitat are located in Mississippi, Alabama, and the Florida panhandle, at least 76 miles (122 km) from the lease area. As explained in **Section A.9.1**, a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion.

<u>Loggerhead Critical Habitat – *Sargassum*</u>. The lease area is approximately 54 miles (87 km) from the *Sargassum* habitat portion of the loggerhead turtle critical habitat (**Figure 3**). A small diesel fuel spill is unlikely to affect *Sargassum* and juvenile turtles in this habitat due to the distance from the lease area. If this habitat were contaminated, juvenile sea turtles could come into contact with or ingest oil, resulting in death, injury, or other sublethal effects. Effects of a small spill on *Sargassum* critical habitat for loggerhead turtles would be limited to the small area (0.5 to 5 ha [1.2 to 12 ac]) likely to be impacted by a small spill. An impact area of 5 ha (12 ac) would represent a negligible portion of the approximately 40,662,810 ha (100,480,000 ac) designated *Sargassum* critical habitat for loggerhead turtles in the northern Gulf of Mexico.

Impacts of a Large Oil Spill

Impacts of oil spills on sea turtles can include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes and smoke (e.g., from *in situ* burning of oil); ingestion of oil (and dispersants) directly or via contaminated food; and stress from the activities and noise of response vessels and aircraft. Complications of the above may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat, disruption of social structure, change in food availability and foraging distribution or patterns, change in reproductive behavior/productivity, and change in movement patterns or migration (NOAA, 2010, NMFS, 2014a). In the unlikely event of a spill, implementation of Anadarko's OSRP is expected to minimize the potential for these types of impacts on sea turtles. **DOCD Section I** provides detail on spill response measures.

Studies of oil effects on loggerhead turtles in a controlled setting (NOAA, 2010, Lutcavage et al., 1995) suggest that sea turtles show no avoidance behavior when they encounter an oil slick, and any sea turtle in an affected area would be expected to be exposed. Sea turtles' diving behaviors also put them at risk. Sea turtles rapidly inhale a large volume of air before diving and continually resurface over time, which may result in repeated exposure to volatile vapors and oiling (NMFS, 2007).

Results of the Macondo spill provide an indication of potential effects of a large oil spill on sea turtles. NOAA (2016b) estimates that between 4,900 and up to 7,600 large juvenile and adult sea turtles (Kemp's ridleys, loggerheads, and hardshelled sea turtles not identified to species), and between 56,000 and 166,000 small juvenile sea turtles (Kemp's ridleys, green turtles, loggerheads, hawksbills, and hardshelled sea turtles not identified to species) were killed by the Macondo spill. Impacts from a large oil spill resulting in the death of individual listed sea turtles would be significant to local populations.

Spill response activities could also kill sea turtles and interfere with nesting. NOAA (2016b) concluded that after the Macondo spill hundreds of sea turtles were likely killed by response activities such as increased boat traffic, dredging for berm construction, increased lighting at night near nesting beaches, and oil cleanup operations on nesting beaches. Nearly 35,000 hatchling sea turtles (loggerheads, Kemp's ridleys, and green turtles) were also injured by response activities (NOAA, 2016b). In addition, it is estimated that oil cleanup operations on Florida Panhandle beaches following the spill deterred adult female loggerheads from coming ashore and laying their eggs, resulting in a decrease of approximately 250 loggerhead nests in 2010 (NOAA, 2016b). Impacts from oil spill response activities resulting in the death of individual listed sea turtles would be significant to local populations.

Loggerhead Critical Habitat – Nesting Beaches. If spilled oil reaches sea turtle nesting beaches, nesting sea turtles and egg development could be affected (NMFS, 2007). An oiled beach could affect nest site selection or result in no nesting at all (e.g., false crawls). Upon hatching and successfully reaching the water, hatchlings are subject to the same types of oil spill exposure hazards as adults. Hatchlings that contact oil residues while crossing a beach can exhibit a range of effects, from acute toxicity to impaired movement and abnormal bodily functions (NMFS, 2007).

The 30-day OSRA results summarized in **Table 3** estimate that Louisiana, Mississippi, Alabama, and Florida shorelines that support limited sea turtle nesting could be contacted within 30 days (1 to 17% conditional probability). Plaquemines Parish in Louisiana is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). The 60-day OSRA modeling (**Table 4**) predicts the conditional probability of contacting Mississippi, Alabama, and Florida Panhandle shorelines that support significant loggerhead sea turtle nesting is 24% or less. The nearest nearshore reproductive critical habitat for the loggerhead turtle is 76 miles (122 km) from the lease area and is predicted by the 60-day OSRA model to have a 18% or less conditional probability of contact within 60 days of a spill.

Loggerhead Critical Habitat – *Sargassum*. The lease area is approximately 54 miles (87 km) from the loggerhead turtle critical habitat designated as *Sargassum* habitat, which includes most of the Western and Central Planning Areas in the Gulf of Mexico and parts of the southern portion of the Eastern Planning Area (**Figure 3**) (NMFS, 2014b). Because of the large area covered by the designated *Sargassum* habitat for loggerhead turtles, a large spill could result in a substantial part of the *Sargassum* habitat in the northern Gulf of Mexico being oiled. However, the catastrophic 2010 Macondo spill affected approximately one-third of the *Sargassum* habitat in the northern Gulf of Mexico (BOEM, 2014a). It is extremely unlikely that the entire *Sargassum* critical habitat would be affected by a large spill. Because *Sargassum* is a floating, pelagic species, it would only be affected by impacts that occur near the surface.

The effects of oiling on *Sargassum* vary with spill severity, but moderate to heavy oiling that could occur during a large spill could cause complete mortality to *Sargassum* and its associated communities (BOEM, 2017a). *Sargassum* also has the potential to sink during a large spill, thus temporarily removing the habitat and possibly being an additional pathway of exposure to the benthic environment (Powers et al., 2013). Lower levels of oiling may cause sub-lethal affects, including a reduction in growth, productivity, and recruitment of organisms associated with *Sargassum*. The *Sargassum* algae itself could be less impacted by light to moderate oiling than associated organisms because of a waxy outer layer that might help protect it from oiling (BOEM, 2016b). *Sargassum* has a yearly seasonal cycle of growth and a yearly cycle of migration from the Gulf of Mexico to the western Atlantic. A large spill could affect a large portion of the annual crop of the algae; however, because of its ubiquitous distribution and seasonal cycle, recovery of the *Sargassum* community would be expected to occur within a short time period (BOEM, 2017a).

In the event of a large spill, the level of vessel and aircraft activity associated with spill response could disturb sea turtles and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL BOEM-2016-G01 (**Table 1**) to reduce the potential for striking or disturbing these animals; however, events leading to the death of individual sea turtles from spill response activities are expected to be significant to local populations.

C.3.5 Piping Plover (Threatened)

The Piping Plover (*Charadrius melodus*) is a migratory shorebird that overwinters along the southeastern U.S. and Gulf of Mexico coasts. This threatened species is in decline as a result of hunting, habitat loss and modification, predation, and disease (USFWS, 2003). Critical overwintering habitat has been designated, including beaches in Texas, Louisiana, Mississippi, Alabama, and Florida (**Figure 4**). Piping Plovers inhabit coastal sandy beaches and mudflats, feeding by probing for invertebrates at or just below the surface. They use beaches adjacent to foraging areas for roosting and preening (USFWS, nd).

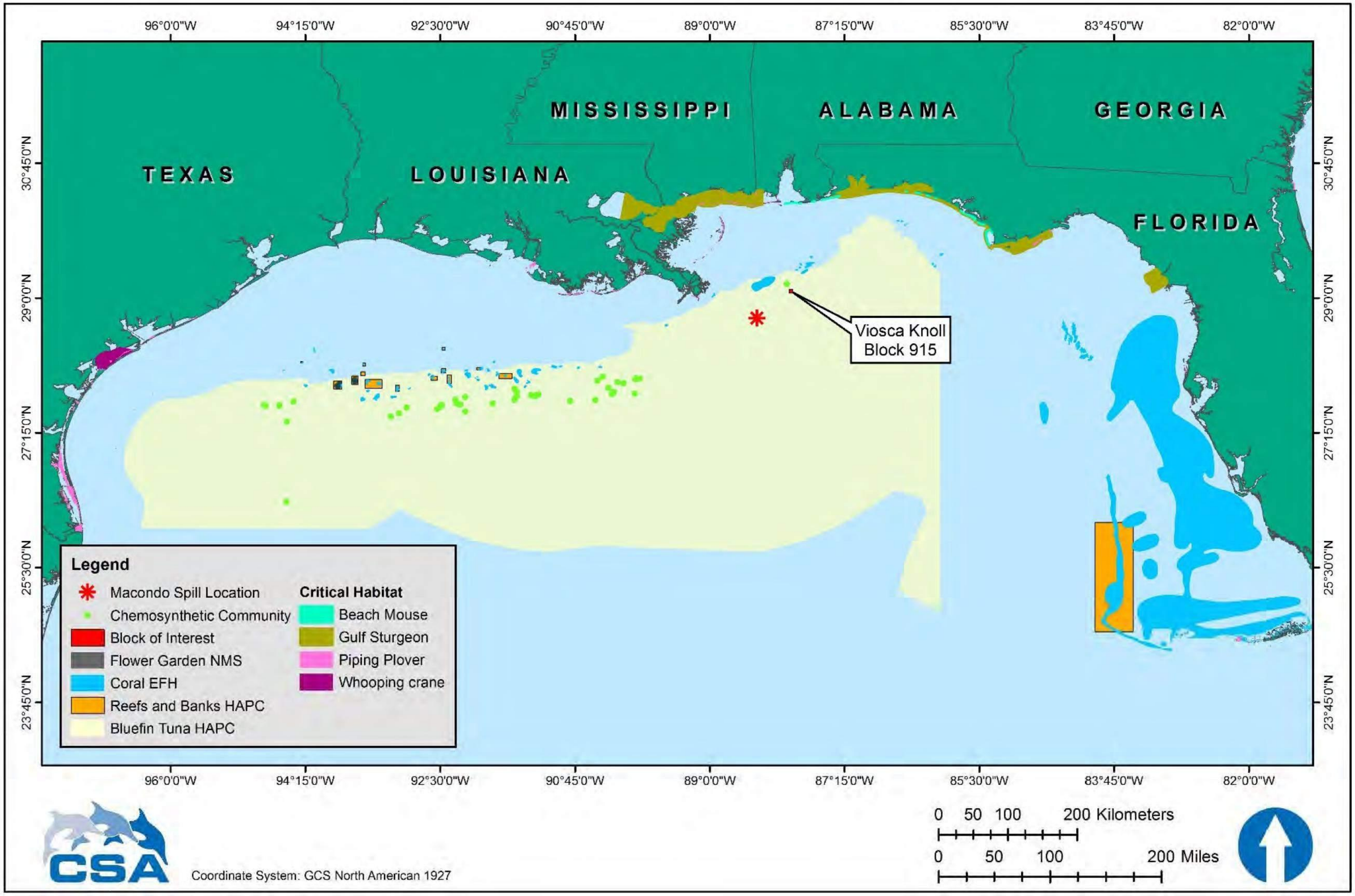

Figure 4. Location of selected environmental features in relation to the lease area. EFH = Essential Fish Habitat; HAPC = Habitat Area of Particular Concern; NMS= National Marine Sanctuary.

IPFs potentially affecting Piping Plovers include helicopter traffic crossing over selected coastal habitats and a large oil spill. These IPFs with potential impacts listed in **Table 2** are discussed below. It is asumed that helicopters will maintain an altitude of 1,000 ft (305 m) over unpopulated areas or across coastlines. Therefore, it is not likely that the crossing of helicopters over coastlines will significantly impact overwintering Piping Plovers.

A small diesel fuel spill in the lease area would be unlikely to affect Piping Plovers because a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion (**Section A.9.1**).

Impacts of a Large Oil Spill

The lease area is approximately 70 miles (113 km) to the nearest shoreline that is designed as critical habitat for Piping Plovers in Plaquemines Parish, Louisiana (**Figure 4**). The 30-day OSRA modeling (**Table 3**) predicts that Piping Plover critical habitat in Plaquemines Parish, Louisiana, could be contacted within 10 days of a spill (7% conditional probability). The 60-day OSRA modeling (**Table 4**) predicts that during the spring, there is a 24% conditional probability that an oil spill from the lease area would reach a shoreline designated as critical habitat for the Piping Plover within 60 days of a spill. Piping Plovers could become physically oiled while foraging on oiled shores or secondarily contaminated through ingestion of oiled intertidal sediments and prey (BOEM, 2017a). Piping Plovers congregate and feed along tidally exposed banks and shorelines, following the tide out to allow foraging at the water's edge. It is possible that some deaths of Piping Plovers could occur, especially if spills occur during winter months when plovers are most common along the coastal Gulf or if spills contacted critical habitat. Impacts also could occur from vehicular traffic on beaches and other activities associated with spill cleanup. Anadarko has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in their Regional OSRP. Impacts resulting in the deaths of individual Piping Plovers may be significant to the local population, based on the number of individuals lost.

C.3.6 Whooping Crane (Endangered)

The Whooping Crane (*Grus americana*) is a large omnivorous wading bird listed as an endangered species. Three wild populations live in North America (National Wildlife Federation, 2016b). One population winters along the Texas coast at Aransas NWR and summers at Wood Buffalo National Park in Canada. This population represents the majority of the world's population of free-ranging Whooping Cranes, reaching a record estimated population of 431 during the 2016 to 2017 winter (USFWS, 2017). A non-migratory population was reintroduced in central Florida, and another reintroduced population summers in Wisconsin and migrates to the southeastern U.S. for the winter. Whooping Cranes breed, migrate, winter, and forage in a variety of habitats, including coastal marshes and estuaries, inland marshes, lakes, ponds, wet meadows and rivers, and agricultural fields (USFWS, 2007). Approximately 9,000 ha (22,240 ac) of salt flats on Aransas NWR and adjacent islands make up the principal wintering grounds of the Whooping Crane (**Figure 4**). Aransas NWR is designated as critical habitat for the species. A species description is presented by BOEM (2012a).

A large oil spill is the only IPF potentially affecting Whooping Cranes. A small diesel fuel spill in the lease area would be unlikely to affect Whooping Cranes due to the distance from Aransas

NWR. As explained in **Section A.9.1**, a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion.

Impacts of a Large Oil Spill

The lease area is 517 miles (832 km) from the Aransas NWR in Aransas and Calhoun Counties, Texas, the nearest shoreline that is designed as critical habitat for Whooping Cranes. The 60-day OSRA modeling (**Table 4**) predicts that there is a <0.5% conditional probability that an oil spill from the lease area would reach a shoreline designated as critical habitat for the Whooping Crane within 60 days of a spill. Whooping Cranes could physically oil themselves while foraging in oiled areas or secondarily contaminate themselves through ingestion of contaminated shellfish, frogs, and fishes. It is possible that some deaths of Whooping Cranes could occur, especially if spills occur during winter months when Whooping Cranes are most common along the Texas coast or if the spill contacts their critical habitat in Aransas NWR. Impacts could also occur from vehicular traffic on beaches and other activities associated with spill cleanup. Anadarko has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in their OSRP. Impacts leading to the death of individual Whooping Cranes would be significant at a species level.

C.3.7 Gulf Sturgeon (Threatened)

The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) is a threatened fish species that inhabits major rivers and inner shelf waters from the Mississippi River to the Suwannee River, Florida (Barkuloo, 1988, Wakeford, 2001). The Gulf sturgeon is anadromous and migrates from the sea upstream into coastal rivers to spawn in freshwater. The historic range of the species extended from the Mississippi River to Charlotte Harbor, Florida (Wakeford, 2001). This range has contracted to encompass major rivers and inner shelf waters from the Mississippi River to the Suwannee River, Florida. Populations have been depleted or even extirpated throughout this range by fishing, shoreline development, dam construction, water quality changes, and other factors (Barkuloo, 1988, Wakeford, 2001). These declines prompted the listing of the Gulf sturgeon as a threatened species in 1991. The best-known populations occur in the Apalachicola and Suwannee Rivers in Florida (Carr, 1996, Sulak and Clugston, 1998), the Choctawhatchee River in Alabama (Fox et al., 2000), and the Pearl River in Mississippi/Louisiana (Morrow et al., 1998). Rudd et al. (2014) reconfirmed the spatial distribution and movement patterns of Gulf Sturgeon by surgically implanting acoustic telemetry tags. Critical habitat in the Gulf extends from Lake Borgne, Louisiana (St. Bernard Parish), to Suwannee Sound, Florida (Levy County) (NMFS, 2014c) (**Figure 4**). A species description is presented by BOEM (2012a) and in the recovery plan for this species (USFWS, 1995).

A large oil spill is the only IPF that could affect Gulf sturgeon. There are no IPFs associated with routine project activities that could affect these fish. A small diesel fuel spill in the lease area would be unlikely to affect Gulf sturgeon because a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion (see explanation in **Section A.9.1**).

Impacts of a Large Oil Spill

Potential spill impacts on Gulf sturgeon are discussed by NMFS (2007) and BOEM (2012a). For this DOCD, there are no unique site-specific issues with respect to this species.

The lease area is approximately 79 miles (127 km) from the nearest Gulf sturgeon critical habitat in St Bernard Parish, Louisiana, and Harrison County, Mississippi. The 30-day OSRA modeling (**Table 3**) predicts that a spill in the lease area has 2% or less conditional probability of contacting any coastal areas containing Gulf sturgeon critical habitat within 10 days of a spill and 7% or less conditional probability within 30 days. The 60-day OSRA modeling (**Table 4**) predicts that a spill in the lease areas has a 14% or less conditional probability of contacting any coastal areas containing Gulf sturgeon critical habitat within 60 days of a spill.

In the event of oil reaching Gulf sturgeon habitat, the fish could be affected by direct ingestion, ingestion of oiled prey, or the absorption of dissolved petroleum products through the gills. Based on the life history of this species, sub-adult and adult Gulf sturgeon would be most vulnerable to an estuarine or marine oil spill, and likely would be vulnerable only from 1 September through 30 April when the species is typically foraging in estuarine and shallow marine habitats (NMFS, 2007).

NOAA (2016b) estimated that 1,100 to 3,600 Gulf sturgeon were exposed to oil from the Macondo spill. Overall, 63% of the Gulf sturgeon from six river populations were potentially exposed to the spill. Although the number of dead or injured Gulf sturgeon was not estimated, laboratory and field tests indicated that Gulf sturgeon exposed to oil displayed both genotoxicity and immunosuppression, which can lead to malignancies, cell death, susceptibility to disease, infections, and a decreased ability to heal (NOAA, 2016b). Impacts resulting in the deaths of individual Gulf sturgeons may be significant to the local population, based on the number of individuals lost.

C.3.8 Beach Mice (Endangered)

Four subspecies of endangered beach mice (*Peromyscus polionotus*) occur on the barrier islands of Alabama and the Florida Panhandle: Alabama, Choctawhatchee, Perdido Key, and St. Andrew beach mice. Critical habitat has been designated for all four subspecies. **Figure 4** shows the combined critical habitat for all four subspecies. Species descriptions are provided by BOEM (2012a).

A large oil spill is the only IPF that could affect beach mice. There are no IPFs associated with routine project activities that could affect these animals due to the distance from shore and the lack of any onshore support activities near their habitat. A small diesel fuel spill in the lease area would not affect beach mice because a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion (**Section A.9.1**).

Impacts of a Large Oil Spill

Potential spill impacts on beach mice are discussed by BOEM (2017a). For this DOCD, there are no unique site-specific issues with respect to these species that were not analyzed in these documents.

Beach mouse critical habitat in Baldwin County, Alabama, is approximately 77 miles (124 km) from the lease area. The 30-day OSRA results (**Table 3**) predicts a 1% or less conditional probability of oil contact with beach mouse critical habitat within 10 days of a spill and 3% or less conditional probability of oil contact within 30 days of a spill. The 60-day OSRA modeling (**Table 4**) predicts that a spill in the lease area has a 18% or less conditional probability of reaching either the Alabama or Florida shorelines inhabited by beach mice within 60 days of a spill.

In the event of oil contacting these beaches, beach mice could experience several types of direct and indirect impacts. Contact with spilled oil could cause skin and eye irritation and subsequent infection; matting of fur; irritation of sweat glands, ear tissues, and throat tissues; disruption of sight and hearing; asphyxiation from inhalation of fumes; and toxicity from ingestion of oil and contaminated food. Indirect impacts could include reduction of food supply, destruction of habitat, and fouling of nests. Impacts could also occur from vehicular traffic and other activities associated with spill cleanup (BOEM, 2017 a,b). However, any such impacts are unlikely due to the distance from shore and response actions that would occur in the event of a spill. Impacts leading to the death of individual beach mice would be significant at a species level.

C.3.9 Threatened Coral Species

Four threatened coral species are known from the northern Gulf of Mexico: elkhorn coral (*Acropora palmata*), lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), and boulder star coral (*Orbicella franksi*). These species have been reported from the coral cap region of the Flower Garden Banks (NOAA, 2014) but are unlikely to be present as regular residents anywhere else in the northern Gulf of Mexico because they typically inhabit coral reefs in shallow, clear tropical, or subtropical waters. Other Caribbean coral species evaluated by NMFS in 2014 (79 *FR* 53852) either do not meet the criteria for ESA listing or are not known from the Flower Garden Banks. Critical habitat has been designated for elkhorn corals in the Florida Keys, but none has been designated for the other threatened coral species included above.

There are no IPFs associated with routine project activities that could affect threatened corals in the northern Gulf of Mexico. A small diesel fuel spill would not affect threatened coral species because the oil would float and dissipate on the sea surface. A large oil spill is the only relevant IPF.

Impacts of a Large Oil Spill

A large oil spill would be unlikely to reach coral reefs at the Flower Garden Banks or elkhorn coral critical habitat in the Florida Keys (Monroe County, Florida). The 60-day OSRA modeling (**Table 4**) predicts the conditional probability of oil contacting the Florida Keys is 0.5% or less. A surface slick would not contact corals on the seafloor. If a subsurface plume were to occur, impacts on the Flower Garden Banks would be unlikely due to the distance and the difference in water depth. Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and typically would not carry a plume up onto the continental shelf edge. Valentine et al. (2014) observed the spatial distribution of excess hopane, a crude oil tracer from Macondo spill sediment core samples, to be in the deeper waters and not transported up the shelf, thus confirming that near-bottom currents flow along the isobaths.

In the unlikely event that an oil slick reached reefs at the Flower Garden Banks or other Gulf of Mexico reefs, oil droplets or oiled sediment particles could come into contact with reef organisms or corals. As discussed by BOEM (2017a), impacts could include loss of habitat, biodiversity, and live coral coverage; destruction of hard substrate; change in sediment characteristics; and reduction or loss of one or more commercial and recreational fishery habitats. Sublethal effects could be long-lasting and affect the resilience of coral colonies to natural disturbances (e.g., elevated water temperature and diseases) (BOEM, 2017a).

Due to the distance between the lease area and coral habitats, there is a low chance of oil contacting threatened coral habitat in the event of a spill, and no significant impacts on threatened coral species are expected.

C.4 Coastal and Marine Birds

C.4.1 Marine Birds

Marine birds include seabirds and other species that may occur in the pelagic environment of the project area (Clapp et al., 1982a, Clapp et al., 1982b, 1983, Peake, 1996, Hess and Ribic, 2000). Seabirds spend much of their lives offshore over the open ocean, except during breeding season when they nest on islands along the coast. Other waterbirds, such as waterfowl, marsh birds, and shorebirds may occasionally be present over open ocean areas. No endangered or threatened bird species are likely to occur at the project area. For a discussion of shorebirds and coastal nesting birds, **Section C.4.2**.

Seabirds of the northern Gulf of Mexico were surveyed from ships during the GulfCet II program (Davis et al., 2000b). Hess and Ribic (2000) reported that terns, storm-petrels, shearwaters, and jaegers were the most frequently sighted seabirds in the deepwater area. From these surveys, four ecological categories of seabirds were documented in the deepwater areas of the Gulf: summer migrants (shearwaters, storm-petrels, boobies); summer residents that breed along the Gulf coast (Sooty Tern, Least Tern, Sandwich Tern, Magnificent Frigatebird); winter residents (gannets, gulls, jaegers); and permanent resident species (Laughing Gulls, Royal Terns, Bridled Terns) (Hess and Ribic, 2000). The GulfCet II study did not estimate bird densities; however, Powers (1987) indicated that seabird densities over the open ocean typically are less than 10 birds km^{-2}.

The distributions and relative densities of seabirds within the deepwater areas of the Gulf of Mexico, including the project area, vary temporally (i.e., seasonally) and spatially. In GulfCet II studies (Davis et al., 2000b), species diversity and density varied by hydrographic environment and by the presence and relative location of mesoscale features such as Loop Current eddies that may enhance nutrient levels and productivity of surface waters where these seabird species forage (Hess and Ribic, 2000).

Trans-Gulf migratory birds including shorebirds, wading birds, and terrestrial birds may also be present in the lease area. Migrant birds may use offshore structures and vessels for resting, feeding, or as temporary shelter from inclement weather. Some birds may be attracted to offshore structures and vessels because of the lights and the fish populations that aggregate around these structures (Russell, 2005).

IPFs that could affect marine and pelagic birds include construction vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small diesel fuel spill and a large oil spill). Effluent discharges are likely to have negligible impacts on the birds due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of these animals. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the potential for marine debris-related impacts on birds. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Construction Vessel Presence, Noise, and Lights

Birds migrating over water have been known to strike offshore structures, resulting in death or injury (Wiese et al., 2001, Russell, 2005). Mortality of migrant birds at tall towers and other land-based structures has been reviewed extensively, and the mechanisms involved in offshore vessels appear to be similar. In some cases, migrants simply do not see a part of the rig until it is too late to avoid it. In other cases, navigation may be disrupted by noise or lighting (Russell, 2005). However, offshore structures may in some cases serve as suitable stopover habitats for trans-Gulf migrant species, particularly in spring (Russell, 2005).

Due to the limited scope and duration of construction vessel activities, any impacts on populations of either seabirds or trans-Gulf migrant birds from activities described in this DOCD are not expected to be significant.

Impacts of Support Vessel and Helicopter Traffic

Support vessels and helicopters are unlikely to significantly disturb pelagic birds in areas of open offshore waters. It is likely that individual birds would experience, at most, only short-term behavioral disruption resulting from support vessel and helicopter traffic, and the impact would not be significant.

Impacts of a Small Diesel Fuel Spill

Potential spill impacts on marine birds are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfers. In the unlikely event of a spill, implementation of Anadarko's OSRP could reduce the potential for impacts on marine and pelagic birds. **DOCD Section I** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small diesel fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small diesel fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The sea surface area covered with diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions.

Birds exposed to oil on the sea surface could experience direct physical and physiological effects including skin irritation; chemical burns of skin, eyes, and mucous membranes; and inhalation of toxic fumes. Due to the limited areal extent and short duration of water quality impacts from a small diesel fuel spill, secondary impacts due to ingestion of oil via contaminated prey or reductions in prey abundance are unlikely. Due to the low densities of birds in open ocean areas, the small area affected, and the brief duration of the surface slick, no significant impacts on pelagic birds are expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine and pelagic birds are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to spill impacts on marine birds.

Pelagic seabirds could be exposed to oil from a spill at the project area. Hess and Ribic (2000) reported that terns, storm-petrels, shearwaters, and jaegers were the most frequently sighted seabirds in the deepwater Gulf of Mexico (>656 ft [>200 m]). Powers (1987) indicated that seabird densities over the open ocean typically are less than 10 birds km^{-2}. The number of pelagic birds that could be affected in open offshore waters would depend on the extent and persistence of the oil slick.

Data following the Macondo spill provide relevant information about the species of pelagic birds that may be affected in the event of a large oil spill. Birds that have been treated for oiling include several pelagic species such as the Northern Gannet, Magnificent Frigatebird, and Masked Booby (USFWS, 2011). The Northern Gannet was among the species with the largest numbers of birds affected by the spill. NOAA reported that at least 93 resident and migratory bird species across all five Gulf Coast states were exposed to oil from the Macondo spill in multiple habitats, including offshore/open waters, island waterbird colonies, barrier islands, beaches, bays, and marshes (NOAA, 2016b). Exposure of marine birds to oil can result in adverse health with severity, depending on the level of oiling. Effects can range from plumage damage and loss of buoyancy from external oiling to more severe effects, such as organ damage, immune suppression, endocrine imbalance, reduced aerobic capacity, and death as a result of oil inhalation or ingestion (NOAA, 2016b). It is expected that impacts to marine birds from a large oil spill resulting in the death of individual birds would be adverse but not significant at population levels.

C.4.2 Coastal Birds

Threatened and endangered bird species (Piping Plover and Whooping Crane) were discussed in **Sections C.3.6** and **C.3.7**. The Brown Pelican (*Pelecanus occidentalis*) was delisted from federal endangered status in 2009 (USFWS, 2016b). However, this species remains listed as endangered by both Louisiana (State of Louisiana Department of Wildlife and Fisheries, 2005) and Mississippi (Mississippi Natural Heritage Program, 2015). The Brown Pelican was delisted as a species of special concern by the State of Florida in 2017 (Florida Fish and Wildlife Conservation Commission, 2017d). Brown Pelicans inhabit coastal habitats and forage within both coastal waters and waters of the inner continental shelf. Aerial and shipboard surveys, including GulfCet and GulfCet II (Davis et al., 2000b), indicate that Brown Pelicans do not occur in deep offshore waters (Fritts and Reynolds, 1981, Peake, 1996, Hess and Ribic, 2000). Nearly half the southeastern population of Brown Pelicans lives in the northern Gulf Coast, generally nesting on protected islands (USFWS, 2010a).

The Bald Eagle (*Haliaeetus leucocephalus*) was delisted from its threatened status in the lower 48 states on 28 June 2007. The Bald Eagle still receives protection under the Migratory Bird Treaty Act of 1918 and the Bald and Golden Eagle Protection Act of 1940 (USFWS, 2015). The Bald Eagle is a terrestrial raptor widely distributed across the southern U.S., including coastal habitats along the Gulf of Mexico. The Gulf Coast is inhabited by both wintering migrant and resident Bald Eagles (Johnsgard, 1990, Ehrlich et al., 1992).

Various species of non-endangered birds are also found along the northern Gulf Coast, including diving birds, shorebirds, marsh birds, wading birds, and waterfowl. Gulf Coast marshes and beaches also provide important feeding grounds and nesting habitats. Species that breed on beaches, flats, dunes, bars, barrier islands, and similar habitats include the Sandwich Tern, Wilson's Plover, Black Skimmer, Forster's Tern, Gull-Billed Tern, Laughing Gull, Least Tern, and Royal Tern (USFWS, 2010a). Additional information is presented by BOEM (2012a, 2017a).

IPFs that could affect coastal birds include support vessel and helicopter traffic and a large oil spill. A small diesel fuel spill in the lease area would be unlikely to affect shorebirds or coastal nesting birds, due to the lease area's distance from the nearest shoreline. As explained in **Section A.9.1**, a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the potential for marine debris-related impacts on shorebirds.

Impacts of Support Vessel and Helicopter Traffic

Support vessels and helicopters will transit coastal areas near Port Fourchon and Houma, Louisiana, where shorebirds and coastal nesting birds may be found. These activities could periodically disturb individuals or groups of birds within sensitive coastal habitats (e.g., wetlands that may support feeding, resting, or breeding birds).

Vessel traffic may disturb foraging and resting birds. Flushing distances vary among species and individuals (Rodgers and Schwikert, 2002). The disturbances will be limited to flushing birds away from vessel pathways; known distances are from 65 to 160 ft (20 to 49 m) for personal watercraft and 75 to 190 ft (23 to 58 m) for outboard-powered boats (Rodgers and Schwikert, 2002). Flushing distances may be similar or less for the support vessels to be used for Anadarko's project, and some species such as gulls are attracted to boats. Support vessels will not approach nesting or breeding areas on the shoreline, so disturbances to nesting birds, eggs, and chicks are not expected. Vessel operators will use designated navigation channels and comply with posted speed and wake restrictions while transiting sensitive inland waterways. Due to the limited scope and short duration of support vessel activities, any short-term impacts are not expected to be biologically significant to coastal bird populations.

Aircraft traffic can cause some disturbance to birds onshore and offshore. Responses are highly dependent on the type of aircraft, bird species, activities that animals were previously engaged in, and previous exposures to overflights (Efroymson et al., 2000). Helicopters seem to cause the most intense responses when compared with other anthropogenic disturbances for some species (Bélanger and Bédard, 1989). Federal Aviation Administration (FAA) Advisory Circular No. 91-36D recommends that pilots maintain a minimum altitude of 2,000 ft (610 m) when flying over noise sensitive areas such as wildlife refuges, parks, and areas with wilderness characteristics. This is greater than the distance (slant range) at which aircraft overflights have been reported to cause behavioral effects on most species of birds studied (Efroymson et al., 2000). With the FAA guidelines in effect, it is likely that individual birds would experience, at most, only short-term behavioral disruption.

Impacts of Large Oil Spill

The OSRA results summarized in **Table 3** estimate that shorelines of Plaquemines Parish, Louisiana, that includes habitat for shorebirds and coastal nesting birds is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other

Louisiana, Mississippi, and Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. The 60-day OSRA modeling (**Table 4**) predicts that shorelines between Matagorda County, Texas , and Levy County, Florida, have up to a 24% probability of contact within 60 days of a spill.

Coastal birds can be exposed to oil as they float on the water surface, dive during foraging, or wade in oiled coastal waters. Oiled birds can lose the ability to fly, dive for food, or float on the water, which could lead to drowning (USFWS, 2010b). Oil interferes with the water repellency of feathers and can cause hypothermia in the right conditions. As birds groom themselves, they can ingest and inhale the oil on their bodies. Scavengers such as Bald Eagles and gulls can be exposed to oil by feeding on carcasses of contaminated fish and wildlife. While ingestion can kill animals immediately, more often it results in lung, liver, and kidney damage, which can lead to death (BOEM, 2017a). Bird eggs may be damaged if an oiled adult sits on the nest.

Data from the Macondo spill provide an indication of the potential impacts of a large spill on coastal bird populations. According to NOAA (2016b), an estimated 51,600 to 84,500 birds were killed by the spill and the reproductive output lost as a result of breeding adult bird mortality was estimated to range from 4,600 to 17,900 fledglings that would have been produced in the absence of premature deaths of adult birds (NOAA, 2016b). Species with the largest numbers of estimated mortalities were American White Pelican, Black Skimmer, Black Tern, Brown Pelican, Laughing Gull, Least Tern, Northern Gannet, and Royal Tern (NOAA, 2016b).

Brown Pelicans are especially at risk from direct and indirect impacts from spilled oil within inner shelf and inshore waters, such as embayments. The range of this species is generally limited to these waters and surrounding coastal habitats. Brown Pelicans feed on mid-size fish that they capture by diving from above (i.e.,plunge diving) and then scooping the fish into their expandable gular pouch. This behavior makes them susceptible to plumage oiling if they feed in areas with surface oil or an oil sheen. They may also capture prey that has been physically contaminated with oil or has ingested oil. Issues for Brown Pelicans include direct contact with oil, disturbance from cleanup activities, and long-term habitat contamination (BOEM, 2012a).

The Bald Eagle also may be especially at risk from direct and indirect impacts from spilled oil. This species often captures fish within shallow water areas (snatching prey from the surface or wading into shallow areas to capture prey with their bill) and so may be susceptible to plumage oiling and, as with the Brown Pelican, they may also capture prey that has been physically contaminated with oil or has ingested oil (BOEM, 2012a). It is expected that impacts to coastal birds from a large oil spill resulting in the death of individual birds would be adverse but not significant at population levels.

C.5 Fisheries Resources

C.5.1 Pelagic Communities and Ichthyoplankton

Biggs and Ressler (2000) reviewed the biology of pelagic communities in the deepwater environment of the northern Gulf of Mexico. The biological oceanography of the region is dominated by the influence of the Loop Current, the surface waters of which are among the most oligotrophic in the world’s oceans. Superimposed on this low-productivity condition are productive "hot spots" associated with entrainment of nutrient-rich Mississippi River water and mesoscale oceanographic features. Anticyclonic and cyclonic hydrographic features play an important role in determining biogeographic patterns and controlling primary productivity in the northern Gulf of Mexico (Biggs and Ressler, 2000).

Most fishes inhabiting shelf or oceanic waters of the Gulf of Mexico have planktonic eggs and larvae (Ditty, 1986, Ditty et al., 1988, Richards et al., 1989, Richards et al., 1993). A study by Ross et al. (2012) on midwater fauna to characterize vertical distribution of mesopelagic fishes in selected deepwater areas in the Gulf of Mexico substantiated high species richness but general numerical domination by relatively few families and species.

IPFs potentially affecting pelagic communities and ichthyoplankton include construction vessel presence, noise, and lights; effluent discharges; water intakes; and two types of accidents (a small diesel fuel spill and a large oil spill).

Impacts of Construction Vessel Presence, Noise, and Lights

The construction vessel, as floating structure in the deepwater environment, will act as a fish aggregating device (FAD). In oceanic waters, the FAD effect would be most pronounced for epipelagic fishes such as tunas, dolphin, billfishes, and jacks, which are commonly attracted to fixed and drifting surface structures (Higashi, 1994, Relini et al., 1994, Holand, 1997). Positive fish associations with offshore rigs and platforms in the Gulf of Mexico are well documented (Gallaway and Lewbel, 1982, Wilson et al., 2003, Peabody and Wilson, 2006). The FAD effect could possibly enhance the feeding of epipelagic predators by attracting and concentrating smaller fish species. Construction vessel noise could potentially cause masking in fishes, thereby reducing their ability to hear biologically relevant sounds (Radford et al., 2014).

The only defined acoustic threshold levels for continuous noise are given by Popper et al. (2014) and apply only to species of fish with swim bladders that provide some hearing (pressure detection) function. Popper et al. (2014) estimated threshold levels of 170 dB re 1 µPa accumulated over a 48-hour period for onset of recoverable injury and 158 dB re 1 µPa accumulated over a 12-hour period for onset temporary auditory threshold shifts. However, no consistent behavioral thresholds for fish have been established (Hawkins and Popper, 2014). Noise may also influence fish behaviors, such as predator-avoidance, foraging, reproduction, intraspecific interactions, and offspring survival (Picciulin et al., 2010, Bruintjes and Radford, 2013, McLaughlin and Kunc, 2015, Simpson et al., 2016, Nedelec et al., 2017). Fish aggregating is likely to occur to some degree due to the presence of the construction vessel, but the impacts would be limited in geographic scope and no population level impacts are expected.

Few data exist regarding the impacts of noise on pelagic larvae and eggs. Generally, it is believed that larval fish will have similar hearing sensitivities as adults, but may be more susceptible to barotrauma injuries associated with impulsive noise (Popper et al., 2014). Larval fish were experimentally exposed to simulated impulsive sounds by Bolle et al. (2012). The controlled playbacks produced cumulative exposures of 206 dB re 1 $\mu Pa^2 \cdot s$ but resulted in no increased mortality between the exposure and control groups. Non-impulsive noise sources are expected to be less injurious than impulsive noise. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters, are not expected to produce received levels greater than 160 dB re 1 µPa beyond 82 ft (25 m) from the source. Because of the limited propagation distances of high sound pressure levels and the periodic and transient nature of ichthyoplankton, no impacts to these life stages are expected.

Impacts of Effluent Discharges

Treated sanitary and domestic wastes may have a slight effect on the pelagic environment in the immediate vicinity of these discharges. These wastes may have elevated levels of nutrients, organic matter, and chlorine, but should dilute rapidly to undetectable levels within tens to hundreds of meters from the source. As a result of quick dilution, minimal impacts on water quality, plankton, and nekton are anticipated.

Deck drainage may have a slight effect on the pelagic environment in the immediate vicinity of these discharges. Deck drainage from contaminated areas will be passed through an oil-and-water separator prior to release, and discharges will be monitored for visible sheen. The discharges may have slightly elevated levels of hydrocarbons but should dilute rapidly to undetectable levels within tens to hundreds of meters from the source. Minimal impacts on water quality, plankton, and nekton are anticipated.

Other discharges in accordance with the NPDES permit, such as non-pollutant completion fluids, subsea production control fluid, produced water, desalination unit brine and uncontaminated cooling water, fire water, bilge, and ballast water, are expected to dilute rapidly and have little or no impact on water column biota.

Impacts of Water Intakes

Seawater will be drawn from the ocean for once-through, non-contact cooling of machinery on the construction vessel. The construction vessel ultimately chosen for this project will be in compliance with all cooling water intake requirements of the NPDES permit to comply with Section 316(b) of the Clean Water Act.

The intake of seawater for cooling water will entrain plankton. The low intake velocity should allow most strong-swimming juvenile fishes and smaller adults to escape entrainment or impingement. However, drifting plankton would not be able to escape entrainment with the exception of a few fast-swimming larvae of certain taxonomic groups. The entrained organisms may be stressed or killed, primarily through changes in water temperature during the route from cooling intake structure to discharge structure and through mechanical damage (turbulence in pumps and condensers) (BOEM, 2017a). Due to the limited scope and duration of proposed activities, any short-term impacts of entrainment are not expected to be significant on a population level for plankton or ichthyoplankton.

Impacts of a Small Diesel Fuel Spill

Potential spill impacts on fisheries resources are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to spill impacts.

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfers between the supply vessel and project area. In the unlikely event of a spill, implementation of Anadarko's OSRP could mitigate the potential for impacts on pelagic communities, including ichthyoplankton. **DOCD Section I** provides detail on spill response measures. Given the open ocean location of the lease area and the duration of a small spill, the opportunity for impacts to occur would be very brief.

A small diesel fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small diesel fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The sea surface area covered with diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions.

A small diesel fuel spill could have localized impacts (i.e., hydrocarbon contamination) on phytoplankton, zooplankton, and nekton. Due to the limited areal extent and short duration of water quality impacts, a small diesel fuel spill would be unlikely to produce detectable impacts on pelagic communities.

Impacts of a Large Oil Spill

Potential spill impacts on pelagic communities and ichthyoplankton are discussed by BOEM (2016b, 2017 a,b). For this DOCD, there are no unique site-specific issues.

A large oil spill could directly affect water column biota including phytoplankton, zooplankton, ichthyoplankton, and nekton. A large spill that persisted for weeks or months would be more likely to affect these communities. While adult and juvenile fishes may actively avoid a large spill, planktonic eggs and larvae would be unable to avoid contact. Fish eggs and larvae are especially vulnerable to oiling because they inhabit the upper layers of the water column, and they will die if exposed to certain toxic fractions of spilled oil. Impacts could be greater if local-scale currents retained planktonic larval assemblages (and the floating oil slick) within the same water mass. Impacts to ichthyoplankton from a large spill would be greatest during spring and summer when shelf concentrations peak (BOEM, 2016b). Adult and juvenile fishes could also be impacted through the ingestion of oiled prey (USFWS, 2010b). It is expected that impacts to pelagic communites and ichthyoplankton from a large oil spill resulting in the death of individual fishes would be adverse but not significant at population levels.

C.5.2 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined as the waters and substrate necessary to fish for spawning, breeding, feeding, and growth to maturity. Under the Magnuson-Stevens Fishery Conservation and Management Act, as amended, federal agencies are required to consult on activities that may adversely affect EFH designated in Fishery Management Plans developed by the regional Fishery Management Councils.

The Gulf of Mexico Fishery Management Council (GMFMC) has prepared Fishery Management Plans for corals and coral reefs, shrimps, spiny lobster, reef fishes, coastal migratory pelagic fishes, and red drum. In 2005, the EFH for these managed species was redefined in Generic Amendment No. 3 to the various Fishery Management Plans (Gulf of Mexico Fishery Management Council, 2005). The EFH for most of these GMFMC-managed species is on the continental shelf in waters shallower than 600 ft (183 m). The shelf edge is the outer boundary for coastal migratory pelagic fishes, reef fishes, and shrimps. EFH for corals and coral reefs includes some shelf-edge topographic features located approximately 14 miles (23 km) west-northwest of the lease area.

Highly migratory pelagic fishes, which occur as transients in the lease area, are the only remaining group for which EFH has been identified in the deepwater Gulf of Mexico. Species in this group, including tunas, swordfishes, billfishes, and sharks are managed by NMFS. Highly migratory species with EFH in or near the lease area include the following species and life stages (NMFS, 2009b):

- Bigeye thresher shark (all)
- Blue marlin (juveniles, adults)
- Bluefin tuna (spawning, eggs, larvae)
- Bull shark (adults)
- Longfin mako shark (all)
- Oceanic whitetip shark (all)
- Scalloped hammerhead shark (juveniles, adults)
- Silky Shark (all)
- Skipjack tuna (spawning, adults)
- Smooth Dogfish (all)
- Swordfish (larvae, juveniles)
- Whale shark (all)
- White marlin (juveniles, adults)
- Yellowfin tuna (spawning, juveniles, adults)

Research indicates the central and western Gulf of Mexico may be important spawning habitat for Atlantic bluefin tuna (*Thunnus thynnus*), and NMFS (2009b) has designated a Habitat Area of Particular Concern (HAPC) for this species. The HAPC covers much of the deepwater Gulf of Mexico, including the lease area (**Figure 4**). The areal extent of the HAPC is approximately 115,830 miles^2 (300,000 km^2). The prevailing assumption is that Atlantic bluefin tuna follow an annual cycle of foraging in June through March off the eastern U.S. and Canadian coasts, followed by migration to the Gulf of Mexico to spawn in April, May, and June (NMFS, 2009b). The Atlantic bluefin tuna has also been designated as a species of concern (NMFS, 2011).

An amendment to the original EFH Generic Amendment was finalized in 2005 (Gulf of Mexico Fishery Management Council, 2005). One of the most significant proposed changes in this amendment reduced the extent of EFH relative to the 1998 Generic Amendment by removing the EFH description and identification from waters between 100 fathoms and the seaward limit of the Exclusive Economic Zone (EEZ). The Highly Migratory Species Fisheries Management Plan was amended in 2009 to update EFH and HAPC to include the bluefin tuna spawning area (NMFS, 2009b).

NTLs 2009-G39 and 2009-G40 provide guidance and clarification of regulations for biologically sensitive underwater features and areas and benthic communities that are considered EFH. As part of an agreement between BOEM and NMFS to complete a new programmatic EFH consultation for each new Five-Year Program, an EFH consultation was initiated between BOEM's Gulf of Mexico Region and NOAA's Southeastern Region during the preparation, distribution, and review of BOEM's 2017-2022 Multisale EIS (BOEM, 2017a). The EFH assessment was completed and there is ongoing coordination among NMFS, BOEM, and BSEE, including discussions of mitigation (BOEM, 2016c).

Other HAPCs have been identified by the Gulf of Mexico Fishery Management Council (2005). These include the Florida Middle Grounds, Madison-Swanson Marine Reserve, Dry Tortugas North and South Ecological Reserves, Pulley Ridge, and several individual reefs and banks of the northwestern Gulf of Mexico. (**Figure 4**). The nearest HAPC is Madison Swanson Marine Reserve, located approximately 126 miles (203 km) east of the lease area.

IPFs that could affect EFH include construction vessel presence, noise, and lights; effluent discharges; water intakes; and two types of accidents (a small diesel fuel spill and a large oil spill).

Impacts of Construction Vessel Presence, Noise, and Lights

The construction vessel, as a floating structure in the deepwater environment, will act as an FAD. In oceanic waters, the FAD effect would be most pronounced for epipelagic fishes such as tunas, dolphin, billfishes, and jacks, which are commonly attracted to fixed and drifting surface structures (Holland, 1990, Higashi, 1994, Relini et al., 1994). The FAD effect would possibly enhance feeding of epipelagic predators by attracting and concentrating smaller fish species. Construction vessel noise could potentially cause acoustic masking for fishes, thereby reducing their ability to hear biologically relevant sounds (Radford et al., 2014). Noise may also influence fish behaviors such as predator avoidance, foraging, reproduction, and intraspecific interactions (Picciulin et al., 2010, Bruintjes and Radford, 2013, McLaughlin and Kunc, 2015).

The only defined acoustic threshold levels for continuous noise are given by Popper et al. (2014) and apply only to species of fish with swim bladders that provide some hearing (pressure detection) function. Popper et al. (2014) estimated threshold levels of 170 dB re 1 µPa accumulated over a 48-hour period for onset of recoverable injury and 158 dB re 1 µPa accumulated over a 12-hour period for onset temporary auditory threshold shifts. No consistent behavioral thresholds for fish have been established (Hawkins and Popper, 2014). Because the construction vessel is a temporary structure, any impacts on EFH for highly migratory pelagic fishes are considered minor.

Few data exist regarding the impacts of noise on pelagic larvae and eggs. Generally, it is believed that larval fish will have similar hearing sensitivities as adults, but may be more susceptible to barotrauma injuries associated with impulsive noise (Popper et al., 2014). Larval fish were experimentally exposed to simulated impulsive sounds by Bolle et al. (2012). The controlled playbacks produced cumulative exposures of 206 dB re 1 $\mu Pa^2 \cdot s$ but resulted in no increased mortality between the exposure and control groups. Non-impulsive noise sources are expected to be less injurious than impulsive noise. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters in use during offshore operations, are not expected to produce received levels greater than 160 dB re 1 µPa beyond 82 ft (25 m) from the source. Because of the limited propagation distances of high sound pressure levels and the periodic and transient nature of ichthyoplankton, no impacts to these life stages are expected.

Impacts of Effluent Discharges

Effluent discharges affecting EFH by diminishing ambient water quality include treated sanitary and domestic wastes, deck drainage, non-pollutant completion fluids, subsea production control fluid, produced water, and miscellaneous discharges such as desalination unit brine, uncontaminated cooling water, fire water, and bilge and ballast water. Impacts on water quality have been discussed previously. No significant impacts on EFH for highly migratory pelagic fishes are expected from these discharges if discharged according to NPDES permit conditions.

Impacts of Water Intakes

As noted previously, cooling water intake will cause entrainment and impingement of plankton, including fish eggs and larvae (ichthyoplankton). Due to the limited scope and relatively short duration of installation activities, any short-term impacts on EFH for highly migratory pelagic fishes due to water intake are not expected to be biologically significant if operated in compliance with USEPA requirements.

Impacts of a Small Diesel Fuel Spill

Potential spill impacts on EFH are discussed by BOEM (2016c, 2017a). For this DOCD, there are no unique site-specific issues with respect to spill impacts.

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfer between the supply vessel and construction vessel. In the unlikely event of a spill, implementation of Anadarko's OSRP could help diminish the potential for impacts on EFH. **DOCD Section I** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small diesel fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small diesel fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The sea surface area covered with diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions.

A small diesel fuel spill could have localized impacts on EFH for highly migratory pelagic fishes, including tunas, swordfishes, billfishes, and sharks. These species occur as transients in the lease area. A spill would also produce short-term impacts on surface and near-surface water quality in the HAPC for spawning bluefin tuna, which covers much of the deepwater Gulf of Mexico. The affected area would represent a negligible portion of the HAPC, which covers approximately 115,830 miles^2 (300,000 km^2) of the Gulf of Mexico.

A small diesel fuel spill would likely not affect EFH for corals and coral reefs, the nearest of which is located approximately 14 miles (23 km) west-northwest from the project area. A small diesel fuel spill would float and dissipate on the sea surface and would not contact these features.

Impacts of a Large Oil Spill

Potential spill impacts on EFH are discussed by BOEM (2016c, 2017a). For this DOCD, there are no unique site-specific issues with respect to EFH.

An oil spill in offshore waters would temporarily increase hydrocarbon concentrations on the water surface and potentially in the subsurface as well. Given the extent of EFH designations in the Gulf of Mexico (Gulf of Mexico Fishery Management Council, 2005, NMFS, 2009b), some impact on EFH would be unavoidable.

A large spill could affect the EFH for many managed species including shrimp, spiny lobster, reef fishes, coastal migratory pelagic fishes, and red drum. It would result in adverse impacts on water quality and water column biota including phytoplankton, zooplankton, and nekton. In coastal waters, sediments could be contaminated and result in persistent degradation of the seafloor habitat for managed demersal fish and shellfish species.

The lease area is within the HAPC for spawning Atlantic bluefin tuna (NMFS, 2009b). A large spill could temporarily degrade the HAPC due to increased hydrocarbon concentrations in the water column, with the potential for lethal or sublethal impacts on spawning tuna. Potential impacts would depend in part on the timing of a spill, as the species migrates to the Gulf of Mexico to spawn in April, May, and June (NMFS, 2009b).

The nearest feature designated as EFH for corals is located approximately 14 miles (23 km) west-northwest from the lease area. An accidental spill could reach or affect this feature, although near-bottom currents in the region are expected to flow along the isobaths (Nowlin et al., 2001, Valentine et al., 2014) and typically would not carry a plume up onto the continental shelf edge.

C.6 Archaeological Resources

C.6.1 Shipwreck Sites

Based on NTL 2011-JOINT-G01, the lease area is on BOEM's list of archaeology survey blocks (BOEM, 2011). No archaeological resources were noted in the site clearance letter for the wellsite where the proposed installation activities will occur (Geoscience Earth & Marine Services Inc., 2014).

Anadarko will abide by the applicable requirements of NTL 2005-G07, which stipulate that work be stopped at the project site if any previously undetected archaeological resource is discovered after work has begun until appropriate surveys and evaluations have been completed. Because there are no known shipwreck sites in the lease area, there are no routine IPFs that are likely to affect shipwrecks. Impacts of a large oil spill are the only IPFs considered. A small diesel fuel spill would not affect shipwrecks because the oil would float and dissipate on the sea surface.

Impacts of a Large Oil Spill

BOEM (2012a) estimated that a severe subsurface blowout could resuspend and disperse sediments within a 984 ft (300 m) radius. Because there are no historic shipwrecks in the lease area, this impact would not be relevant.

Beyond this radius, there is the potential for impacts from oil, dispersants, and depleted oxygen levels. These impacts could include chemical contamination as well as alteration of the rates of microbial activity (BOEM, 2017a). During the Macondo spill, subsurface plumes were reported at a water depth of approximately 3,609 ft (1,100 m), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface plumes apparently resulted from the use of subsea dispersants at the wellhead (NOAA, 2011c). While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could have the potential to contact shipwreck sites beyond the 984 ft (300 m) radius estimated by BOEM (2012a), depending on its extent, trajectory, and persistence (Spier et al., 2013). If oil from a subsea spill should come into contact with wooden shipwrecks on the seafloor, it could adversely affect their condition or preservation. Should there be any indication that potential shipwreck sites could be affected, in accordance with NTL 2005-G07, Anadarko will immediately halt operations, take steps to ensure that the site is not disturbed in any way, and contact BOEM Regional Supervisor, Leasing and Environment, within 48 hours of its discovery. Anadarko would cease all operations within 1,000 ft (305 m) of the site until the Regional Supervisor provides instructions on steps to take to assess the site's potential historic significance and protect it.

A spill entering shallow coastal waters could conceivably contaminate an undiscovered shipwreck site. The 30-day OSRA modeling summarized in **Table 3** predicts that shorelines in

Plaquemines Parish, Louisiana, is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Mississippi, or Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. In addition, the 60-day OSRA modeling (**Table 4**) predicts that shorelines between Matagorda County, Texas, and Levy County, Florida, have up to a 24% conditional probability of oil contact within 60 days of a spill. If an oil spill contacted a coastal historic site, such as a fort or a lighthouse, the impacts may be temporary and reversible (BOEM, 2017a).

C.6.2 Prehistoric Archaeological Sites

With a water depth at the location of the proposed activities approximately 5,466 ft (1,666 m), the project area is well beyond the 197 ft (60 m) depth contour used by BOEM as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. Because of this, the only relevant IPF is a large oil spill. A small diesel fuel spill would not affect prehistoric archaeological resources because the oil would float and dissipate on the sea surface.

Impacts of a Large Oil Spill

Because of the water depth and the lack of prehistoric archaeological sites found in the lease area, they would not be impacted by the physical effects of a subsea blowout. BOEM (2012a) estimated that a severe subsurface blowout could resuspend and disperse sediments within a 984 ft (300 m) radius.

Along the northern Gulf Coast, prehistoric sites occur frequently along the barrier islands and mainland coast and along the margins of bays and bayous (BOEM, 2016a). The 30-day OSRA modeling summarized in **Table 3** estimates that shorelines in Plaquemines Parish, Louisiana, is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Mississippi, or Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. In addition, the 60-day OSRA modeling (**Table 4**) predicts that shorelines between Matagorda County, Texas, and Levy County, Florida, have up to a 24% conditional probability of oil contact within 60 days of a spill. If a spill did reach a prehistoric site along these shorelines, it could coat fragile artifacts or site features and compromise the potential for radiocarbon dating organic materials in a site. Coastal prehistoric sites also could be damaged by spill cleanup operations (e.g., by destroying fragile artifacts and disturbing the provenance of artifacts and site features). BOEM (2017c) notes that some unavoidable direct and indirect impacts on coastal historic resources could occur, resulting in the loss of information.

C.7 Coastal Habitats and Protected Areas

Coastal habitats in the northeastern Gulf of Mexico that may be affected by oil and gas activities are described by BOEM (2016a, 2017 a,b), and are tabulated in the OSRP. Coastal habitats inshore of the project area include coastal and barrier island beaches and dunes, wetlands, and submerged seagrass beds. Most of the northeastern Gulf of Mexico is fringed by coastal and barrier island beaches, with wetlands and submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries.

Due to the distance from shore, the only IPF associated with routine activities in the lease area that could affect beaches and dunes, wetlands, seagrass beds, coastal wildlife refuges, wilderness areas, or any other managed or protected coastal area is support vessel traffic. The support bases at Port Fourchon and Houma, Louisiana, are not in wildlife refuges or wilderness areas. Potential impacts of support vessel traffic are briefly addressed below.

A large oil spill is the only accidental IPF that could affect coastal habitats and protected areas. A small diesel fuel spill in the lease area would be unlikely to affect coastal habitats due to the lease area's distance from the nearest shoreline. As explained in **Section A.9.1**, a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion.

Impacts of Support Vessel Traffic

Support operations, including crew boats and supply boats as detailed in **DOCD Section H**, may have a minor incremental impact on coastal and barrier island beaches, wetlands, and protected areas. Over time with a large number of vessel trips, vessel wakes can erode shorelines along inlets, channels, and harbors, resulting in localized land loss. Impacts to beaches, wetlands, and protected areas will be minimized by following the speed and wake restrictions in harbors and channels.

Support operations, including crew boats and supply boats are not anticipated to have a significant impact on submerged seagrass beds. While submerged seagrass beds have the potential to be uprooted, scarred, or lost due to direct contact from vessels, use of navigation channels and adherence to local requirements and implemented programs will decrease the likelihood of impacts to submerged seagrass beds (BOEM, 2017 a,b).

Impacts of a Large Oil Spill

Potential spill impacts on coastal habitats are discussed by BOEM (2017a). Coastal habitats inshore of the project area include coastal and barrier island beaches, wetlands, and submerged seagrass beds. For this DOCD, there are no unique site-specific issues with respect to coastal habitats.

The 30-day OSRA modeling (**Table 3**) indicates that shorelines in Plaquemines Parish, Louisiana, is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Mississippi, or Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. The 60-day OSRA modeling (**Table 4**) predicts that shorelines between Matagorda County, Texas, and Levy County, Florida, have up to a 24% conditional probability of oil contact within 60 days of a spill.

The shorelines within the geographic range predicted by the 60-day OSRA modeling (**Table 4**) include extensive barrier beaches and wetlands, with submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries. NWRs and other protected areas along the coast are discussed by BOEM (2017a) and Anadarko's OSRP. Based on the 30-day OSRA, coastal and near-coastal wildlife refuges, wilderness areas, and state and national parks within the geographic range of the potential shoreline contacts within 30 days are presented in **Table 7**.

Table 7. Wildlife refuges, wilderness areas, and state and national parks and preserves within the geographic range of 1% or greater conditional probability of shoreline contacts within 30 days based on the 30-day Oil Spill Risk Analysis model.

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
Terrebonne, Louisiana	Isles Dernieres Barrier Islands Refuge
	Pointe aux Chenes Wildlife Management Area
Lafourche, Louisiana	East Timbalier Island National Wildlife Refuge
	Pointe aux Chenes Wildlife Management Area
	Wisner Wildlife Management Area (Includes Picciola Tract)
Plaquemines, Louisiana	Breton National Wildlife Refuge
	Delta National Wildlife Refuge
	Pass a Loutre Wildlife Management Area
St. Bernard, Louisiana	Biloxi Wildlife Management Area
	Breton National Wildlife Refuge
	Saint Bernard State Park
Hancock and Harrison, Mississippi	Grand Bayou Preserve
	Jourdan River Preserve
	Hancock County Marshes Preserve
	Bayou Portage Preserve
	Biloxi River Marshes Preserve
	Cat Island Preserve
	Deer Island Preserve
	Gulf Islands National Seashore
	Hiller Park Recreational Area
	Sandhill Crane Refuge Preserve
	Ship Island Preserve
	Wolf River Preserve
Jackson, Mississippi	Bellefontaine Marsh Preserve
	Davis Bayou Preserve
	Escatawpa River Marsh Preserve
	Grand Bay National Estuarine Research Reserve
	Grand Bay Savanna Preserve
	Graveline Bay Preserve
	Gulf Islands National Seashore
	Gulf Islands Wilderness
	Horn Island Preserve
	Old Fort Bayou Preserve
	Pascagoula River Marsh Preserve
	Petit Bois Island Preserve
	Round Island Preserve
	Shepard State Park

Table 7. (Continued).

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
Baldwin, Alabama	Betty and Crawford Rainwater Perdido River Nature Preserve
	Bon Secour National Wildlife Refuge
	Gulf State Park
	Meaher State Park
	Mobile-Tensaw Delta CIAP Parcel State Habitat Area
	Mobile-Tensaw Delta Wildlife Management Area
	Perdido River Water Management Area
	W.L. Holland Wildlife Management Area
	Weeks Bay Harris and Worcester Tracts
	Weeks Bay National Estuarine Research Reserve
	Weeks Bay Reserve Addition - Beck Tract
Mobile, Alabama	Grand Bay National Wildlife Refuge
	Grand Bay Savanna State Nature Preserve
	Mobile-Tensaw Delta Wildlife Management Area
	Penalver Park
	The Grand Bay Savanna Tract (and Addition Tract)
	W.L. Holland Wildlife Management Area
Escambia, Florida	Bayou Marcus Wetlands
	Big Lagoon State Park
	Blue Angel Recreation Park
	Bay Bluffs Park
	Ft. Pickens Aquatic Preserve
	Gulf Islands National Seashore
	Mallory Heights Park #3
	Perdido Bay/Crown Pointe Preserve
	Perdido Key State Park
	Tarkiln Bayou Preserve State Park
	USS Massachusetts (BB-2) Underwater Archaeological Preserve
	Wayside Park
Okaloosa, Florida	Eglin Beach Park
	Fred Gannon Rocky Bayou State Park
	Gulf Islands National Seashore
	Henderson Beach State Park
	Rocky Bayou Aquatic Preserve
	Yellow River Wildlife Management Area
Walton, Florida	Choctawhatchee River Delta Preserve
	Choctawhatchee River Water Management Area
	Deer Lake State Park
	Grayton Beach State Park
	Point Washington State Forest
	Topsail Hill Preserve State Park
Bay, Florida	Camp Helen State Park
	SS Tarpon Underwater Archaeological Preserve
	St. Andrews Aquatic Preserve
	St. Andrews State Park
	Vamar Underwater Archaeological Preserve

Table 7. (Continued).

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
Gulf, Florida	Apalachicola Bay Aquatic Preserve
	Apalachicola National Estuarine Research Reserve
	Apalachicola River Wildlife and Environmental Area
	Apalachicola River Water Management Area
	Box-R Wildlife Management Area
	Constitution Convention Museum State Park
	St. Joseph Bay State Buffer Preserve
	St. Joseph Bay Aquatic Preserve
	T.H. Stone Memorial St. Joseph Peninsula State Park
Franklin, Florida	Alligator Harbor Aquatic Preserve
	Apalachicola Bay Aquatic Preserve
	Apalachicola National Estuarine Research Reserve
	Bald Point State Park
	Cape St. George State Island State Reserve
	Dr. Julian G. Bruce St. George Island State Park
	Jeff Lewis Wilderness Preserve
	John S. Phipps Preserve
	St. Marks National Wildlife Refuge
	St. Vincent National Wildlife Refuge
	Tate's Hell State Forest

The level of impacts from oil spills on coastal habitats depends on many factors, including the oil characteristics, the geographic location of the landfall, and the weather and oceanographic conditions during the time of the spill (BOEM, 2017 a,b). Oil that makes it to beaches may be either liquid weathered oil, an oil-and-water mousse, or tarballs. Oil is generally deposited on beaches in lines defined by wave action at the time of landfall. Oil that remains on the beach will thicken as its volatile components are lost. Thickened oil may form tarballs or aggregations that incorporate sand, shell, and other materials into its mass. Tar may be buried to varying depths under the sand. On warm days, both exposed and buried tarballs may liquefy and ooze. Oozing may also serve to expand the size of a mass as it incorporates beach materials. Oil on beaches may be cleaned up manually, mechanically, or both. Some oil can remain on the beach at varying depths and may persist for several years as it slowly biodegrades and volatilizes (BOEM, 2017a). Impacts associated with an extensive oiling of coastal and barrier island beaches from a large oil spill are expected to be adverse.

Coastal wetlands are highly sensitive to oiling and can be significantly affected because of the inherent toxicity of hydrocarbon and non-hydrocarbon components of the spilled substances (Beazley et al., 2012, Lin and Mendelssohn, 2012, Mendelssohn et al., 2012). Numerous variables such as oil concentration and chemical composition, vegetation type and density, season or weather, preexisting stress levels, soil types, and water levels may influence the impacts of oil exposure on wetlands. Light oiling could cause plant die-back, followed by recovery in a fairly short time. Vegetation exposed to oil that persists in wetlands could take years to recover (BOEM, 2017a). However, in a study in Barataria Bay, Louisiana, after the Macondo spill, Silliman et al. (2012) reported that vegetation in previously healthy marshes largely recovered to a pre-oiling state within 18 months. Oiled marshes that had prior accelerated rates of erosion experienced a bio-geomorphological feedback that further increased marsh loss to erosion and did not experience regrowth (Silliman et al., 2012). In addition to the direct impacts of oil, cleanup activities in marshes may accelerate rates of erosion and retard recovery rates (BOEM, 2017a, Lin et al., 2016, Turner et al., 2016, b). A recent review of the literature and new studies indicated that oil spill impacts to seagrass beds are often limited and may be limited to when oil is in direct contact with these plants (Fonseca et al., 2017). Impacts associated with an extensive oiling of coastal wetland habitat from a large oil spill are expected to be significant.

C.8 Socioeconomic and Other Resources

C.8.1 Recreational and Commercial Fishing

Potential impacts to recreational and commercial fishing are analyzed by BOEM (2017 a,b). The main commercial fishing activity in deep waters of the northern Gulf of Mexico is pelagic longlining for tunas, swordfishes, and other billfishes (Continental Shelf Associates, 2002). Pelagic longlining has occurred historically in the project area, primarily during spring and summer.

Longline gear consists of monofilament line deployed from a moving vessel and generally allowed to drift for 4 to 5 hours. As the mainline is put out, baited leaders and buoys are clipped in place at regular intervals. It takes 8 to 10 hours to deploy a longline and approximately the same time to retrieve it. Longlines are often set near oceanographic features such as fronts or downwellings, with the aid of sophisticated onboard temperature sensors, depth finders, and positioning equipment. Vessels typically are 33 to 98 ft (10 to 30 m) long, and their trips last from 1 to 3 weeks. The main Gulf of Mexico homeports for longlining vessels are in Louisiana (Dulac and Venice) and Florida (Destin, Madeira Beach, and Panama City) (Continental Shelf Associates, 2002).

It is unlikely that any commercial fishing activity other than longlining will occur in or near the project area due to the water depth at the project area. Benthic species targeted by commercial fishers occur on the upper continental slope, well inshore of the project area. Royal red shrimp (*Pleoticus robustus*) are caught by trawlers in water depths of approximately 820 to 1,804 ft (250 to 550 m). Tilefishes (primarily *Lophalotilus chamaeleonticeps*) are caught by bottom longlining in water depths from approximately 540 to 1,476 ft (165 to 450 m) (Continental Shelf Associates, 2002).

Most recreational fishing activity in the region occurs in water depths less than 656 ft (200 m) (Continental Shelf Associates, 1997, 2002). In deeper water, the main attraction to recreational fishers is petroleum rigs offshore Texas and Louisiana. Due to the project site's distance from shore, it is unlikely that recreational fishing activity is occurring in the lease area.

The only routine IPF potentially affecting fisheries and, therefore, commercial and recreational fishing, is construction vessel presence (including noise and lights). Potential accidental IPFs that could affect fisheries are include both a small diesel fuel spill and a large oil spill.

Impacts of Construction Vessel Presence, Noise, and Lights

There is a slight possibility of pelagic longlines becoming entangled in the construction vessel. For example, in January 1999 a portion of a pelagic longline snagged on the acoustic Doppler current profiler of a drillship working in the Gulf of Mexico (Continental Shelf Associates, 2002).

The line was removed without incident. Generally, longline fishers use radar and are aware of offshore structures and ships when placing their sets. Therefore, little or no impact on pelagic longlining is expected.

Because it is unlikely that any recreational fishing activity is occurring in the project area, no adverse impacts are anticipated. Other factors such as effluent discharges are likely to have negligible impacts on commercial or recreational fisheries due to rapid dispersion, the small area of ocean affected, and the intermittent nature of the discharges.

Impacts of a Small Diesel Fuel Spill

Pelagic longlining activities in the lease area, if any, could be interrupted in the event of a small diesel fuel spill. The sea surface area covered with diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions (**Section A.9.1**). Fishing activities could be interrupted due to the activities of response vessels operating in the lease area. A small diesel fuel spill would not affect coastal water quality because the spill would not be expected to make landfall or reach coastal waters prior to natural dispersion (**Section A.9.1**).

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfers. In the unlikely event of a spill, implementation of Anadarko's OSRP could potentially mitigate and reduce the potential for impacts. **DOCD Section I** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur is expected to be very brief.

Impacts of a Large Oil Spill

Potential spill impacts on fishing activities are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to this activity.

Pelagic longlining activities in the lease area and other fishing activities in the northern Gulf of Mexico could be interrupted in the event of a large oil spill. A spill may or may not result in fishery closures, depending on the duration of the spill, the oceanographic and meteorological conditions at the time, and the effectiveness of spill response measures. Data following the Macondo spill provide information about the maximum potential extent of fishery closures in the event of a large oil spill in the Gulf of Mexico (NMFS, 2010b). At its peak on 12 July 2010, closures encompassed 84,101 miles^2 (217,821 km^2), or 34.8% of the U.S. Gulf of Mexico EEZ. BOEM (2012a) notes that fisheries closures from a large spill event could have a negative effect on short-term fisheries catch and marketability.

According to BOEM (2012a, 2017 a,b), the potential impacts on commercial and recreational fishing activities from an accidental oil spill are anticipated to be minimal because the potential for oil spills is very low, the most typical events are small and of short duration, and the effects are so localized that fishes are typically able to avoid the affected area. Fish populations may be affected by an oil spill event should it occur, but they would be primarily affected if the oil reaches the productive shelf and estuarine areas where many fishes spend a portion of their life cycle. The probability of an offshore spill affecting these nearshore environments is also low. Should a large oil spill occur, economic impacts on commercial and recreational fishing activities would likely occur, but are difficult to predict because impacts would differ by fishery and season (BOEM, 2017a,b).

C.8.2 Public Health and Safety

There are no IPFs associated with routine operations that are expected to affect public health and safety. A small diesel fuel spill would not have any impacts on public health and safety because it would affect only a small area of the open ocean. The lease area is approximately 66 miles (106 km) from the nearest shoreline and nearly all of the diesel fuel would evaporate or disperse naturally within 24 hours (**Section A.9.1**). Impacts of a large oil spill are addressed below.

Impacts of a Large Oil Spill

In the event of a large spill from a blowout, the main safety and health concerns are those of the offshore personnel involved in the incident and those responding to the spill. The proposed activities will be covered by Anadarko's Regional OSRP and the construction vessel's emergency response plans.

Depending on the spill rate and duration, the physical/chemical characteristics of the oil, meteorological and oceanographic conditions at the time, and the effectiveness of spill response measures, the public could be exposed to oil on the water and along the shoreline, including skin contact or breathing VOCs. Oil is a highly flammable material, and any smoke or vapors from an oil fire can cause irritation, and in large quantities may pose a health hazard.

Studies conducted after the Macondo spill provide relevant information about the types of health issues that may occur in the event of a large oil spill. Wildlife cleaning and rehabilitation workers have reported concerns including scrapes and cuts, itchy or red skin or rash, and symptoms of headache or feeling faint, dizzy, or fatigued (King and Gibbins, 2011). Hand, shoulder, or back pain was reported by some wildlife-cleaning workers as well. Awkward postures, repetitive motions, and heavy lifting tasks were noted by investigators as contributing to musculoskeletal symptoms. Personnel working on offshore vessels or providing direct oversight to offshore vessels, including USCG personnel, civilian contractors, and other responders who were exposed to oil and dispersants, had a 7 to 12 times higher prevalence of upper respiratory symptoms and cough than those not exposed (Centers for Disease Control and Prevention, 2010). Another potential occupational hazard for spill response workers in general was heat stress from work in a hot and humid environment (King and Gibbins, 2011). Initial symptoms from cleanup workers who sought medical care in Louisiana were typical of acute exposure to hydrocarbons or H_2S (e.g., headaches, dizziness, nausea, vomiting, cough, respiratory distress, and chest pain) (Solomon and Janssen, 2010). Impacts associated with a large oil spill to public safety are expected to be adverse but not significant.

C.8.3 Employment and Infrastructure

There are no IPFs associated with routine operations that are expected to affect employment and infrastructure. The project involves support from an installation vessel contractor and associated third-party services, and existing shorebase facilities in Louisiana. No new or expanded facilities will be constructed, and no new employees are expected to move permanently into the area. The project will have a negligible impact on socioeconomic conditions such as local employment and existing offshore and coastal infrastructure. A small diesel fuel spill that is dissipated within a few days would have little or no economic impact, as the spill response would use existing facilities, resources, and personnel. Impacts of a large oil spill on employment and infrastrucre are addressed below.

Impacts of a Large Oil Spill

Potential socioeconomic impacts of an oil spill are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to employment and coastal infrastructure. A large spill could cause economic impacts in several ways: it could result in extensive fishery closures that put fishermen out of work; it could result in temporary employment as part of the response effort; it could result in adverse publicity that affects employment in coastal recreation and tourism industries; and it could result in another suspension of OCS drilling activities, including service and support operations that are an important part of local economies.

In addition to the analyses presented by BOEM (2012a), a study explored the economic impacts of the Macondo spill on oil and gas industry employment due to suspension of deepwater drilling (U.S. Department of Commerce, 2010). The study indicates that during the moratorium, the number of oil industry workers in the Gulf of Mexico fell by approximately 2,000 and may have indirectly caused a temporary loss of 8,000 to 12,000 jobs along the Gulf Coast. Total spending by drilling operators is estimated to have declined by $1.8 billion over a 6-month period; this direct reduction in spending affected employment in the industries that supply the Gulf drilling industry and in all other industries affected by declines in consumer and business spending (U.S. Department of Commerce, 2010).

As noted by BOEM (2012a), the short-term social and economic consequences for the Gulf Coast region should a large spill occur include the opportunity cost of employment and expenditures that could have gone to production or consumption rather the spill cleanup efforts. Nonmarket effects such as traffic congestion, strains on public services, shortages of commodities or services, and disruptions to the normal patterns of activities or expectations could also occur in the short term. These negative, short-term social and economic consequences of a spill are expected to be modest in terms of projected cleanup expenditures and the number of people employed in cleanup and remediation activities (BOEM, 2017 a,b). Net employment impacts from a spill would not be expected to exceed 1% of baseline employment in any given year (BOEM, 2012a).

C.8.4 Recreation and Tourism

For this DOCD, there are no unique site-specific issues with respect to this recreation and tourism. There are no known recreational uses of the lease area. Recreational resources and tourism in coastal areas would not be affected by any routine activities due to the distance from shore. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the chance of trash or debris being lost overboard from the construction vessel and subsequently washing up on beaches. A small diesel fuel spill in the lease area would be unlikely to affect recreation and tourism because, as explained in **Section A.9.1**, it would not be expected to make landfall or reach coastal waters prior to breaking up. Impacts of a large oil spill on recreation and tourism are discussed below.

Impacts of a Large Oil Spill

Potential impacts of an oil spill on recreation and tourism are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to these impacts.

Impacts on recreation and tourism would vary depending on the duration of the spill and its fate including the effectiveness of response measures. A large spill that reached coastal waters and shorelines could adversely affect recreation and tourism by contaminating beaches and wetlands, resulting in negative publicity that encourages people to stay away. The 30-day OSRA modeling (**Table 3**) indicates that Plaquemines Parish in Louisiana is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Mississippi, or Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. However, the 60-day OSRA modeling (**Table 4**) predicts that shorelines between Matagorda County, Texas, and Levy County, Florida, have up to a 24% conditional probability of oil contact within 60 days of a spill.

According to BOEM (2017 a,b), should an oil spill occur and contact a beach area or other recreational resource, it would cause some disruption during the impact and cleanup phases of the spill. However, these effects are also likely to be small in scale and of short duration, in part because the probability of an offshore spill contacting most beaches is small. In the unlikely event that a spill occurs that is sufficiently large enough to affect large areas of the coast and, through public perception, have effects that reach beyond the damaged area, effects to recreation and tourism could be significant (BOEM, 2017 a,b).

Impacts of the Macondo spill on recreation and tourism provide some insight into the potential effects of a large spill. NOAA (2016b) estimated that the public lost 16,857,116 user days of fishing, boating, and beach-going experiences as a result of the spill. The U.S. Travel Association has estimated the economic impact of the Macondo spill on tourism across the Gulf Coast over a 3-year period at $22.7 billion (Oxford Economics, 2010). Hotels and restaurants were the most affected tourism businesses, but charter fishing, marinas, and boat dealers and sellers were among the others affected (Eastern Research Group, 2014).

C.8.5 Land Use

Land use along the northern Gulf Coast is discussed by BOEM (2016a, 2017a). There are no routine IPFs that could affect land use. The project will use existing onshore support facilities in Louisiana. The land use at the existing shorebase sites is industrial. The project will not involve any new construction or changes to existing land use and therefore will not have any impacts. Levels of boat and helicopter traffic as well as demand for goods and services including scarce coastal resources will represent a small fraction of the level of activity occurring at the shorebases.

A large oil spill is the only relevant IPF on land use. A small diesel fuel spill would not have any impacts on land use, as the response would be staged out of existing shorebases and facilities.

Impacts of a Large Oil Spill

The initial response for a large oil spill would be staged out of existing facilities with no effect on land use. A large spill could have limited temporary impacts on land use along the coast if additional staging areas were needed. For example, during the Macondo spill, temporary staging areas were established in Louisiana, Mississippi, Alabama, and Florida for spill response and cleanup efforts. In the event of a large spill in the lease area, similar temporary staging areas could be needed. These areas would eventually return to their original use as the response is demobilized.

An accidental oil spill is not likely to significantly affect land use and coastal infrastructure in the region, in part because an offshore spill would have a small probability of contacting onshore resources. BOEM (2016b) states that landfill capacity would probably not be an issue at any phase of an oil spill event or the long-term recovery. In the case of the Macondo spill and response, the USEPA reported that existing landfills receiving oil spill waste had plenty of capacity to handle waste volumes; the wastes that were disposed of in landfills represented <7% of the total daily waste normally accepted at these landfills (USEPA, 2016).

C.8.6 Other Marine Uses

The lease area is not located within any USCG-designated fairway orshipping lane, but is located within Military Warning Area W-155B. The site clearance letter for the wellsite where the proposed activities will occur one well, one umbilical, and two pipelines within 2,000 ft (610 m) (Geoscience Earth & Marine Services Inc., 2014). Anadarko will comply with BOEM requirements and lease stipulations to avoid impacts to other marine uses.

There are no IPFs from routine project activities that are likely to affect other marine uses of the lease area. A large oil spill is the only relevant accident-related IPF on other marine uses. A small diesel fuel spill would not have any impacts on other marine uses because spill response activities would be mainly within the lease area and the duration would be brief.

Impacts of a Large Oil Spill

In the event of a large spill requiring numerous response vessels, coordination would be required to manage the vessel traffic for safe operations and to ensure that no anchoring or seafloor-disturbing activities occur near the existing wells. Other OCS activities located nearby the location of a large spill may be temporarily interrupted, which could include evacuation of non-essential personnel. Anadarko will comply with BOEM requirements and lease stipulations to avoid impacts on uses of the area by military vessels and aircraft.

C.9 Cumulative Impacts

For purposes of the National Environmental Policy Act, cumulative impact is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 CFR 1508.7). Any single activity or action may have a negligible impact(s) by itself, but when combined with impacts from other activities in the same area or time period, substantial impacts may result.

Prior Studies:

BOEM (2017a) prepared a multisale EIS in which it analyzed the environmental impact of activities that might occur in the multisale area. The level and types of activities planned in Anadarko's DOCD are within the range of activities described and evaluated by BOEM in the 2017 to 2022 Programmatic EIS for the OCS Oil and Gas Leasing Program (BOEM, 2016a), and the Final EIS for Gulf of Mexico OCS Oil and Gas Lease Sales 2017-2022 (BOEM, 2017a). Past, present, and reasonably foreseeable activities are identified in the cumulative effects scenario of these documents, which are incorporated by reference. The proposed activities should not result in any additional impacts beyond those evaluated in the multisale and Final EISs.

Description of Activities Reasonably Expected to Occur in the Vicinity of Project Area:

Other exploration and development activities are ongoing in the vicinity of the proposed project area. Anadarko does not anticipate other projects in the vicinity of the proposed project location beyond the types of projects analyzed in the lease sale and Supplemental EISs (BOEM, 2012 a,b, 2013a, 2014a, 2015, 2016b, 2017a,b).

Cumulative Impacts of Activities in this DOCD:

The BOEM (2017a) Final EIS included a lengthy discussion of cumulative impacts, which analyzed the environmental and socioeconomic impacts from the incremental impacts of the 10 proposed lease sales, in addition to all activities (including non-OCS activities) projected to occur from past, proposed, and future lease sales. The following activities were considered in development of the EISs: exploration, delineation, and development of wells, platform installation, service vessel trips, and oil spills. The EISs examined the potential cumulative effects on each specific resource for the entire Gulf of Mexico.

The level and type of activity proposed in Anadarko's DOCD are within the range of activities described and evaluated in the recent lease sale EISs. The EIA incorporates and builds on these analyses by examining the potential impacts on physical, biological, and socioeconomic resources from the work planned in this DOCD along with other reasonably foreseeable activities expected to occur in the Gulf of Mexico. Thus, for all impacts, the incremental contribution of Anadarko's proposed actions to the cumulative impacts in these prior analyses should not be significant.

D. Environmental Hazards

D.1 Geologic Hazards

The location of the wellsiute where the proposed activities will occcur is free of constraining seafloor conditions (Geoscience Earth & Marine Services Inc., 2014). See **DOCD Section D** for supporting geological and geophysical information.

D.2 Severe Weather

Under most circumstances, weather is not expected to have any effect on the proposed activities. Extreme weather, including high winds, strong currents, and large waves, was considered in the design criteria for the construction vessel under consideration for this project. High winds and limited visibility during a severe storm could disrupt support activities (vessel and helicopter traffic) and make it necessary to suspend some activities for safety reasons until the storm or weather event passes. In the event of a hurricane, procedures as outlined in the Hurricane Evacuation Plan would be adhered to. Evacuation in the event of a hurricane or other severe weather would increase the number and frequency of support vessel and helicopter trips to and from the project area.

D.3 Currents and Waves

Metocean conditions such as sea states, wind speed, and ocean currents will be continuously monitored. Under most circumstances, physical oceanographic conditions are not expected to have any effect on the proposed activities. Strong currents (e.g., caused by Loop Current eddies and intrusions) and large waves were considered in the design criteria for the construction vessel under consideration for this project. High waves during a severe storm could disrupt support activities (i.e., vessel and helicopter traffic) and make it necessary to suspend some activities for safety reasons until the storm or weather event passes.

E. Alternatives

No formal alternatives were evaluated in the EIA for this DOCD. However, various technical and operational options, including the locations of the wellsites and the selection of the construction vessel were considered by Anadarko in developing the proposed action.

F. Mitigation Measures

The proposed action includes numerous mitigation measures required by laws, regulations, and BSEE and BOEM lease stipulations and NTLs. The project will comply with all applicable federal, state, and local requirements concerning air pollutant emissions, discharges to water, and solid waste disposal. All project activities will be conducted under guidance by Anadarko's OSRP and Safety and Environmental Management System. Additional information can be found in **DOCD Section I**.

G. Consultation

No persons or agencies beyond those cited as Preparers (**Section H**) were consulted during the preparation of the EIA.

H. Preparers

The EIA was prepared by CSA Ocean Sciences Inc. Contributors included:

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OCS PLAN INFORMATION FORM (CONTINUED)
Include one copy of this page for each proposed well/structure

Proposed Well/Structure Location

Well or Structure Name/Number (If renaming well or structure, reference previous name): A-Marlin TLP				Previously reviewed under an approved EP or DOCD?	X	Yes		No
Is this an existing well or structure?	X	Yes		No	If this is an existing well or structure, list the Complex ID or API No.	00235		
Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?						Yes	X	No

WCD Info	For wells, volume of uncontrolled blowout (Bbls/Day): 18,000 bbl/day	For structures, volume of all storage and pipelines (Bbls): 327 bbl	API Gravity of fluid	32.8°

	Surface Location	**Bottom-Hole Location (For Wells)**	**Completion (For multiple completions, enter separate lines)**
Lease No.	OCS-G 06894		OCS OCS
Area Name	Viosca Knoll		
Block No.	915		
Blockline Departures (in feet)	N/S Departure: 690 FNL	N/S Departure:	N/S Departure F __ L N/S Departure F __ L N/S Departure F __ L
	E/W Departure: 7221 FEL	E/W Departure:	E/W Departure F __ L E/W Departure F __ L E/W Departure F __ L
Lambert X-Y coordinates	X: 1,339,179’	X:	X: X: X:
	Y: 10,564,590’	Y:	Y: Y: Y:
Latitude/ Longitude	Latitude: 29° 6’ 27.2” N	Latitude:	Latitude Latitude Latitude
	Longitude: 87° 56’ 37.04” W	Longitude:	Longitude Longitude Longitude

Water Depth (Feet): 3250’	MD (Feet):	TVD (Feet):	MD (Feet): MD (Feet): MD (Feet):	TVD (Feet): TVD (Feet): TVD (Feet):
Anchor Radius (if applicable) in feet:	NA			

Anchor Locations for Drilling Rig or Construction Barge (If anchor radius supplied above, not necessary)

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X:	Y:	
			X:	Y:	
			X:	Y:	
			X:	Y:	
			X:	Y:	
			X:	Y:	
			X:	Y:	
			X:	Y:	

OMB Control Number: 1010-0151
OMB Approval Expires: 12/31/14

OCS PLAN INFORMATION FORM

General Information

Type of OCS Plan:		Exploration Plan (EP)	Development Operations Coordination Document (DOCD)	X

Company Name: Anadarko Petroleum Corporation	BOEM Operator Number: 00981
Address:	Contact Person: Jill Fowler
1201 Lake Robbins Dr.	Phone Number: 832-636-1554
The Woodlands, TX 77380	E-Mail Address: jill.fowler@anadarko.com

If a service fee is required under 30 CFR 550.125(a), provide the	Amount paid	$4,238.00	Receipt No.	75415506667

Project and Worst Case Discharge (WCD) Information

Lease(s): OCS-G 06894	Area: VK	Block(s): 915	Project Name (If Applicable): Dorado

Objective(s)	x	Oil	x	Gas		Sulphur		Salt	Onshore Support Base(s): Fourchon, LA	

Platform/Well Name: VK 915 #007	Total Volume of WCD: 20,315 BOPD	API Gravity: 35.4
Distance to Closest Land (Miles): 66 miles	Volume from uncontrolled blowout: 2,437,800 bbls	

Have you previously provided information to verify the calculations and assumptions for your WCD?		Yes	x	No
If so, provide the Control Number of the EP or DOCD with which this information was provided				
Do you propose to use new or unusual technology to conduct your activities?		Yes	x	No
Do you propose to use a vessel with anchors to install or modify a structure?		Yes	x	No
Do you propose any facility that will serve as a host facility for deepwater subsea development?		Yes	x	No

Description of Proposed Activities and Tentative Schedule (Mark all that apply)

Proposed Activity	Start Date	End Date	No. of Days
Install lease term pipelines	06/15/2018	07/12/2018	27 days
Hookup VK 915 #007 & commence production	07/13/2018	N/A	7-10 years

Description of Drilling Rig

	Jackup		Drillship
	Gorilla Jackup		Platform rig
	Semisubmersible		Submersible
	DP Semisubmersible	x	Other (Attach Description)
Drilling Rig Name (If Known): DP Construction Vessel			

Description of Structure

	Caisson		Tension leg platform
	Fixed platform		Compliant tower
	Spar		Guyed tower
	Floating production system		Other (Attach Description)

Description of Lease Term Pipelines

From (Facility/Area/Block)	To (Facility/Area/Block)	Diameter (Inches)	Length (Feet)
See attached summary			

(f) Bonding Statement

The bond requirements for the activities and facilities proposed in this DOCD are satisfied by an area-wide bond furnished and maintained according to 30 CFR part 256, subpart I; NTL No. 2015-N04, "General Financial Assurance," and National NTL No. 2016-N01 "Requiring Additional Security".

(g) Oil Spill Financial Responsibility (OSFR)

Anadarko Petroleum Corporation (Company Number 00981) has demonstrated oil spill financial responsibility for the facilities proposed in this DOCD according to 30 CFR Part 254, and NTL No. 2008-N05, "Guidelines for Oil Spill Financial Responsibility for Covered Facilities".

(h) Deepwater Well Control Statement

Anadarko Petroleum Corporation (Company Number 00981) has the financial capability to drill a relief well and conduct other emergency well control operations if required.

(i) Suspensions of Production

Should a suspension of production become necessary to hold this lease, an application will be submitted to BOEM in accordance with NTL 2000-G17.

(j) Blowout Scenario

The worst-case discharge scenario for this project is defined as an uncontrollable discharge to the seafloor during production operations. The scenario assumes that the wellhead fails mechanically and a blowout occurs at the seafloor, allowing the entire wellbore fluid to flow up the existing production string.

The maximum oil discharge during production from Viosca Knoll (VK) Block 915 is calculated to be 20,315 BOPD from the VK 915 #007 well. The VK 915 #007 is addressed in this production blowout scenario since it is still the location with the highest potential worst case discharge (WCD) within the block.

Should a blowout occur, the formation types present in the GOM tend to bridge over in most cases. Additional well intervention and time requirements to drill a relief well pursuant to guidance provided in NTL No. 2015-N01 were discussed under the approved Exploration Plan (Plan Control No. S-7864). The following scenario summarizes the time taken to mobilize a rig and drill a relief well as discussed under previously approved Plan No. S-7864, which Anadarko would also utilize in the event of a blowout during a production scenario:

An estimate of 7-21 days would be required to suspend operations on a deepwater GOM well and begin drilling the relief well. This assumes 0-14 days to suspend current operations on an existing well and 7 days to mobilize and be ready to spud the relief well. The estimated time to drill the relief well to a blowout originating from the objective hydrocarbon zones is 80-99 days for an estimated total of 120 days maximum from time of blowout to completion of a relief well. The drilling days were based on the proposed days to drill the VK 915 #007 well through the objective sands (interval of WCD) with additional time added for ranging.

The time estimate provided for the plan well is inclusive of 'both' drilling 'and' completion operations. As a completion is not typically part of relief well operations no time has been included for completion operations in the relief well estimate. In addition, information and learning from the drilling of the original well may provide opportunities to optimize drilling performance for relief well operations and thus reduce the required drilling time. The maximum total volume during a production scenario blowout could potentially be **2,437,800 bbls** assuming 120 days for the maximum duration of a blowout, multiplied by the worst case daily uncontrolled production blowout volume of 20,315 bbls.

k) Chemical Products

Per NTL No. 2008-G04, information regarding chemical products is not required to accompany this plan.

H
AIR EMISSIONS INFORMATION

(a) Screening Questions

Screen Procedures for DOCD's	Yes	No
Is any calculated Complex Total (CT) Emission amount (tons) associated with your proposed development activities more than 90% of the amounts calculated using the following formulas: CT = $3400D^{2/3}$ for CO, and CT = 33.3D for the other air pollutants (where D = distance to shore in miles)?		X
Do your emission calculations include any emission reduction measures or modified emission factors?	X	
Does or will the facility complex associated with your proposed development and production activities process production from eight or more wells?	X	
Do you expect to encounter H_2S at concentrations greater than 20 parts per million (ppm)?		X
Do you propose to flare or vent natural gas in excess of the criteria set forth under 250.1105(a)(2) and (3)?		X
Do you propose to burn produced hydrocarbon liquids?		X
Are your proposed development and production activities located within 25 miles from shore?		X
Are your proposed development and production activities located within 200 kilometers of the Breton Wilderness Area?	X	

(b) Air Emissions Spreadsheets

Air emission worksheets have been prepared utilizing the maximum horsepower rating from an Anadarko contracted DP Construction Vessel. A different vessel may be utilized, but the horsepower rating, average engine load, and air emissions will be equal to, or less than, the calculated plan emission amounts shown on the following pages. Air Emission Spreadsheets have been prepared and are enclosed as **Attachment H-1.** The complex total emission amounts include previously approved air emissions from Revised DOCD Control No. R-06597. Air emissions previously included and approved under R-06597 are being brought forward under this plan; no changes have been made to these previously approved emissions other than SS installation activity info.

(c) Summary Information

Air Pollutant	Plan Emission Amounts[1] (tons)	Calculated Exemption Amounts[2] (tons)	Calculated Complex Total Emission Amounts[3] (tons)
Particulate matter (PM)	2.25	2197.80	10.98
Sulphur dioxide (SO_2)	0.04	2197.80	1.28
Nitrogen oxides (NO_x)	77.43	2197.80	1152.46
Volatile organic compounds (VOC)	2.32	2197.80	410.61
Carbon monoxide (CO)	16.89	55527.51	674.92

The air emission calculations were calculated by:

Jill Fowler
Regulatory Analyst
(832) 636-1554
jill.fowler@anadarko.com

DOCD AIR QUALITY SCREENING CHECKLIST

COMPANY	Anadarko Petroleum Corporation
AREA	Viosca Knoll
BLOCK	915
LEASE	OCS-G06894
PLATFORM	A-Marlin TLP
WELL	VK 915 #007
COMPANY CONTACT	Jill Fowler
TELEPHONE NO.	832-636-1554
REMARKS	Complex totals with Marlin TLP emissions, placing VK 915 #007 on production, and installation of subsea infrastructure. Air emissions previously included and approved under R-06597 (approved on 12/5/17) are being brought forward under this plan; no changes have been made to these previously approved emissions other than SS installation activity info.

LEASE TERM PIPELINE CONSTRUCTION INFORMATION:		
YEAR	NUMBER OF PIPELINES	TOTAL NUMBER OF CONSTRUCTION DAYS

Yes	No	Air Quality Screening Questions
	X	Is any calculated Complex Total (CT) Emission amount (tons) associated with your proposed development and production activities more than 90% of the amounts calculated using the following formulas: $CT = 3400D^{2/3}$ for CO, and $CT = 33.3D$ for the other air pollutants (where D = distance to shore in miles)?
X		Do your emission calculations include any emission reduction measures or modified emission factors?
X		Does or will the facility complex associated with your proposed development and production activities process production from eight or more wells?
	X	Do you expect to encounter H_2S at concentrations greater than 20 parts per million (ppm)?
	X	Do you propose to flare or vent natural gas in excess of the criteria set forth under 250.1105(a)(2) and (3)?
	X	Do you propose to burn produced hydrocarbon liquids?
	X	Are your proposed development and production activities located within 25 miles from shore?
X		Are our proposed development and production activities located within 200 kilometers of the Breton Wilderness Area?

AIR EMISSIONS COMPUTATION FACTORS

Fuel Usage Conversion Factors	Natural Gas Turbines		Natural Gas Engines		Diesel Recip. Engine		REF.	DATE
	SCF/hp-hr	9.524	SCF/hp-hr	7.143	GAL/hp-hr	0.0483	AP42 3.2-1	4/76 & 8/84

Equipment/Emission Factors	units	PM	SOx	NOx	VOC	CO	REF.	DATE
NG Turbines	gms/hp-hr		0.00247	1.3	0.01	0.83	AP42 3.2-1& 3.1-1	10/96
Diesel Turbines[1]	gms/hp-hr	0.054	0.007	4	0.002	0.015	AP42 3.1-1 & 3.1-2a	4/00
NG 2-cycle lean	gms/hp-hr		0.00185	10.9	0.43	1.5	AP42 3.2-1	10/96
NG 4-cycle lean	gms/hp-hr		0.00185	11.8	0.72	1.6	AP42 3.2-1	10/96
NG 4-cycle rich	gms/hp-hr		0.00185	10	0.14	8.6	AP42 3.2-1	10/96
Diesel Recip. < 600 hp.	gms/hp-hr	1	0.005505	14	1.12	3.03	AP42 3.3-1	10/96
Diesel Recip. > 600 hp.	gms/hp-hr	0.32	0.005505	11	0.33	2.4	AP42 3.4-1	10/96
Diesel Boiler	lbs/bbl	0.084	0.009075	0.84	0.008	0.21	AP42 1.3-12,14	9/98
NG Heaters/Boilers/Burners	lbs/mmscf	7.6	0.593	100	5.5	84	AP42 1.4-1, 14-2, & 14-3	7/98
NG Flares	lbs/mmscf		0.593	71.4	60.3	388.5	AP42 11.5-1	9/91
Liquid Flaring	lbs/bbl	0.42	6.83	2	0.01	0.21	AP42 1.3-1 & 1.3-3	9/98
Tank Vapors	lbs/bbl				0.03		E&P Forum	1/93
Fugitives	lbs/hr/comp.				0.0005		API Study	12/93
Glycol Dehydrator Vent	lbs/mmscf				6.6		La. DEQ	1991
Gas Venting	lbs/scf				0.0034			

Diesel Turbine Fuel Usage based on data from AP-42,
(10,000 BTU/hp-hr)(1 gal diesel/139,000 BTU) = 0.072 GAL/hp-hr

Sulphur Content Source	Value	Units
Fuel Gas	3.33	ppm
Diesel Fuel[2]	0.0015	% weight
Produced Gas(Flares)	3.33	ppm
Produced Oil (Liquid Flaring)	1	% weight

[1]Diesel Turbine Factors from AP-42 used for periods when diesel fuel burned by Generator Turbines (GT-01, GT-02, GT-03).

[2]Diesel Fuel factor adjusted based on use of ultra-low sulfur diesel.

AIR EMISSIONS CALCULATIONS -
2018

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL	CONTACT	PHONE	REMARKS
Anadarko Petroleum Corporation	Viosca Knoll	915	OCS-G06894	A-Marlin TLP	VK 915 #007	Jill Fowler	832-636-1554	Complex totals with Marlin TLP emissions, placing VK 915 #007 on production, and installation of subsea infrastructure. Air emissions previously included and approved under R-06597 (approved on 12/5/17) are being brought forward under this plan; no changes have been made to these previously approved emissions other than SS installation activity info.

OPERATIONS	EQUIPMENT	RATING	MAX. FUEL	ACT. FUEL	RUN TIME		MAXIMUM POUNDS PER HOUR					ESTIMATED TONS				
	Diesel Engines	HP	GAL/HR	GAL/D												
	Nat. Gas Engines	HP	SCF/HR	SCF/D												
	Burners	MMBTU/HR	SCF/HR	SCF/D	HR/D	DAYS	PM	SOx	NOx	VOC	CO	PM	SOx	NOx	VOC	CO
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FACILITY SS Installation	VESSELS>600hp	9864	476.4312	11434.35	24	27	6.95	0.12	239.00	7.17	52.14	2.25	0.04	77.43	2.32	16.89
INSTALLATION	MATERIAL TUG diesel		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRODUCTION																
PW-01 (pressure washer)	RECIP.<600hp diesel	10	0.483	11.59	24	365	0.02	0.00	0.31	0.02	0.07	0.10	0.00	1.35	0.11	0.29
PW-02 (presure washer)	RECIP.<600hp diesel	10	0.483	11.59	24	365	0.02	0.00	0.31	0.02	0.07	0.10	0.00	1.35	0.11	0.29
LB-01 (life boat)	RECIP.<600hp diesel	30	1.449	34.78	1	52	0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.02	0.00	0.01
LB-02 (life boat)	RECIP.<600hp diesel	30	1.449	34.78	1	52	0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.02	0.00	0.01
Air Compressor #1	RECIP.<600hp diesel	140	6.762	162.29	24	365	0.31	0.00	4.32	0.35	0.93	1.35	0.01	18.91	1.51	4.09
UHP-01 (paint)	RECIP.<600hp diesel	275	13.2825	318.78	24	90	0.61	0.00	8.48	0.68	1.84	0.65	0.00	9.16	0.73	1.98
UHP-02 (paint)	RECIP.<600hp diesel	275	13.2825	318.78	24	90	0.61	0.00	8.48	0.68	1.84	0.65	0.00	9.16	0.73	1.98
DCE-01 (crane)	RECIP.<600hp diesel	525	25.3575	608.58	3	365	1.16	0.01	16.19	1.30	3.50	0.63	0.00	8.86	0.71	1.92
DCE-02 (crane)	RECIP.<600hp diesel	525	25.3575	608.58	3	365	1.16	0.01	16.19	1.30	3.50	0.63	0.00	8.86	0.71	1.92
PE-01 (firewater)	RECIP.<600hp diesel	572	27.6276	663.06	2	36	1.26	0.01	17.64	1.41	3.82	0.05	0.00	0.63	0.05	0.14
PE-02 (firewater)	RECIP.<600hp diesel	572	27.6276	663.06	2	36	1.26	0.01	17.64	1.41	3.82	0.05	0.00	0.63	0.05	0.14
GE-05 (emergency generator)	RECIP.>600hp diesel	1019	49.2177	1181.22	2	52	0.72	0.01	24.69	0.74	5.39	0.04	0.00	1.28	0.04	0.28
GE-06 (emergency generator)	RECIP.>600hp diesel	1340	64.722	1553.33	2	52	0.94	0.02	32.47	0.97	7.08	0.05	0.00	1.69	0.05	0.37
Temporary 1	RECIP.>600hp diesel	1000	48.3	1159.20	24	180	0.70	0.01	24.23	0.73	5.29	1.52	0.03	52.33	1.57	11.42
Supply Boat	SUPPORT VESSEL diesel	9266	447.5478	10741.15	12	52	6.53	0.11	224.51	6.74	48.98	2.04	0.04	70.05	2.10	15.28
CE-01 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76	24	365		0.01	37.00	0.52	31.82		0.03	162.08	2.27	139.39
CE-02 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76	24	365		0.01	37.00	0.52	31.82		0.03	162.08	2.27	139.39
CT-01 (turbine)	TURBINE nat gas	13222	125926.328	3022231.87	24	240		0.07	37.86	0.29	24.17		0.21	109.04	0.84	69.62
CT-02 (turbine)	TURBINE nat gas	15000	125926.328	3022231.87	24	240		0.08	42.95	0.33	27.42		0.24	123.70	0.95	78.98
HeatMediaPump	TURBINE nat gas	1291	142860	3428640.00	24	365		0.01	3.70	0.03	2.36		0.03	16.19	0.12	10.34
GT-01A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-01B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
GT-02A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-02B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
GT-03A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-03B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
	BURNER nat gas		0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MISC.	BPD	SCF/HR	COUNT												
	TANK-	27000			24	365				33.75					147.83	
	FLARE- Routine		516.42		24	275		0.00	0.04	0.03	0.20		0.00	0.12	0.10	0.66
	FLARE- Upset		1,416,666.67		12	6		0.84	101.15	85.43	550.38		0.03	3.64	3.08	19.81
	PROCESS VENT- Routine		473.03		24	90				1.61					1.74	
	PROCESS VENT- Upset		1,416,666.67		12	6				4816.67					173.40	
	FUGITIVES-			10000.0		365				5.00					21.90	
	GLYCOL STILL VENT-		1500000		24	365				9.90					43.36	
DRILLING	OIL BURN	0			0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WELL TEST	GAS FLARE		0		0	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
2018	YEAR TOTAL						24.75	1.74	1128.50	4978.25	843.92	10.98	1.28	1152.46	410.61	674.92
EXEMPTION CALCULATION	DISTANCE FROM LAND IN MILES											2197.80	2197.80	2197.80	2197.80	55527.51
	66.0															

AIR EMISSIONS CALCULATIONS -
2019-2027

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL	CONTACT	PHONE	REMARKS
Anadarko Petroleum Corporation	Viosca Knoll	915	OCS-G06894	A-Marlin TLP	VK 915 #007	Jill Fowler	832-636-1554	Complex totals with Marlin TLP emissions, placing VK 915 #007 on production, and installation of subsea infrastructure All emissions were previously included and approved under R-06597 (approved on 12/5/17), no changes have been made to these previously approved emissions

OPERATIONS	EQUIPMENT	RATING	MAX. FUEL	ACT. FUEL	RUN TIME		MAXIMUM POUNDS PER HOUR					ESTIMATED TONS				
	Diesel Engines	HP	GAL/HR	GAL/D												
	Nat. Gas Engines	HP	SCF/HR	SCF/D												
	Burners	MMBTU/HR	SCF/HR	SCF/D	HR/D	DAYS	PM	SOx	NOx	VOC	CO	PM	SOx	NOx	VOC	CO
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FACILITY	VESSELS>600hp		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTALLATION	MATERIAL TUG diesel		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRODUCTION																
PW-01 (pressure washer)	RECIP.<600hp diesel	10	0.483	11.59	24	365	0.02	0.00	0.31	0.02	0.07	0.10	0.00	1.35	0.11	0.29
PW-02 (presure washer)	RECIP.<600hp diesel	10	0.483	11.59	24	365	0.02	0.00	0.31	0.02	0.07	0.10	0.00	1.35	0.11	0.29
LB-01 (life boat)	RECIP.<600hp diesel	30	1.449	34.78	1	52	0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.02	0.00	0.01
LB-02 (life boat)	RECIP.<600hp diesel	30	1.449	34.78	1	52	0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.02	0.00	0.01
Air Compressor #1	RECIP.<600hp diesel	140	6.762	162.29	24	365	0.31	0.00	4.32	0.35	0.93	1.35	0.01	18.91	1.51	4.09
UHP-01 (paint)	RECIP.<600hp diesel	275	13.2825	318.78	24	90	0.61	0.00	8.48	0.68	1.84	0.65	0.00	9.16	0.73	1.98
UHP-02 (paint)	RECIP.<600hp diesel	275	13.2825	318.78	24	90	0.61	0.00	8.48	0.68	1.84	0.65	0.00	9.16	0.73	1.98
DCE-01 (crane)	RECIP.<600hp diesel	525	25.3575	608.58	3	365	1.16	0.01	16.19	1.30	3.50	0.63	0.00	8.86	0.71	1.92
DCE-02 (crane)	RECIP.<600hp diesel	525	25.3575	608.58	3	365	1.16	0.01	16.19	1.30	3.50	0.63	0.00	8.86	0.71	1.92
PE-01 (firewater)	RECIP.<600hp diesel	572	27.6276	663.06	2	36	1.26	0.01	17.64	1.41	3.82	0.05	0.00	0.63	0.05	0.14
PE-02 (firewater)	RECIP.<600hp diesel	572	27.6276	663.06	2	36	1.26	0.01	17.64	1.41	3.82	0.05	0.00	0.63	0.05	0.14
GE-05 (emergency generator)	RECIP.>600hp diesel	1019	49.2177	1181.22	2	52	0.72	0.01	24.69	0.74	5.39	0.04	0.00	1.28	0.04	0.28
GE-06 (emergency generator)	RECIP.>600hp diesel	1340	64.722	1553.33	2	52	0.94	0.02	32.47	0.97	7.08	0.05	0.00	1.69	0.05	0.37
Temporary 1	RECIP.>600hp diesel	1000	48.3	1159.20	24	180	0.70	0.01	24.23	0.73	5.29	1.52	0.03	52.33	1.57	11.42
Supply Boat	SUPPORT VESSEL diesel	9266	447.5478	10741.15	12	52	6.53	0.11	224.51	6.74	48.98	2.04	0.04	70.05	2.10	15.28
CE-01 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76	24	365		0.01	37.00	0.52	31.82		0.03	162.08	2.27	139.39
CE-02 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76	24	365		0.01	37.00	0.52	31.82		0.03	162.08	2.27	139.39
CT-01 (turbine)	TURBINE nat gas	13222	125926.328	3022231.87	24	240		0.07	37.86	0.29	24.17		0.21	109.04	0.84	69.62
CT-02 (turbine)	TURBINE nat gas	15000	125926.328	3022231.87	24	240		0.08	42.95	0.33	27.42		0.24	123.70	0.95	78.98
HeatMediaPump	TURBINE nat gas	1291	142860	3428640.00	24	365		0.01	3.70	0.03	2.36		0.03	16.19	0.12	10.34
GT-01A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-01B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
GT-02A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-02B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
GT-03A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-03B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
	BURNER nat gas		0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MISC.	BPD	SCF/HR	COUNT												
	TANK-	27000			24	365				33.75					147.83	
	FLARE- Routine		516.42		24	275		0.00	0.04	0.03	0.20		0.00	0.12	0.10	0.66
	FLARE- Upset		1,416,666.67		12	6		0.84	101.15	85.43	550.38		0.03	3.64	3.08	19.81
	PROCESS VENT- Routine		473.03		24	90				1.61					1.74	
	PROCESS VENT- Upset		1,416,666.67		12	6				4816.67					173.40	
	FUGITIVES-			10000.0		365				5.00					21.90	
	GLYCOL STILL VENT-		1500000		24	365				9.90					43.36	
DRILLING	OIL BURN	0			0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WELL TEST	GAS FLARE		0		0	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
2019-2027	YEAR TOTAL						17.80	1.62	889.51	4971.08	791.77	8.72	1.24	1075.02	408.29	658.02
EXEMPTION CALCULATION	DISTANCE FROM LAND IN MILES											2197.80	2197.80	2197.80	2197.80	55527.51
	66.0															

AIR EMISSIONS CALCULATIONS -
2028

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL	CONTACT	PHONE	REMARKS
Anadarko Petroleum Corporation	Viosca Knoll	915	OCS-G06894	A-Marlin TLP	VK915 #007	Jill Fowler	832-636-1554	Complex totals with Marlin TLP emissions, placing VK915 #007 on production, and installation of subsea infrastructure All emissions were previously included and approved under R-06597 (approved on 12/5/17), no changes have been made to these previously approved emissions

OPERATIONS	EQUIPMENT	RATING	MAX. FUEL	ACT. FUEL	RUN TIME		MAXIMUM POUNDS PER HOUR					ESTIMATED TONS				
	Diesel Engines	HP	GAL/HR	GAL/D												
	Nat. Gas Engines	HP	SCF/HR	SCF/D												
	Burners	MMBTU/HR	SCF/HR	SCF/D	HR/D	DAYS	PM	SOx	NOx	VOC	CO	PM	SOx	NOx	VOC	CO
Well Work	Main Deiesel Engines		0	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
	VESSELS>600hp diesel(supply)		0	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
PIPELINE INSTALLATION (Tie-Back)	PIPELINE LAY BARGE diesel		0	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
	SUPPORT VESSEL diesel		0	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
	PIPELINE BURY BARGE diesel		0	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
	SUPPORT VESSEL diesel		0	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
	VESSELS>600hp diesel(crew)		0	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
	VESSELS>600hp diesel(supply)		0	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
FACILITY INSTALLATION	DERRICK BARGE diesel		0	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
	MATERIAL TUG diesel		0	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
	VESSELS>600hp diesel(crew)		0	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
	VESSELS>600hp diesel(supply)		0	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
PRODUCTION																
PW-01 (pressure washe	RECIP <600hp diesel	10	0 483	11 59	24	365	0 02	0 00	0 31	0 02	0 07	0 10	0 00	1 35	0 11	0 29
PW-02 (presure washer	RECIP <600hp diesel	10	0 483	11 59	24	365	0 02	0 00	0 31	0 02	0 07	0 10	0 00	1 35	0 11	0 29
LB-01 (life boat)	RECIP <600hp diesel	30	1 449	34 78	1	52	0 07	0 00	0 93	0 07	0 20	0 00	0 00	0 02	0 00	0 01
LB-02 (life boat)	RECIP <600hp diesel	30	1 449	34 78	1	52	0 07	0 00	0 93	0 07	0 20	0 00	0 00	0 02	0 00	0 01
Air Compressor #1	RECIP <600hp diesel	140	6 762	162 29	24	365	0 31	0 00	4 32	0 35	0 93	1 35	0 01	18 91	1 51	4 09
UHP-01 (paint)	RECIP <600hp diesel	275	13 2825	318 78	24	90	0 61	0 00	8 48	0 68	1 84	0 65	0 00	9 16	0 73	1 98
UHP-02 (paint)	RECIP <600hp diesel	275	13 2825	318 78	24	90	0 61	0 00	8 48	0 68	1 84	0 65	0 00	9 16	0 73	1 98
DCE-01 (crane)	RECIP <600hp diesel	525	25 3575	608 58	3	365	1 16	0 01	16 19	1 30	3 50	0 63	0 00	8 86	0 71	1 92
DCE-02 (crane)	RECIP <600hp diesel	525	25 3575	608 58	3	365	1 16	0 01	16 19	1 30	3 50	0 63	0 00	8 86	0 71	1 92
PE-01 (firewater)	RECIP <600hp diesel	572	27 6276	663 06	2	36	1 26	0 01	17 64	1 41	3 82	0 05	0 00	0 63	0 05	0 14
PE-02 (firewater)	RECIP <600hp diesel	572	27 6276	663 06	2	36	1 26	0 01	17 64	1 41	3 82	0 05	0 00	0 63	0 05	0 14
GE-05 (emergency gen	RECIP >600hp diesel	1019	49 2177	1181 22	2	52	0 72	0 01	24 69	0 74	5 39	0 04	0 00	1 28	0 04	0 28
GE-06 (emergency gen	RECIP >600hp diesel	1340	64 722	1553 33	2	52	0 94	0 02	32 47	0 97	7 08	0 05	0 00	1 69	0 05	0 37
Temporary 1	RECIP >600hp diesel	1000	48 3	1159 20	24	180	0 70	0 01	24 23	0 73	5 29	1 52	0 03	52 33	1 57	11 42
Supply Boat	SUPPORT VESSEL diesel	9266	447 5478	10741 15	12	52	6 53	0 11	224 51	6 74	48 98	2 04	0 04	70 05	2 10	15 28
CE-01 (compressor)	RECIP 4 cycle rich nat gas	1680	12000 24	288005 76	24	365		0 01	37 00	0 52	31 82		0 03	162 08	2 27	139 39
CE-02 (compressor)	RECIP 4 cycle rich nat gas	1680	12000 24	288005 76	24	365		0 01	37 00	0 52	31 82		0 03	162 08	2 27	139 39
CT-01 (turbine)	TURBINE nat gas	13222	125926 328	3022231 87	24	240		0 07	37 86	0 29	24 17		0 21	109 04	0 84	69 62
CT-02 (turbine)	TURBINE nat gas	15000	125926 328	3022231 87	24	240		0 08	42 95	0 33	27 42		0 24	123 70	0 95	78 98
HeatMediaPump	TURBINE nat gas	1291	142860	3428640 00	24	365		0 01	3 70	0 03	2 36		0 03	16 19	0 12	10 34
GT-01A (generator)	TURBINE Dual Fuel-diesel	6639	478 008	11472 19	2	365	0 79	0 10	58 49	0 03	0 22	0 29	0 04	21 35	0 01	0 08
GT-01B (generator)	TURBINE Dual Fuel-natural gas	6639	63229 836	1517516 06	24	365		0 04	19 01	0 15	12 14		0 16	83 27	0 64	53 16
GT-02A (generator)	TURBINE Dual Fuel-diesel	6639	478 008	11472 19	2	365	0 79	0 10	58 49	0 03	0 22	0 29	0 04	21 35	0 01	0 08
GT-02B (generator)	TURBINE Dual Fuel-natural gas	6639	63229 836	1517516 06	24	365		0 04	19 01	0 15	12 14		0 16	83 27	0 64	53 16
GT-03A (generator)	TURBINE Dual Fuel-diesel	6639	478 008	11472 19	2	365	0 79	0 10	58 49	0 03	0 22	0 29	0 04	21 35	0 01	0 08
GT-03B (generator)	TURBINE Dual Fuel-natural gas	6639	63229 836	1517516 06	24	365		0 04	19 01	0 15	12 14		0 16	83 27	0 64	53 16
	BURNER nat gas		0 00	0 00			0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
	MISC.	BPD	SCF/HR	COUNT												
	TANK-	27000			24	365				33 75					147 83	
	FLARE- Routine		516 42		24	365		0 00	0 04	0 03	0 20		0 00	0 16	0 14	0 88
	FLARE- Upset		1,416,666 67		12	6		0 84	101 15	85 43	550 38		0 03	3 64	3 08	19 81
	PROCESS VENT- Routine		473 03		24	365				1 61					7 04	
	PROCESS VENT- Upset		1,416,666 67		12	6				4816 67					173 40	
	FUGITIVES-			10000 0		365				5 00					21 90	
	GLYCOL STILL VENT-		1500000		24	365				9 90					43 36	
DRILLING	OIL BURN	0			0	0	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
WELL TEST	GAS FLARE		0		0	0		0 00	0 00	0 00	0 00		0 00	0 00	0 00	0 00
2028 YEAR TOTAL							17.80	1.62	889.51	4971.08	791.77	8.72	1.24	1075.06	413.63	658.24
EXEMPTION CALCULATION	DISTANCE FROM LAND IN MILES											2197.80	2197.80	2197.80	2197.80	55527.51
	66 0															

SUMMARY

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL
Anadarko Petroleum Corporation	Viosca Knoll	915	OCS-G06894	A-Marlin TLP	VK 915 #007

Year	Emitted		Substance		
	PM	SOx	NOx	VOC	CO
2018	10.98	1.28	1152.46	410.61	674.92
2019-2027	8.72	1.24	1075.02	408.29	658.02
2028	8.72	1.24	1075.06	413.63	658.24
Allowable	2197.80	2197.80	2197.80	2197.80	55527.51

COMPANY	Anadarko Petroleum Corporation
AREA	Viosca Knoll
BLOCK	915
LEASE	OCS-G06894
PLATFORM	A-Marlin TLP
WELL	VK 915 #007
COMPANY CONTACT	Jill Fowler
TELEPHONE NO.	832-636-1554
REMARKS	Plan totals with placing VK 915 #007 on production, and installation of subsea infrastructure.

LEASE TERM PIPELINE CONSTRUCTION INFORMATION:

YEAR	NUMBER OF PIPELINES	TOTAL NUMBER OF CONSTRUCTION DAYS

AIR EMISSIONS COMPUTATION FACTORS

Fuel Usage Conversion Factors	Natural Gas Turbines		Natural Gas Engines		Diesel Recip. Engine		REF.	DATE
	SCF/hp-hr	9.524	SCF/hp-hr	7.143	GAL/hp-hr	0.0483	AP42 3.2-1	4/76 & 8/84

Equipment/Emission Factors	units	PM	SOx	NOx	VOC	CO	REF.	DATE
NG Turbines	gms/hp-hr		0.00247	1.3	0.01	0.83	AP42 3.2-1& 3.1-1	10/96
Diesel Turbines[1]	gms/hp-hr	0.054	0.007	4	0.002	0.015	AP42 3.1-1 & 3.1-2a	4/00
NG 2-cycle lean	gms/hp-hr		0.00185	10.9	0.43	1.5	AP42 3.2-1	10/96
NG 4-cycle lean	gms/hp-hr		0.00185	11.8	0.72	1.6	AP42 3.2-1	10/96
NG 4-cycle rich	gms/hp-hr		0.00185	10	0.14	8.6	AP42 3.2-1	10/96
Diesel Recip. < 600 hp.	gms/hp-hr	1	0.005505	14	1.12	3.03	AP42 3.3-1	10/96
Diesel Recip. > 600 hp.	gms/hp-hr	0.32	0.005505	11	0.33	2.4	AP42 3.4-1	10/96
Diesel Boiler	lbs/bbl	0.084	0.009075	0.84	0.008	0.21	AP42 1.3-12,14	9/98
NG Heaters/Boilers/Burners	lbs/mmscf	7.6	0.593	100	5.5	84	AP42 1.4-1, 14-2, & 14-3	7/98
NG Flares	lbs/mmscf		0.593	71.4	60.3	388.5	AP42 11.5-1	9/91
Liquid Flaring	lbs/bbl	0.42	6.83	2	0.01	0.21	AP42 1.3-1 & 1.3-3	9/98
Tank Vapors	lbs/bbl				0.03		E&P Forum	1/93
Fugitives	lbs/hr/comp.				0.0005		API Study	12/93
Glycol Dehydrator Vent	lbs/mmscf				6.6		La. DEQ	1991
Gas Venting	lbs/scf				0.0034			

Diesel Turbine Fuel Usage based on data from AP-42,
(10,000 BTU/hp-hr)(1 gal diesel/139,000 BTU) = 0.072 GAL/hp-hr

Sulphur Content Source	**Value**	**Units**
Fuel Gas	3.33	ppm
Diesel Fuel[2]	0.0015	% weight
Produced Gas(Flares)	3.33	ppm
Produced Oil (Liquid Flaring)	1	% weight

[1]Diesel Turbine Factors from AP-42 used for periods when diesel fuel burned by Generator Turbines (GT-01, GT-02, GT-03).

[2]Diesel Fuel factor adjusted based on use of ultra-low sulfur diesel.

AIR EMISSIONS CALCULATIONS -
2018

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL	CONTACT	PHONE	REMARKS
Anadarko Petroleum Corporation	Viosca Knoll	915	OCS-G06894	A-Marlin TLP	VK 915 #007	Jill Fowler	832-636-1554	Plan totals with placing VK 915 #007 on production, and installation of subsea infrastructure.

OPERATIONS	EQUIPMENT	RATING	MAX. FUEL	ACT. FUEL	RUN TIME		MAXIMUM POUNDS PER HOUR					ESTIMATED TONS				
	Diesel Engines	HP	GAL/HR	GAL/D												
	Nat. Gas Engines	HP	SCF/HR	SCF/D												
	Burners	MMBTU/HR	SCF/HR	SCF/D	HR/D	DAYS	PM	SOx	NOx	VOC	CO	PM	SOx	NOx	VOC	CO
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FACILITY SS Installation	VESSELS>600hp	9864	476.4312	11434.35	24	27	6.95	0.12	239.00	7.17	52.14	2.25	0.04	77.43	2.32	16.89
INSTALLATION	MATERIAL TUG diesel		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRODUCTION																
PW-01 (pressure washer)	RECIP.<600hp diesel	10	0.483	11.59			0.02	0.00	0.31	0.02	0.07	0.00	0.00	0.00	0.00	0.00
PW-02 (presure washer)	RECIP.<600hp diesel	10	0.483	11.59			0.02	0.00	0.31	0.02	0.07	0.00	0.00	0.00	0.00	0.00
LB-01 (life boat)	RECIP.<600hp diesel	30	1.449	34.78			0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.00	0.00	0.00
LB-02 (life boat)	RECIP.<600hp diesel	30	1.449	34.78			0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.00	0.00	0.00
Air Compressor #1	RECIP.<600hp diesel	140	6.762	162.29			0.31	0.00	4.32	0.35	0.93	0.00	0.00	0.00	0.00	0.00
UHP-01 (paint)	RECIP.<600hp diesel	275	13.2825	318.78			0.61	0.00	8.48	0.68	1.84	0.00	0.00	0.00	0.00	0.00
UHP-02 (paint)	RECIP.<600hp diesel	275	13.2825	318.78			0.61	0.00	8.48	0.68	1.84	0.00	0.00	0.00	0.00	0.00
DCE-01 (crane)	RECIP.<600hp diesel	525	25.3575	608.58			1.16	0.01	16.19	1.30	3.50	0.00	0.00	0.00	0.00	0.00
DCE-02 (crane)	RECIP.<600hp diesel	525	25.3575	608.58			1.16	0.01	16.19	1.30	3.50	0.00	0.00	0.00	0.00	0.00
PE-01 (firewater)	RECIP.<600hp diesel	572	27.6276	663.06			1.26	0.01	17.64	1.41	3.82	0.00	0.00	0.00	0.00	0.00
PE-02 (firewater)	RECIP.<600hp diesel	572	27.6276	663.06			1.26	0.01	17.64	1.41	3.82	0.00	0.00	0.00	0.00	0.00
GE-05 (emergency generator)	RECIP.>600hp diesel	1019	49.2177	1181.22			0.72	0.01	24.69	0.74	5.39	0.00	0.00	0.00	0.00	0.00
GE-06 (emergency generator)	RECIP.>600hp diesel	1340	64.722	1553.33			0.94	0.02	32.47	0.97	7.08	0.00	0.00	0.00	0.00	0.00
Temporary 1	RECIP.>600hp diesel	1000	48.3	1159.20			0.70	0.01	24.23	0.73	5.29	0.00	0.00	0.00	0.00	0.00
Supply Boat	SUPPORT VESSEL diesel	9266	447.5478	10741.15			6.53	0.11	224.51	6.74	48.98	0.00	0.00	0.00	0.00	0.00
CE-01 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76				0.01	37.00	0.52	31.82		0.00	0.00	0.00	0.00
CE-02 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76				0.01	37.00	0.52	31.82		0.00	0.00	0.00	0.00
CT-01 (turbine)	TURBINE nat gas	13222	125926.328	3022231.87				0.07	37.86	0.29	24.17		0.00	0.00	0.00	0.00
CT-02 (turbine)	TURBINE nat gas	15000	125926.328	3022231.87				0.08	42.95	0.33	27.42		0.00	0.00	0.00	0.00
HeatMediaPump	TURBINE nat gas	1291	142860	3428640.00				0.01	3.70	0.03	2.36		0.00	0.00	0.00	0.00
GT-01A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19			0.79	0.10	58.49	0.03	0.22	0.00	0.00	0.00	0.00	0.00
GT-01B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06				0.04	19.01	0.15	12.14		0.00	0.00	0.00	0.00
GT-02A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19			0.79	0.10	58.49	0.03	0.22	0.00	0.00	0.00	0.00	0.00
GT-02B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06				0.04	19.01	0.15	12.14		0.00	0.00	0.00	0.00
GT-03A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19			0.79	0.10	58.49	0.03	0.22	0.00	0.00	0.00	0.00	0.00
GT-03B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06				0.04	19.01	0.15	12.14		0.00	0.00	0.00	0.00
	BURNER nat gas		0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MISC.	BPD	SCF/HR	COUNT												
	TANK-	27000								33.75					0.00	
	FLARE- Routine		516.42					0.00	0.04	0.03	0.20		0.00	0.00	0.00	0.00
	FLARE- Upset		1,416,666.67					0.84	101.15	85.43	550.38		0.00	0.00	0.00	0.00
	PROCESS VENT- Routine		473.03							1.61					0.00	
	PROCESS VENT- Upset		1,416,666.67							4816.67					0.00	
	FUGITIVES-			10000.0						5.00					0.00	
	GLYCOL STILL VENT-		1500000							9.90					0.00	
DRILLING	OIL BURN	0					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WELL TEST	GAS FLARE		0					0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
	2018 YEAR TOTAL						24.75	1.74	1128.50	4978.25	843.92	2.25	0.04	77.43	2.32	16.89
EXEMPTION CALCULATION	DISTANCE FROM LAND IN MILES											2197.80	2197.80	2197.80	2197.80	55527.51
	66.0															

SUMMARY

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL
Anadarko Petroleum Corporation	Viosca Knoll	915	OCS-G06894	A-Marlin TLP	VK 915 #007

Year	Emitted Substance				
	PM	SOx	NOx	VOC	CO
2018	2.25	0.04	77.43	2.32	16.89
Allowable	2197.80	2197.80	2197.80	2197.80	55527.51

M
Support Vessels and Aircraft Information

(a) General

Type	Max. Total Fuel Tank Storage Capacity	Max. No. in Area at any Time	Trip Frequency or Duration
Supply Vessel	336,227 gallons	n/a	n/a
Helicopter	735.3 gallons	1	10 trips/week
Crew Vessel	70,000 gallons	n/a	n/a
DP Construction Vessel	241,408 gallons*	1	Duration of operation

assumptions based off of vessel similar to Harvey Intervention Vessel

(b) Diesel Oil Supply Vessels

Fuel for the DP Construction Vessel will be transported via a supply vessel as follows:

a. Size of fuel supply vessel:	230 feet
b. Carrying capacity of fuel supply vessel:	336,227 gallons
c. Frequency that fuel supply vessel will visit the facilities:	twice per week
d. Routes the fuel supply vessel will use to travel between the onshore support base and proposed facility:	Shortest route from shore-base to block

(c) Solid and Liquid Wastes Transporation

Type of Waste	Composition	Total Projected Amount	Rate	Transpor t Method	Name/Location of Facility	Disposal Method
Synthetic-based drilling fluid or mud	Synthetic-based drilling muds	N/A	N/A	Re-use and/or transport to shore in DOT approved containers.	An approved waste disposal facility will be utilized, such as Port Fourchon, LA and on to Newpark Fourchon Transfer Station #1 & #2. Newpark Transfer Station Morgan City. Newpark Transfer Station Port Arthur. USLL Galveston and Fourchon Transfer Station. If recycled, returned to vendor (Bariod or MI).	Re-used and/or recycled; if can't be reused and/or recycled the waste is disposed of at an approved waste disposal facility, such as Newpark (injection disposal facility) or USLL (landfarm).

N
ONSHORE SUPPORT FACILITIES INFORMATION

(a) General

Per NTL No. 2008-G04, the following tables reflect the onshore facilities Anadarko may utilize to provide supplies and service support for the activities proposed in this DOCD.

Name	Primary Location	Existing/New/Modified
Anadarko Service Base	Fourchon, Louisiana	Existing

Name	*Alternate Locations	Existing/New/Modified
Anadarko Service Base	Galveston, TX	Existing
Anadarko Service Base	Cameron, LA	Existing
Anadarko Service Base	Lake Charles, LA	Existing
Anadarko Service Base	Houma, LA	Existing
Anadarko Service Base	Pascagoula, MS**	Existing

***In the unlikely event Anadarko's primary service base cannot be utilized Anadarko will exercise the use of an alternate service base during drilling and/or completion operations.**

****Helicopter base only; location is approximately 93 miles from Pascagoula via most direct route**

(b) Support Base

No support base construction or expansion is planned for these activities.

(c) Waste Disposal

Disposed wastes describe those wastes generated by the proposed activity that are disposed of by means other than by release into the water of the GOM at the site where they are generated. These wastes can be disposed of by offsite release, injection, encapsulation, or placement at either onshore or offshore permitted locations for the purposes of returning them back to the environment.

Type of Waste	Composition	Total Projected Amount	Rate	Transport Method	Name/Location of Facility	Disposal Method
Synthetic-based drilling fluid or mud	Synthetic-based drilling muds	N/A	N/A	Re-use and/or transport to shore in DOT approved containers.	An approved waste disposal facility will be utilized, such as Port Fourchon, LA and on to Newpark Fourchon Transfer Station #1 & #2. Newpark Transfer Station Morgan City. Newpark Transfer Station Port Arthur. USLL Galveston and Fourchon Transfer	Re-used and/or recycled; if can't be reused and/or recycled the waste is disposed of at an approved waste disposal facility, such as Newpark (injection disposal facility) or USLL (landfarm).

SUPPLEMENTAL DEVELOPMENT OPERATIONS COORDINATION DOCUMENT

VIOSCA KNOLL BLOCK 915
OCS-G 06894

UNIT AGREEMENT NO. 754396011

OFFSHORE, ALABAMA

Public

Anadarko Petroleum Corporation
1201 Lake Robbins Drive
The Woodlands, Texas 77380
Contact: Jill Fowler
Jill.fowler@anadarko.com
(832) 636-1554

1 – Hard Copy Confidential
1 – CD Confidential
1 – Hard Copy Public Information
3 – CDs Public Information

February, 2018

ANADARKO PETROLEUM CORPORATION
SUPPLEMENTAL DEVELOPMENT OPERATIONS COORDINATION DOCUMENT
VIOSCA KNOLL BLOCK 915
OCS-G 06894

A.	Plan Contents
B.	General Information
C.	Geological, Geophysical
D.	Hydrogen Sulfide Information
E.	Mineral Resource Conservation Information
F.	Biological, Physical and Socioeconomic Information
G.	Wastes and Discharge Information
H.	Air Emissions Information
I.	Oil Spill Information
J.	Environmental Monitoring Information
K.	Lease Stipulations
L.	Related Facilities and Operations Information
M.	Support Vessels and Aircraft Information
N.	Onshore Support Facilities Information
O.	Coastal Zone Management Act Information
P.	Environmental Impact Analysis
Q.	Administrative Information

A
PLAN CONTENTS

(a) Plan Information Form

Under this Supplemental DOCD Anadarko will place one well, the VK 915 #007, on production, and conduct lease term pipeline installation activities. Enclosed as **Attachment A-1** is Form BOEM-137, OCS Plan Information Form.

(b) Location

Enclosed as **Attachment A-2** is a well location plat at a scale of 1 inch = 2000 feet that depicts the surface location and water depth of the subsea wells.

(c) Safety and Pollution Prevention Features

Safety features on the platform will include well control, pollution prevention, safe welding procedures, and blowout prevention equipment as described in Title 30 CFR Part 250, Subparts C, D, E, G and O; and as further clarified by BOEM Notices to Lessees, and applicable regulations of the Environmental Protection Agency and the U.S. Coast Guard. The appropriate life rafts, life jackets, ring buoys, etc., as prescribed by the U.S. Coast Guard, will be maintained on the facility at all times.

Per NTL 2008-G04, Anadarko proposes additional measures for safety, pollution prevention, and early spill detection beyond those required by 30 CFR 250, as outlined in Anadarko's Regional Oil Spill Response Plan. These additional measures include:

1. Shipboard Oil Pollution Emergency Plan
2. Operations Manual
3. Spill Prevention Control and Countermeasures Plan

Procedures for fuel transfers and well control programs are also detailed in the Regional Oil Spill Response Plan.

(d) Storage Tanks and Production Vessels

The Viosca Knoll Block 915 well will utilize a contracted ROV Vessel and/or DP Construction Vessel, to install the new pipeline segments. Another vessel may be utilized during operations, but will have a total storage tank capacity equal to or less than the following:

Type of Facility	Type Of Storage Tank	Tank Capacity	Number Of Tanks	Total Capacity	Fluid Gravity (Api)	Total Capacity of all Tanks for Facility Type
ROV Vessel	Fuel-Oil Strg Tank	4454.4 bbls	1	4454.4 bbls	No. 2 Diesel	**16 tanks total= 17,614.3 bbls**

	Fuel Oil Strg Tank	4061.3 bbls	1	4061.3 bbls	No. 2 Diesel	
	Fuel Oil Strg Tank	3173.8 bbls	1	3173.8 bbls	No. 2 Diesel	
	Fuel Oil Strg Tank	3772.6 bbls	1	3772.6 bbls	No. 2 Diesel	
	Fuel Oil Strg Tank	717.7 bbls	1	717.7 bbls	No. 2 Diesel	
	Fuel Oil Day Tank	26.4 bbls	2	52.8 bbls	No. 2 Diesel	
	Settling Tank	183.0 bbls	3	549.0 bbls	No. 2 Diesel	
	Settling Tank	305.7 bbls	1	305.7 bbls	No. 2 Diesel	
	Service Tank	162.9 bbls	2	325.8 bbls	No. 2 Diesel	
	Overflow Tank	44.0 bbls	1	44.0 bbls	No. 2 Diesel	
	Overflow Tank	91.2 bbls	1	91.2 bbls	No. 2 Diesel	
	Drain Tank	66.0 bbls	1	66.0 bbls	No. 2 Diesel	

Type of Facility	**Type Of Storage Tank**	**Tank Capacity**	**Number Of Tanks**	**Total Capacity**	**Fluid Gravity (Api)**	**Total Capacity of all Tanks for Facility Type**
DP Construction Vessel/Pipelay Vessel	Fuel Oil Strg Tank	3458.7 bbls	2	6917.4 bbls	No. 2 Diesel	**27 tanks total= 28,583.1 bbls**
	Fuel Oil Strg Tank	3483.9 bbls	2	6967.8 bbls	No. 2 Diesel	
	Fuel Oil Strg Tank	1323 bbls	2	2646 bbls	No. 2 Diesel	
	Fuel Oil Strg Tank	907.2 bbls	2	1814.4 bbls	No. 2 Diesel	
	Fuel Oil Strg Tank	2230.2 bbls	2	4460.4 bbls	No. 2 Diesel	
	Overflow Tank	201.6 bbls	2	403.2 bbls	No. 2 Diesel	
	Day Tank and Settling Tank	793.8 bbls	2	1587.6 bbls	No. 2 Diesel	
	Day Tank and Settling Tank	743.4 bbls	2	1486.8 bbls	No. 2 Diesel	
	Drain Tank	182.7 bbls	2	365.4 bbls	No. 2 Diesel	
	Deck Drain Waste Oil	289.8 bbls	1	289.8 bbls		
	Dirty Oil	176.4 bbls	1	176.4 bbls		
	Renovated Oil	132.3 bbls	2	264.6 bbls	Lube Oil	
	Lube Oil Storage	485.1 bbls	2	970.2 bbls	Lube Oil	
	Hydraulic Oil Storage Tank	69.3 bbls	2	138.6 bbls	Hydraulic Oil	
	Dirty Hydraulic Oil Storage Tank	94.5 bbls	1	94.5 bbls	Hydraulic Oil	

(e) Pollution Prevention Measures

Per NTL 2008-G04, Anadarko proposes additional measures for safety, pollution prevention, and early spill detection beyond those required by 30 CFR 250, as outlined in Anadarko's Regional Oil Spill Response Plan. These additional measures include:

1. Shipboard Oil Pollution Emergency Plan
2. Operations Manual
3. Spill Prevention Control and Countermeasures Plan

Procedures for fuel transfers and well control programs are detailed in the Regional Oil Spill Response Plan.

Production from Viosca Knoll Block 915 will be transported to Anadarko's Marlin TLP also in Viosca Knoll Block 915.

.

The facilities are designed, installed and operated in accordance with current regulations, engineering documents incorporated by reference, and industry practice in order to ensure protection of personnel, environment and the facilities. When necessary, maintenance or repairs that are necessary to prevent pollution of offshore waters shall be undertaken immediately.

The pollution prevention measures for the facility include installation of curbs, gutters, drip pans, and drains on deck areas to collect all contaminants and debris.

The facility is designed to produce oil and gas. All equipment, such as separators, tanks and treaters, utilized for the handling of hydrocarbons are designed, installed and operated to prevent pollution. Necessary maintenance or repair work needed to prevent pollution of offshore waters shall be performed immediately. Curbs, gutters, drip pans and drains are installed in deck areas in a manner necessary to collect all contaminants not authorized for discharge. Any unexpected oil drainage will be piped to an operated and maintained sump system which will automatically maintain the oil at a level sufficient to prevent discharge of oil into offshore waters. All gravity drains are equipped with a water trap or other means to prevent gas in the sump system from escaping through the drains. Sump piles will not be used as processing devices to treat or skim liquids, but may be used to collect treated liquids from drip pans and deck drains and as a final trap for hydrocarbon liquid in the event of equipment upsets. There will be no disposal of equipment, cables, chains, containers or other materials into offshore waters.

Supervisory and certain designated personnel on-board the facility are familiar with the effluent limitations and guidelines for overboard discharges into the receiving waters as outlined in the NPDES General Permit for the EPA Region IV.

Production safety equipment was designed, and is installed, used, maintained, and tested in a manner to assure the safety and protection of the human, marine, and coastal environments in accordance with 30 CFR 250 Subpart H. Anadarko will perform all installation and production operations in a safe and workmanlike manner, and will maintain all equipment in a safe condition, thereby ensuring the protection of lease and associated facilities, the health and safety of all persons, and the preservation and conservation of property and the environment. The appropriate life rafts, life jackets, ring buoys, etc., as prescribed by the U.S. Coast Guard, will be maintained on the facility at all times.

Any platform production facilities shall be protected with a basic and ancillary surface system designed, analyzed, installed, tested, and maintained in operating condition in accordance with the provisions of API RP 14C, Recommended Practice for Analysis, Design, Installation and Testing of Basic Surface Safety Systems for Offshore Production Platforms.

The Marlin TLP is a manned structure, and will be identified and reported in accordance with the requirements of the U.S. Coast Guard and BOEM/BSEE. The unit is a floating production system of the spar design using a conventional mooring system. It is considered a floating facility and is inspected and constructed to the requirements of 46 CFR Parts 107 and 108 as directed by 33 CFR 143.120.

(f) Description of Previously Approved Lease Activities

Well Location	Status of Well Location	Potential Future Operations
VK 915 “A”	Location used to drill VK 915 #SS006	Well currently on production
VK 915 “B”	Approved well location for future utility	Future drill location

Approval was granted for the following well locations under the Supplemental Exploration Plan (filed by FMOG) , Plan Control No. S-7707, approved on December 13, 2014:

Well Location	Status of Well Location	Potential Future Operations
VK 915 “F”	Approved well location for future utility	Future drill location
VK 915 “G”	Approved well location for future utility	Future drill location

Approval was granted for the following well locations under the Supplemental Exploration Plan (filed by FMOG), Plan Control No. S-7742, approved on June 19, 2015:

Well Location	Status of Well Location	Potential Future Operations
VK 915 “H”	Approved well location for future utility	Future drill location
VK 915 “I”	Approved well location for future utility	Future drill location
VK 915 “J”	Approved well location for future utility	Future drill location

Approval was granted for the following well locations under the Supplemental Exploration Plan for Viosca Knoll Block 915 (Plan Control No. S-7864) approved on September 1, 2017:

Well Location	Status of Well Location	Potential Future Operations
VK 915 “M”	Location used to drill VK 915 #SS007	Place on production
VK 915 “MM”	Approved well location for future utility	Future drill location
VK 915 “MMM”	Approved well location for future utility	Future drill location

VK 915 “N”	Approved well location for future utility	Future drill location
VK 915 “NN”	Approved well location for future utility	Future drill location
VK 915 “NNN”	Approved well location for future utility	Future drill location

OCS PLAN INFORMATION FORM

General Information

Type of OCS Plan:		Exploration Plan (EP)	Development Operations Coordination Document (DOCD)	X

Company Name: Anadarko Petroleum Corporation	BOEM Operator Number: 00981
Address:	Contact Person: Jill Fowler
1201 Lake Robbins Dr.	Phone Number: 832-636-1554
The Woodlands, TX 77380	E-Mail Address: jill.fowler@anadarko.com

If a service fee is required under 30 CFR 550.125(a), provide the	Amount paid	$4,238.00	Receipt No.	75415506667

Project and Worst Case Discharge (WCD) Information

Lease(s): OCS-G 06894	Area: VK	Block(s): 915	Project Name (If Applicable): Dorado

Objective(s)	x	Oil	x	Gas		Sulphur		Salt	Onshore Support Base(s): Fourchon, LA

Platform/Well Name: VK 915 #007	Total Volume of WCD: 20,315 BOPD	API Gravity: 35.4

Distance to Closest Land (Miles): 66 miles	Volume from uncontrolled blowout: 2,437,800 bbls

Have you previously provided information to verify the calculations and assumptions for your WCD?	x	Yes		No
If so, provide the Control Number of the EP or DOCD with which this information was provided	S-7864			
Do you propose to use new or unusual technology to conduct your activities?		Yes	x	No
Do you propose to use a vessel with anchors to install or modify a structure?		Yes	x	No
Do you propose any facility that will serve as a host facility for deepwater subsea development?		Yes	x	No

Description of Proposed Activities and Tentative Schedule (Mark all that apply)

Proposed Activity	Start Date	End Date	No. of Days
Install lease term pipelines	06/15/2018	07/12/2018	27 days
Hookup VK 915 #007 & commence production	07/13/2018	N/A	7-10 years

Description of Drilling Rig

	Jackup		Drillship
	Gorilla Jackup		Platform rig
	Semisubmersible		Submersible
	DP Semisubmersible	x	Other (Attach Description)

Drilling Rig Name (If Known): DP Construction Vessel

Description of Structure

	Caisson		Tension leg platform
	Fixed platform		Compliant tower
	Spar		Guyed tower
	Floating production system		Other (Attach Description)

Description of Lease Term Pipelines

From (Facility/Area/Block)	To (Facility/Area/Block)	Diameter (Inches)	Length (Feet)
See attached summary			

BOEM Form 137 Description of Lease Term Pipelines

From (Facility/Area/Block)	To (Facility/Area/Block)	Diameter (Inches)	Length (Feet)
SS007 VK 915	Manifold VK 915	6"	80'
Manifold VK 915	In-Line-Sled (part of S-16151)	6"	80'

OCS PLAN INFORMATION FORM (CONTINUED)
Include one copy of this page for each proposed well/structure

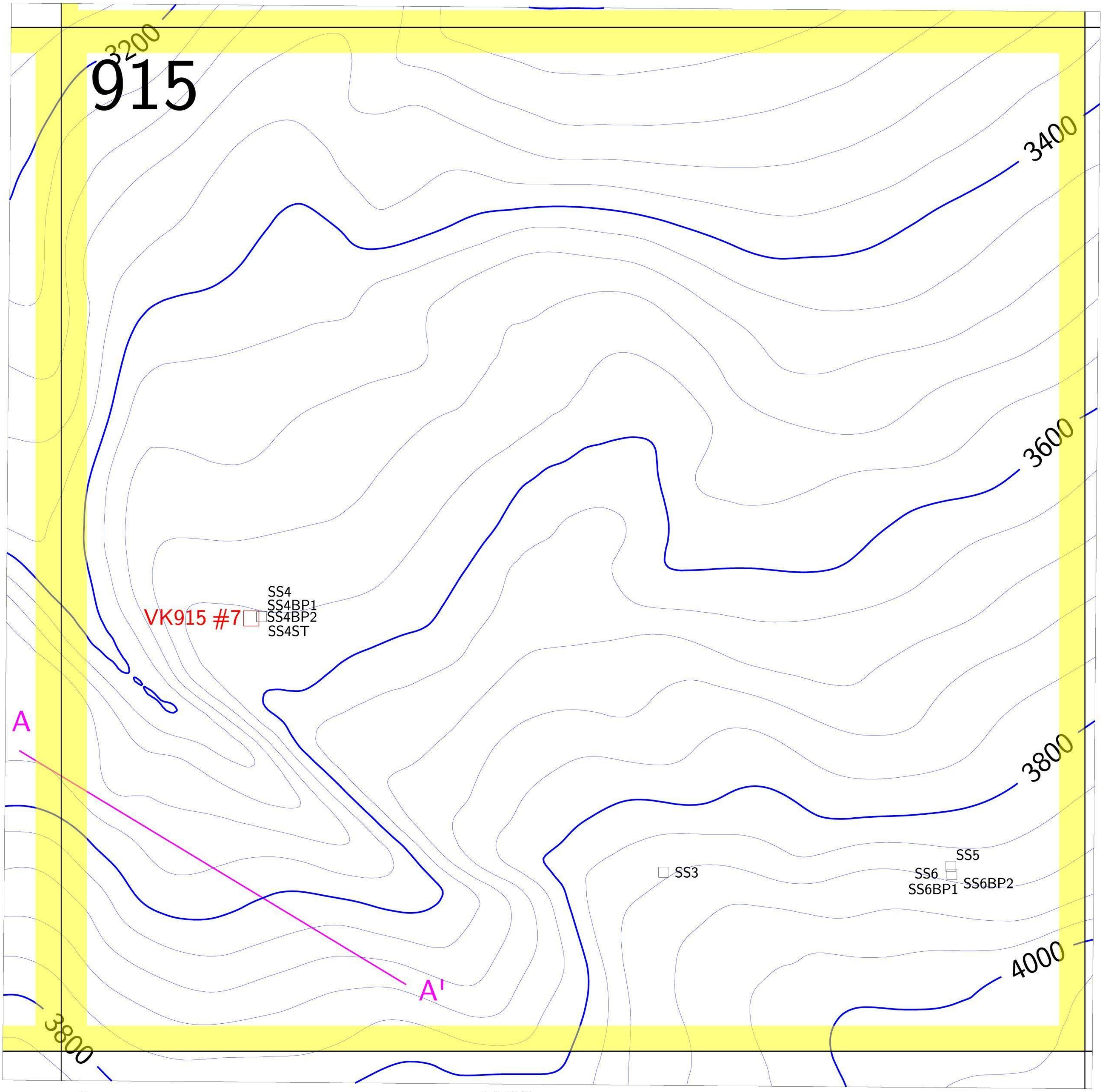
Proposed Well/Structure Location							
Well or Structure Name/Number (If renaming well or structure, reference previous name): VK 915 #007 (S-7864 Loc. M)		Previously reviewed under an approved EP or DOCD?		X	Yes		No S-7864
Is this an existing well or structure?		Yes X		No	If this is an existing well or structure, list the Complex ID or API No.		6081640462
Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?					Yes	x	No
WCD info	For wells, volume of uncontrolled blowout (Bbls/day): 20,315 BOPD		For structures, volume of all storage and pipelines (Bbls): n/a		API Gravity of fluid		35.4

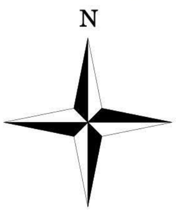
	Surface Location	**Bottom-Hole Location (For Wells)**	**Completion (For multiple completions, enter separate lines)**
Lease No.	OCS G 06894	OCS G 06894	OCS OCS
Area Name	Viosca Knoll	Viosca Knoll	
Block No.	915	915	
Blockline Departures (in feet)	N/S Departure: F____ L 6696'FSL	N/S Departure: F____ L	N/S Departure: F____ L N/S Departure: F____ L N/S Departure: F____ L
	E/W Departure: F____ L 2941'FWL	E/W Departure: F____ L	E/W Departure: F____ L E/W Departure: F____ L E/W Departure: F____ L
Lambert X-Y coordinates	X: 1,333,500.77	X:	X: X: X:
	Y: 10,556,135.63	Y:	Y: Y: Y:
Latitude/ Longitude	Latitude 29.0841739	Latitude	Latitude Latitude Latitude
	Longitude -87.9611909	Longitude	Longitude Longitude Longitude

Water Depth (Feet): 3,564'	MD (Feet):	TVD (Feet):	MD (Feet): TVD (Feet): MD (Feet): TVD (Feet): MD (Feet): TVD (Feet):
Anchor Radius (if applicable) in feet:	N/A		

Anchor Locations for Drilling Rig or Construction Barge (If anchor radius supplied above, not necessary)

Anchor Name or No.	**Area**	**Block**	**X Coordinate**	**Y Coordinate**	**Length of Anchor Chain on Seafloor**
			X =	Y =	
			X =	Y =	
			X =	Y =	
			X =	Y =	
			X =	Y =	
			X =	Y =	
			X =	Y =	
			X =	Y =	





1:24000
1" = 1000'

0 1
MILES

NAD27 / BLM 16N (ftUS) (EPSG 32066)
Transverse Mercator
Clarke 1866 spheroid
Natural origin: [87 00 00W, 0 00 00N]

Well	Calls N/S	Calls W/E	X Coordinate	Y Coordinate	Latitude	Longitude	WD
VK915 #7 (SL)	6695.63 FSL	2940.77 FWL	1333500.77	10556135.63	29.0841739	-87.9611909	3564'

Anadarko Petroleum Corporation

VK 915
OCS-G-06894

Dorado Development
Public Plat

Bathymetry Map
CI:40

Author : Peter Gamwell, Jordan Dubuisson, David Ju

Date : February 1, 2018 | Scale : 1:24000

B
GENERAL INFORMATION

(a) Applications and Permits

Prior to beginning development operations in Viosca Knoll Block 915, the following applications will be submitted for approval.

Application/Permit	Issuing Agency	Status
Surface Commingling Application	BSEE	To be submitted
Lease Term Pipeline Applications	BSEE	To be submitted
Deepwater Operations Plan	BOEM	To be submitted
Conservation Information Document	BOEM	To be submitted

(b) Drilling Fluids

Not applicable as wells will not be drilled under this plan.

(c) Production

The following table provides information about each type of anticipated production from the wells covered under this plan:

Proprietary Information

(d) Oil Characteristics

A table summarizing the chemical and physical characteristics of the oils that will be produced, handled, transported or stored is required per NTL 2008-G04 when operators propose one of the following activities:

"**(1)** Activities for which the State of Florida is an affected State.
(2) Activities within the Protective Zones of the Flower Garden Banks and Stetson Bank.
(3) To install a surface facility located in water depths greater than 400 meters (1,312 feet), or a surface facility in any water depth that supports a subsea development in water depths greater than 400 meters (1,312 feet)."

Anadarko does not propose any of these three activities under this plan, therefore the oil characteristics tables required by NTL 2008-G04 are not applicable.

(e) New or Unusual Technology

Anadarko does not propose to use any new or unusual technology to develop the well proposed in this plan. Best available and safest technologies as referenced in 30 CFR 250 will be incorporated as standard operational procedure.

(f) Bonding Statement

The bond requirements for the activities and facilities proposed in this DOCD are satisfied by an area-wide bond furnished and maintained according to 30 CFR part 256, subpart I; NTL No. 2000-G16, “Guidelines for General Lease Surety Bonds,” and National NTL No. 2008-N07, “Supplemental Bond Procedures”.

(g) Oil Spill Financial Responsibility (OSFR)

Anadarko Petroleum Corporation (Company Number 00981) has demonstrated oil spill financial responsibility for the facilities proposed in this DOCD according to 30 CFR Part 254, and NTL No. 2008-N05, “Guidelines for Oil Spill Financial Responsibility for Covered Facilities”.

(h) Deepwater Well Control Statement

Anadarko Petroleum Corporation (Company Number 00981) has the financial capability to drill a relief well and conduct other emergency well control operations if required.

(i) Suspensions of Production

Should a suspension of production become necessary to hold this lease, an application will be submitted to BOEM in accordance with NTL 2000-G17.

(j) Blowout Scenario

The worst-case discharge scenario for this project is defined as an uncontrollable discharge to the seafloor during production operations. The scenario assumes that the wellhead fails mechanically and a blowout occurs at the seafloor, allowing the entire wellbore fluid to flow up the existing production string.

The maximum oil discharge during production from Viosca Knoll (VK) Block 915 is calculated to be 20,315 BOPD from the VK 915 #007 well. The VK 915 #007 is addressed in this blowout scenario since it is still the location with the highest potential worst case discharge (WCD) within the block.

Should a blowout occur, the formation types present in the GOM tend to bridge over in most cases. Additional well intervention and time requirements to drill a relief well pursuant to guidance provided in NTL No. 2015-N01 were discussed under the approved Exploration Plan (Plan Control No. S-7864). The following scenario summarizes the time taken to mobilize a rig and drill a relief well as discussed under previously approved Plan No. S-7864:

An estimate of 7-21 days would be required to suspend operations on a deepwater GOM well and begin drilling the relief well. This assumes 0-14 days to suspend current operations on an existing well and 7 days to mobilize and be ready to spud the relief well. The estimated time to drill the relief well to a blowout originating from the objective hydrocarbon zones is 80-99 days for an estimated total of 120 days maximum from time of blowout to completion of a relief well. The drilling days were based on the proposed days to drill the VK 915 #007 well through the objective sands (interval of WCD) with additional time added for ranging.

The time estimate provided for the plan well is inclusive of 'both' drilling 'and' completion operations. As a completion is not typically part of relief well operations no time has been included for completion operations in the relief well estimate. In addition, information and learning from the drilling of the original well may provide opportunities to optimize drilling performance for relief well operations and thus reduce the required drilling time. The maximum total volume during a blowout could potentially be **2,437,800 bbls** assuming 120 days for the maximum duration of a blowout, multiplied by the worst case daily uncontrolled blowout volume of 20,315 bbls.

k) Chemical Products

Per NTL No. 2008-G04, information regarding chemical products is not required to accompany this plan.

C
GEOLOGICAL AND GEOPHYSICAL INFORMATION

(a) Geological Description

Discussions regarding geologic information are considered proprietary and have been omitted from this section of the public copy DOCD.

(b) Structure Contour Maps

Current structure maps drawn to the top of each productive hydrocarbon sand showing the entire lease blocks, the surface location of each well and locations of geological cross-sections, are enclosed as **Attachment C-1.**

(c) Interpreted 2-D and/or 3-D Seismic Lines

Interpreted 2-D and/or 3-D Seismic Lines were previously included with the EP, and therefore not required per NTL 2008-G04.

(d) Geological Structure Cross-Sections

Interpreted geological structure cross-sections showing the location, depth, and expected productive formations of each proposed well are enclosed as **Attachment C-2.**

(e) Shallow Hazards Report

A Shallow Hazards Report was previously submitted to BOEM with the EP, and therefore not required per NTL 2008-G04.

(f) Shallow Hazards Assessment

A shallow hazards site clearance letter for the proposed well location was previously submitted under Exploration Plan Control No. S-7864.

(g) High-resolution Seismic Lines

High resolution seismic lines are not required per NTL No. 2008-G04.

(h) Stratigraphic Column

A generalized stratigraphic column is not required per NTL No. 2008-G04.

(i) Time Vs. Depth Tables

The proposed activities under this DOCD are not considered to be in areas where there is no well control. Therefore, a seismic travel time versus depth table is not required per NTL No. 2008-G04.

D
HYDROGEN SULFIDE INFORMATION

In accordance with Title 30 CFR 250.490(c), Viosca Knoll Block 915 was classified as H2S absent under previously approved initial and supplemental Exploration Plans.

E
Mineral Resource Conservation Information

(a) Technology & Reservoir Engineering Practices and Procedures

Anadarko does not plan to use enhanced recovery methods for development of this block. The reservoirs are pressure supported by natural water drive and standard production will afford efficient reserve recovery.

(b) Technology and Recovery Practices and Procedures

The well will be completed as conventional completions. As applicable, the well will be frac packed/gravel packed to maximize recovery.

(c) Reservoir Development

The wells will be monitored for performance and assessed for reservoir depletion to ensure recovery. Additional development drilling will be taken into account to ensure maximum recovery.

F
BIOLOGICAL, PHYSICAL, AND SOCIOECONOMIC INFORMATION

(a) Chemosynthetic Communities Report

Not applicable as wells have been and/or will be drilled and completed under an approved Exploration Plan. Chemosynthetic information for the proposed lease term pipelines will be submitted with the pipeline application.

Analysis

No drilling will be conducted under this plan. Drilling at the proposed location was approved under previous Plan Control No S-7864. Drilling was approved because features or areas that could support high-density chemosynthetic communities would not be located within 2,000 feet of the proposed muds and cuttings discharge location.

Features or areas that could support high-density chemosynthetic communities are not located within 250 feet of any seafloor disturbances.

(b) Topographic Features Map

The proposed activities are not within 1,000 feet of a no-activity zone or within the 3-mile radius zone of an identified topographic feature. Therefore, no map is required per NTL No. 2008-G04.

(c) Topographic Features Statement (Shunting)

Anadarko does not plan to drill more than two wells from the same surface location within the Protective Zone of an identified topographic feature. Therefore, the topographic features statement required by NTL No. 2008-G04 is not applicable.

(d) Live Bottoms (Pinnacle Trend) Map

The activities proposed in this plan are not within 200 feet of any pinnacle trend feature with vertical relief equal to or greater than 8 feet. Therefore, no map is required per NTL No. 2008-G04.

(e) Live Bottoms (Low Relief) Map

The activities proposed in this plan are not within 100 feet of any live bottom low relief features. Therefore, no map is required per NTL No. 2008-G04.

(f) Potentially Sensitive Biological Features

The activities proposed in this plan are not within 200 feet of any potentially sensitive biological features. Therefore, no map is required per NTL No. 2008-G04.

(g) Threatened and Endangered Species Information

Under Section 7 of the Endangered Species Act (ESA) all federal agencies must ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its designated critical habitat.

In accordance with the 30 CFR 250, Subpart B, effective May 14, 2007, and further outlined in Notice to Lessees (NTL) 2008-G04, lessees/operators are required to address site-specific information on the presence of federally listed threatened or endangered species and critical habitat designated under the ESA and marine mammals protected under the Marine Mammal Protection Act (MMPA) in the area of proposes activities under this plan.

Currently there are no designated critical habitats for the listed species in the Gulf of Mexico Outer Continental Shelf; however, it is possible that one or more of these species could be seen in the area of our operations.

The following table reflects the Federally-listed endangered and threatened species in the lease area and along the northern Gulf coast:

Species	Scientific Name	Status	Potential Presence		Critical Habitat Designated in Gulf of Mexico
			Lease Area	Coastal	
Marine Mammals					
Sperm whale	*Physeter macrocephalus*	E	X	--	None
West Indian manatee	*Trichechus manatus*[a]	E	--	X	Florida (Peninsular)
Sea Turtles					
Loggerhead turtle	*Caretta caretta*	T, E[b]	X	X	Nesting beaches and nearshore reproductive habitat in Mississippi, Alabama, and Florida (Panhandle); *Sargassum* habitat including most of the central and western Gulf of Mexico
Green turtle	*Chelonia mydas*	T, E[c]	X	X	None
Leatherback turtle	*Dermochelys coriacea*	E	X	X	None
Hawksbill turtle	*Eretmochelys imbricata*	E	X	X	None
Kemp's ridley turtle	*Lepidochelys kempii*	E	X	X	None
Birds					
Piping Plover	*Charadrius melodus*	T	--	X	Coastal Texas, Louisiana, Mississippi, Alabama, and Florida (Panhandle)
Whooping Crane	*Grus americana*	E	--	X	Coastal Texas (Aransas National Wildlife Refuge)
Fishes					
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	--	X	Coastal Louisiana, Mississippi, Alabama, and Florida (Panhandle)
Invertebrates					
Elkhorn coral	*Acropora palmata*	T	--	X	The Florida Keys and the Dry Tortugas
Lobed star coral	*Orbicella annularis*	T	--	X	None
Mountainous star coral	*Orbicella faveolata*	T	--	X	None
Boulder star coral	*Orbicella franksi*	T	--	X	None
Terrestrial Mammals					
Beach mice (subspecies: Alabama, Choctawhatchee, Perdido Key, St. Andrew)	*Peromyscus polionotus*	E	--	X	Alabama and Florida (Panhandle) beaches

Abbreviations: E = endangered; T = threatened.

[a] There are two subspecies of West Indian manatee: the Florida manatee (*T. m. latirostris*), which ranges from the northern Gulf of Mexico to Virginia, and the Antillean manatee (*T. m. manatus*), which ranges from northern Mexico to eastern Brazil. Only the Florida manatee subspecies is likely to be found in the northern Gulf of Mexico.

[b] The loggerhead turtle is composed of nine distinct population segments (DPSs) that are considered "species." The only DPS that may occur in the project area (Northwest Atlantic DPS) is listed as threatened (76 FR 58868; 22 September 2011).

[c] The green sea turtle is threatened, except for the Florida breeding population, which is listed as endangered.

The Environmental Impact Analysis in Section P of this plan further discusses potential impacts and mitigation measures related to threatened and endangered species.

(h) Archaeological Report

Viosca Knoll Block 915 has been determined to be located in an area where historic shipwrecks may exist. In accordance with NTL No. 2005-G07, "Archaeological Resource Surveys and Reports," and NTL No. 2011-JOINT-G01, "Revisions to the List of OCS Lease Blocks Requiring Archaeological Resource Surveys and Reports," an archaeological resource survey report, prepared by C&C Technologies Survey Services, was provided with previously approved Exploration Plan Control No. R-6011.

(i) Air and Water Quality Information

This DOCD does not propose activities for which the State of Florida is an affected State. Therefore, the discussion required per NTL 2008-G04 is not applicable to this DOCD.

(j) Socioeconomic Information

The activities proposed in this plan are not located offshore Florida. Therefore, socioeconomic information required per NTL 2008-G04 is not applicable to this DOCD.

G
WASTE AND DISCHARGE INFORMATION

The following estimates were prepared utilizing Anadarko's experience with similar operations. Estimated maximum discharge rates are reflected below. Projected amounts may vary during the course of operations.

(a) Projected Generated Wastes

Type of Waste	Composition	Projected Amount	Treatment/Storage/Disposal
Synthetic-based drilling fluids	Synthetic-based drilling muds	N/A	Re-use and/or transport to shore in DOT approved containers to an approved waste disposal facility, such as in Fourchon, Louisiana, and on to base/transfer station. If recycled, returned to vendor (Bariod or MI).
Cuttings wetted with synthetic-based fluids	Cuttings coated with synthetic drilling muds/fluids, including drilled out cement	N/A	Treated and discharge overboard **Note, an estimated 5-10% of cuttings may be transported to shore in tanks and/or cutting boxes and on to the base/transfer station if oil still remains.*
Water-based drilling fluids	Water based drilling muds (NaCl saturated, seawater, freshwater, barite)	N/A	Discharge overboard or at seafloor
Cuttings wetted with water-based fluids	Cuttings coated with water-based drilling muds/fluids	N/A	Discharge overboard
Chemical product waste (well treatment fluids)	Ethylene glycol Methanol ***Xylene**** ***Diesel****	89.91 bbls total 22.41 bbls total 450.09 bbls total 50 bbls total/year	Transport to shore in DOT approved containers to an approved waste disposal facility, such as Fourchon, Louisiana and on to Ecoserv Base. **Note, on average an estimated 5-10% of product total volume used during well treatment ops is sent back to shore for disposal. Volume shown reflects volume to be disposed of*
Completion Fluids	Brine, spent acid, prop sand, debris, gelled fluids, dead oil	3,000 bbls/well	Transport to shore in DOT approved containers to an approved waste disposal facility, such as Fourchon, Louisiana and on to Ecoserv Base.
Non-pollutant completion fluids	Low density uninhibited completion brines	5,000 bbls/well	Discharge overboard
Workover fluids/ Stim fluids	Brine, spent acid, prop sand, debris, gelled fluids, dead oil	3,000 bbls/well	Transport to shore in DOT approved containers to an approved waste disposal facility, such as Fourchon, Louisiana and on to Ecoserv Base.

Trash and debris	Refuse generated during operations	12,000 lbs total	Transport to shore in disposal bags by vessel to shorebase for pickup by municipal operations.
*Sanitary Wastes	Treated human body waste	2,619 bbls total	Chlorinate and discharge overboard
*Domestic Waste	Gray water	4,860 bbls total	Chlorinate and discharge overboard
Deck drainage	Platform washings and rainwater	68 bbls total	Treat for oil and grease and discharge overboard
Subsea production control fluid	Subsea production control fluid for actuating valves	135 bbls/well during commissioning and start-up. 12 bbl/well/year average during normal operations	Discharge at seafloor
Produced water	Formation water	81,000 bbls/well	Treat through flotation unit and discharge overboard
Desalinization Unit	Seawater	2,700 bbls total	Discharge overboard
Wash water	Drill water (fresh)	n/a	Discharge overboard
Blowout preventer fluid	Blend (3% Stack Magic & Filtered Fresh Water)	n/a	Discharge at seafloor
Ballast water	Seawater	As needed	Discharge overboard
Bilge water	Seawater	284 bbls total	Discharge overboard through 15 ppm equipment
Excess cement at the seafloor	Nitrified cement slurry	n/a	Discharge at seafloor
Fire water	Seawater	8,050,958 bbls/month	Discharge overboard
Cooling water	Seawater	8,050,958 bbls/month	Discharge overboard
Produced Sand	Oil-contaminated formation Sand	50 bbls/well/year	Transport to shore in DOT approved containers to an approved waste disposal facility, such as Newpark (injection disposal facility) or USLL (landfarm).
Used oil	Excess oil from engines	60 bbls total	Transport in DOT approved containers to shore for recycling

NOTE: ***Total amounts assume operations associated with 1 well will take 27 days total to complete***

(b) Projected Ocean Discharges

Type of Waste	Total Amount to be Discharged	Discharge Rate	Discharge Method
*Sanitary Wastes	2,619 bbls total	97 bbls/well/day	Chlorinate and discharge overboard
*Domestic waste	4,860 bbls total	180 bbls/well/day	Chlorinate and discharge overboard
Deck drainage	68 bbls total	2.5 bbls/well/day	Treat for oil and grease and discharge overboard
Desalinization Unit	2,700 bbls total	100 bbls/well/day	Discharge overboard
Wash water	N/A	N/A	Discharge overboard
Blowout preventer fluid	N/A	N/A	Discharge at seafloor
Ballast water	As needed	Not continuous	Discharge overboard

Bilge water	284 bbls	315 bbls/month	Discharge overboard through 15 ppm equipment
Excess cement at the seafloor	N/A	N/A	Discharge at seafloor
Fire water	7,245,855 bbls/total	8,050,958 bbls/month	Discharge overboard
Cooling water	7,245,855 bbls/total	8,050,958 bbls/month	Discharge overboard
Cuttings wetted with Water-based fluids	N/A	1,000 bbls/hr max	Discharge overboard
Water-based drilling fluids	N/A	1,000 bbls/hr max	Discharge at seafloor or overboard
Cuttings wetted with Synthetic-based fluids	N/A	NA	Treated and discharge overboard **Note, an estimated 5-10% of cuttings may be transported to shore in tanks and/or cutting boxes and on to the base/transfer station if oil still remains.*
Subsea production control fluid	135 bbls/well during commissioning and start-up. 12 bbl/well/year average during normal operations	5 bbl/well/day during commissioning and start-up. 1 bbl/well/month average during normal operations	Discharge at seafloor
Produced Water	81,000 bbls	3,000 bbls/well/day	Treat through flotation unit and discharge overboard
Non-pollutant completion fluids	5,000 bbls	100 bbl/hour	Discharge overboard

NOTE: ***Total amounts assume operations associated with 1 well will take 27 days total to complete***

(c) Modeling Report

The proposed activities under this plan do not meet the U.S. Environmental Protection Agency requirements for an individual NPDES permit. Therefore, modeling report requirements per NTL No. 2008-G04 is not applicable to this DOCD.

H
AIR EMISSIONS INFORMATION

(a) Screening Questions

Screen Procedures for DOCD's	Yes	No
Is any calculated Complex Total (CT) Emission amount (tons) associated with your proposed development activities more than 90% of the amounts calculated using the following formulas: CT = $3400D^{2/3}$ for CO, and CT = 33.3D for the other air pollutants (where D = distance to shore in miles)?		X
Do your emission calculations include any emission reduction measures or modified emission factors?	X	
Does or will the facility complex associated with your proposed development and production activities process production from eight or more wells?	X	
Do you expect to encounter H_2S at concentrations greater than 20 parts per million (ppm)?		X
Do you propose to flare or vent natural gas in excess of the criteria set forth under 250.1105(a)(2) and (3)?		X
Do you propose to burn produced hydrocarbon liquids?		X
Are your proposed development and production activities located within 25 miles from shore?		X
Are your proposed development and production activities located within 200 kilometers of the Breton Wilderness Area?	X	

(b) Air Emissions Spreadsheets

Air emission worksheets have been prepared utilizing the maximum horsepower rating from an Anadarko contracted DP Construction Vessel. A different vessel may be utilized, but the horsepower rating, average engine load, and air emissions will be equal to, or less than, the calculated plan emission amounts shown on the following pages. Air Emission Spreadsheets have been prepared and are enclosed as **Attachment H-1.** The complex total emission amounts include previously approved air emissions from Revised DOCD Control No. R-06597. There are no other assumptions made or proposed under this DOCD.

(c) Summary Information

Air Pollutant	Plan Emission Amounts[1] (tons)	Calculated Exemption Amounts[2] (tons)	Calculated Complex Total Emission Amounts[3] (tons)
Particulate matter (PM)	1.52	2197.80	10.25
Sulphur dioxide (SO_2)	0.03	2197.80	1.26
Nitrogen oxides (NO_x)	52.33	2197.80	1127.36
Volatile organic compounds (VOC)	1.57	2197.80	409.86
Carbon monoxide (CO)	11.42	55527.51	669.44

The air emission calculations were calculated by:

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Regulatory Analyst
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COMPANY	Anadarko Petroleum Corporation
AREA	Viosca Knoll
BLOCK	915
LEASE	OCS-G06894
PLATFORM	A-Marlin TLP
WELL	VK 915 #007
COMPANY CONTACT	Jill Fowler
TELEPHONE NO.	832-636-1554
REMARKS	Complex totals with Marlin TLP emissions, placing VK 915 #007 on production, and installation of subsea infrastructure. All emissions were previously included and approved under R-06597 (approved on 12/5/17); no changes have been made to these previously approved emissions.

LEASE TERM PIPELINE CONSTRUCTION INFORMATION:		
YEAR	NUMBER OF PIPELINES	TOTAL NUMBER OF CONSTRUCTION DAYS

Yes	No	Air Quality Screening Questions
	X	Is any calculated Complex Total (CT) Emission amount (tons) associated with your proposed development and production activities more than 90% of the amounts calculated using the following formulas: CT = $3400D^{2/3}$ for CO, and CT = 33.3D for the other air pollutants (where D = distance to shore in miles)?
X		Do your emission calculations include any emission reduction measures or modified emission factors?
X		Does or will the facility complex associated with your proposed development and production activities process production from eight or more wells?
	X	Do you expect to encounter H2S at concentrations greater than 20 parts per million (ppm)?
	X	Do you propose to flare or vent natural gas in excess of the criteria set forth under 250.1105(a)(2) and (3)?
	X	Do you propose to burn produced hydrocarbon liquids?
	X	Are your proposed development and production activities located within 25 miles from shore?
X		Are our proposed development and production activities located within 200 kilometers of the Breton Wilderness Area?

AIR EMISSIONS COMPUTATION FACTORS

Fuel Usage Conversion Factors	Natural Gas Turbines		Natural Gas Engines		Diesel Recip. Engine		REF.	DATE
	SCF/hp-hr	9.524	SCF/hp-hr	7.143	GAL/hp-hr	0.0483	AP42 3.2-1	4/76 & 8/84

Equipment/Emission Factors	units	PM	SOx	NOx	VOC	CO	REF.	DATE
NG Turbines	gms/hp-hr		0.00247	1.3	0.01	0.83	AP42 3.2-1& 3.1-1	10/96
Diesel Turbines[1]	gms/hp-hr	0.054	0.007	4	0.002	0.015	AP42 3.1-1 & 3.1-2a	4/00
NG 2-cycle lean	gms/hp-hr		0.00185	10.9	0.43	1.5	AP42 3.2-1	10/96
NG 4-cycle lean	gms/hp-hr		0.00185	11.8	0.72	1.6	AP42 3.2-1	10/96
NG 4-cycle rich	gms/hp-hr		0.00185	10	0.14	8.6	AP42 3.2-1	10/96
Diesel Recip. < 600 hp.	gms/hp-hr	1	0.005505	14	1.12	3.03	AP42 3.3-1	10/96
Diesel Recip. > 600 hp.	gms/hp-hr	0.32	0.005505	11	0.33	2.4	AP42 3.4-1	10/96
Diesel Boiler	lbs/bbl	0.084	0.009075	0.84	0.008	0.21	AP42 1.3-12,14	9/98
NG Heaters/Boilers/Burners	lbs/mmscf	7.6	0.593	100	5.5	84	AP42 1.4-1, 14-2, & 14-3	7/98
NG Flares	lbs/mmscf		0.593	71.4	60.3	388.5	AP42 11.5-1	9/91
Liquid Flaring	lbs/bbl	0.42	6.83	2	0.01	0.21	AP42 1.3-1 & 1.3-3	9/98
Tank Vapors	lbs/bbl				0.03		E&P Forum	1/93
Fugitives	lbs/hr/comp.				0.0005		API Study	12/93
Glycol Dehydrator Vent	lbs/mmscf				6.6		La. DEQ	1991
Gas Venting	lbs/scf				0.0034			

Diesel Turbine Fuel Usage based on data from AP-42,
(10,000 BTU/hp-hr)(1 gal diesel/139,000 BTU) = 0.072 GAL/hp-hr

Sulphur Content Source	Value	Units
Fuel Gas	3.33	ppm
Diesel Fuel[2]	0.0015	% weight
Produced Gas(Flares)	3.33	ppm
Produced Oil (Liquid Flaring)	1	% weight

[1]Diesel Turbine Factors from AP-42 used for periods when diesel fuel burned by Generator Turbines (GT-01, GT-02, GT-03).

[2]Diesel Fuel factor adjusted based on use of ultra-low sulfur diesel.

AIR EMISSIONS CALCULATIONS -
2018

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL	CONTACT	PHONE	REMARKS
Anadarko Petroleum Corporation	Viosca Knoll	915	OCS-G06894	A-Marlin TLP	VK 915 #007	Jill Fowler	832-636-1554	Complex totals with Marlin TLP emissions, placing VK 915 #007 on production, and installation of subsea infrastructure. All emissions were previously included and approved under R-06597 (approved on 12/5/17); no changes have been made to these previously approved emissions.

OPERATIONS	EQUIPMENT	RATING	MAX. FUEL	ACT. FUEL	RUN TIME		MAXIMUM POUNDS PER HOUR					ESTIMATED TONS				
	Diesel Engines	HP	GAL/HR	GAL/D												
	Nat. Gas Engines	HP	SCF/HR	SCF/D												
	Burners	MMBTU/HR	SCF/HR	SCF/D	HR/D	DAYS	PM	SOx	NOx	VOC	CO	PM	SOx	NOx	VOC	CO
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FACILITY SS Installation	VESSELS>600hp	12000	579.6	13910.40	24	15	8.46	0.15	290.75	8.72	63.44	1.52	0.03	52.33	1.57	11.42
INSTALLATION	MATERIAL TUG diesel		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRODUCTION																
PW-01 (pressure washer)	RECIP.<600hp diesel	10	0.483	11.59	24	365	0.02	0.00	0.31	0.02	0.07	0.10	0.00	1.35	0.11	0.29
PW-02 (presure washer)	RECIP.<600hp diesel	10	0.483	11.59	24	365	0.02	0.00	0.31	0.02	0.07	0.10	0.00	1.35	0.11	0.29
LB-01 (life boat)	RECIP.<600hp diesel	30	1.449	34.78	1	52	0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.02	0.00	0.01
LB-02 (life boat)	RECIP.<600hp diesel	30	1.449	34.78	1	52	0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.02	0.00	0.01
Air Compressor #1	RECIP.<600hp diesel	140	6.762	162.29	24	365	0.31	0.00	4.32	0.35	0.93	1.35	0.01	18.91	1.51	4.09
UHP-01 (paint)	RECIP.<600hp diesel	275	13.2825	318.78	24	90	0.61	0.00	8.48	0.68	1.84	0.65	0.00	9.16	0.73	1.98
UHP-02 (paint)	RECIP.<600hp diesel	275	13.2825	318.78	24	90	0.61	0.00	8.48	0.68	1.84	0.65	0.00	9.16	0.73	1.98
DCE-01 (crane)	RECIP.<600hp diesel	525	25.3575	608.58	3	365	1.16	0.01	16.19	1.30	3.50	0.63	0.00	8.86	0.71	1.92
DCE-02 (crane)	RECIP.<600hp diesel	525	25.3575	608.58	3	365	1.16	0.01	16.19	1.30	3.50	0.63	0.00	8.86	0.71	1.92
PE-01 (firewater)	RECIP.<600hp diesel	572	27.6276	663.06	2	36	1.26	0.01	17.64	1.41	3.82	0.05	0.00	0.63	0.05	0.14
PE-02 (firewater)	RECIP.<600hp diesel	572	27.6276	663.06	2	36	1.26	0.01	17.64	1.41	3.82	0.05	0.00	0.63	0.05	0.14
GE-05 (emergency generator)	RECIP.>600hp diesel	1019	49.2177	1181.22	2	52	0.72	0.01	24.69	0.74	5.39	0.04	0.00	1.28	0.04	0.28
GE-06 (emergency generator)	RECIP.>600hp diesel	1340	64.722	1553.33	2	52	0.94	0.02	32.47	0.97	7.08	0.05	0.00	1.69	0.05	0.37
Temporary 1	RECIP.>600hp diesel	1000	48.3	1159.20	24	180	0.70	0.01	24.23	0.73	5.29	1.52	0.03	52.33	1.57	11.42
Supply Boat	SUPPORT VESSEL diesel	9266	447.5478	10741.15	12	52	6.53	0.11	224.51	6.74	48.98	2.04	0.04	70.05	2.10	15.28
CE-01 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76	24	365		0.01	37.00	0.52	31.82		0.03	162.08	2.27	139.39
CE-02 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76	24	365		0.01	37.00	0.52	31.82		0.03	162.08	2.27	139.39
CT-01 (turbine)	TURBINE nat gas	13222	125926.328	3022231.87	24	240		0.07	37.86	0.29	24.17		0.21	109.04	0.84	69.62
CT-02 (turbine)	TURBINE nat gas	15000	125926.328	3022231.87	24	240		0.08	42.95	0.33	27.42		0.24	123.70	0.95	78.98
HeatMediaPump	TURBINE nat gas	1291	142860	3428640.00	24	365		0.01	3.70	0.03	2.36		0.03	16.19	0.12	10.34
GT-01A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-01B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
GT-02A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-02B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
GT-03A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-03B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
	BURNER nat gas		0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MISC.	**BPD**	**SCF/HR**	**COUNT**												
	TANK-	27000			24	365				33.75					147.83	
	FLARE- Routine		516.42		24	275		0.00	0.04	0.03	0.20		0.00	0.12	0.10	0.66
	FLARE- Upset		1,416,666.67		12	6		0.84	101.15	85.43	550.38		0.03	3.64	3.08	19.81
	PROCESS VENT- Routine		473.03		24	90				1.61					1.74	
	PROCESS VENT- Upset		1,416,666.67		12	6				4816.67					173.40	
	FUGITIVES-			10000.0		365				5.00					21.90	
	GLYCOL STILL VENT-		1500000		24	365				9.90					43.36	
DRILLING	OIL BURN	0			0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WELL TEST	GAS FLARE		0		0	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
2018	**YEAR TOTAL**						**26.25**	**1.76**	**1180.26**	**4979.81**	**855.21**	**10.25**	**1.26**	**1127.36**	**409.86**	**669.44**
EXEMPTION CALCULATION	**DISTANCE FROM LAND IN MILES**											**2197.80**	**2197.80**	**2197.80**	**2197.80**	**55527.51**
	66.0															

AIR EMISSIONS CALCULATIONS -
2019-2027

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL	CONTACT	PHONE	REMARKS
Anadarko Petroleum Corporation	Viosca Knoll	915	OCS-G06894	A-Marlin TLP	VK 915 #007	Jill Fowler	832-636-1554	Complex totals with Marlin TLP emissions, placing VK 915 #007 on production, and installation of subsea infrastructure All emissions were previously included and approved under R-06597 (approved on 12/5/17), no changes have been made to these previously approved emissions

OPERATIONS	EQUIPMENT	RATING	MAX. FUEL	ACT. FUEL	RUN TIME		MAXIMUM POUNDS PER HOUR					ESTIMATED TONS				
	Diesel Engines	HP	GAL/HR	GAL/D												
	Nat. Gas Engines	HP	SCF/HR	SCF/D												
	Burners	MMBTU/HR	SCF/HR	SCF/D	HR/D	DAYS	PM	SOx	NOx	VOC	CO	PM	SOx	NOx	VOC	CO
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FACILITY	VESSELS>600hp		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTALLATION	MATERIAL TUG diesel		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRODUCTION																
PW-01 (pressure washer)	RECIP.<600hp diesel	10	0.483	11.59	24	365	0.02	0.00	0.31	0.02	0.07	0.10	0.00	1.35	0.11	0.29
PW-02 (presure washer)	RECIP.<600hp diesel	10	0.483	11.59	24	365	0.02	0.00	0.31	0.02	0.07	0.10	0.00	1.35	0.11	0.29
LB-01 (life boat)	RECIP.<600hp diesel	30	1.449	34.78	1	52	0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.02	0.00	0.01
LB-02 (life boat)	RECIP.<600hp diesel	30	1.449	34.78	1	52	0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.02	0.00	0.01
Air Compressor #1	RECIP.<600hp diesel	140	6.762	162.29	24	365	0.31	0.00	4.32	0.35	0.93	1.35	0.01	18.91	1.51	4.09
UHP-01 (paint)	RECIP.<600hp diesel	275	13.2825	318.78	24	90	0.61	0.00	8.48	0.68	1.84	0.65	0.00	9.16	0.73	1.98
UHP-02 (paint)	RECIP.<600hp diesel	275	13.2825	318.78	24	90	0.61	0.00	8.48	0.68	1.84	0.65	0.00	9.16	0.73	1.98
DCE-01 (crane)	RECIP.<600hp diesel	525	25.3575	608.58	3	365	1.16	0.01	16.19	1.30	3.50	0.63	0.00	8.86	0.71	1.92
DCE-02 (crane)	RECIP.<600hp diesel	525	25.3575	608.58	3	365	1.16	0.01	16.19	1.30	3.50	0.63	0.00	8.86	0.71	1.92
PE-01 (firewater)	RECIP.<600hp diesel	572	27.6276	663.06	2	36	1.26	0.01	17.64	1.41	3.82	0.05	0.00	0.63	0.05	0.14
PE-02 (firewater)	RECIP.<600hp diesel	572	27.6276	663.06	2	36	1.26	0.01	17.64	1.41	3.82	0.05	0.00	0.63	0.05	0.14
GE-05 (emergency generator)	RECIP.>600hp diesel	1019	49.2177	1181.22	2	52	0.72	0.01	24.69	0.74	5.39	0.04	0.00	1.28	0.04	0.28
GE-06 (emergency generator)	RECIP.>600hp diesel	1340	64.722	1553.33	2	52	0.94	0.02	32.47	0.97	7.08	0.05	0.00	1.69	0.05	0.37
Temporary 1	RECIP.>600hp diesel	1000	48.3	1159.20	24	180	0.70	0.01	24.23	0.73	5.29	1.52	0.03	52.33	1.57	11.42
Supply Boat	SUPPORT VESSEL diesel	9266	447.5478	10741.15	12	52	6.53	0.11	224.51	6.74	48.98	2.04	0.04	70.05	2.10	15.28
CE-01 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76	24	365		0.01	37.00	0.52	31.82		0.03	162.08	2.27	139.39
CE-02 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76	24	365		0.01	37.00	0.52	31.82		0.03	162.08	2.27	139.39
CT-01 (turbine)	TURBINE nat gas	13222	125926.328	3022231.87	24	240		0.07	37.86	0.29	24.17		0.21	109.04	0.84	69.62
CT-02 (turbine)	TURBINE nat gas	15000	125926.328	3022231.87	24	240		0.08	42.95	0.33	27.42		0.24	123.70	0.95	78.98
HeatMediaPump	TURBINE nat gas	1291	142860	3428640.00	24	365		0.01	3.70	0.03	2.36		0.03	16.19	0.12	10.34
GT-01A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-01B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
GT-02A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-02B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
GT-03A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-03B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
	BURNER nat gas		0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MISC.	BPD	SCF/HR	COUNT												
	TANK-	27000			24	365				33.75					147.83	
	FLARE- Routine		516.42		24	275		0.00	0.04	0.03	0.20		0.00	0.12	0.10	0.66
	FLARE- Upset		1,416,666.67		12	6		0.84	101.15	85.43	550.38		0.03	3.64	3.08	19.81
	PROCESS VENT- Routine		473.03		24	90				1.61					1.74	
	PROCESS VENT- Upset		1,416,666.67		12	6				4816.67					173.40	
	FUGITIVES-			10000.0		365				5.00					21.90	
	GLYCOL STILL VENT-		1500000		24	365				9.90					43.36	
DRILLING	OIL BURN	0			0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WELL TEST	GAS FLARE		0		0	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
2019-2027	YEAR TOTAL						17.80	1.62	889.51	4971.08	791.77	8.72	1.24	1075.02	408.29	658.02
EXEMPTION CALCULATION	DISTANCE FROM LAND IN MILES											2197.80	2197.80	2197.80	2197.80	55527.51
	66.0															

AIR EMISSIONS CALCULATIONS -
2028

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL	CONTACT	PHONE	REMARKS
Anadarko Petroleum Corporation	Viosca Knoll	915	OCS-G06894	A-Marlin TLP	VK915 #007	Jill Fowler	832-636-1554	Complex totals with Marlin TLP emissions, placing VK915 #007 on production, and installation of subsea infrastructure All emissions were previously included and approved under R-06597 (approved on 12/5/17), no changes have been made to these previously approved emissions

OPERATIONS	EQUIPMENT	RATING	MAX. FUEL	ACT. FUEL	RUN TIME		MAXIMUM POUNDS PER HOUR					ESTIMATED TONS				
	Diesel Engines	HP	GAL/HR	GAL/D												
	Nat. Gas Engines	HP	SCF/HR	SCF/D												
	Burners	MMBTU/HR	SCF/HR	SCF/D	HR/D	DAYS	PM	SOx	NOx	VOC	CO	PM	SOx	NOx	VOC	CO
Well Work	Main Deiesel Engines		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPELINE INSTALLATION (Tie-Back)	PIPELINE LAY BARGE diesel		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SUPPORT VESSEL diesel		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	PIPELINE BURY BARGE diesel		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SUPPORT VESSEL diesel		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FACILITY INSTALLATION	DERRICK BARGE diesel		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MATERIAL TUG diesel		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRODUCTION																
PW-01 (pressure washe	RECIP <600hp diesel	10	0.483	11.59	24	365	0.02	0.00	0.31	0.02	0.07	0.10	0.00	1.35	0.11	0.29
PW-02 (presure washer	RECIP <600hp diesel	10	0.483	11.59	24	365	0.02	0.00	0.31	0.02	0.07	0.10	0.00	1.35	0.11	0.29
LB-01 (life boat)	RECIP <600hp diesel	30	1.449	34.78	1	52	0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.02	0.00	0.01
LB-02 (life boat)	RECIP <600hp diesel	30	1.449	34.78	1	52	0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.02	0.00	0.01
Air Compressor #1	RECIP <600hp diesel	140	6.762	162.29	24	365	0.31	0.00	4.32	0.35	0.93	1.35	0.01	18.91	1.51	4.09
UHP-01 (paint)	RECIP <600hp diesel	275	13.2825	318.78	24	90	0.61	0.00	8.48	0.68	1.84	0.65	0.00	9.16	0.73	1.98
UHP-02 (paint)	RECIP <600hp diesel	275	13.2825	318.78	24	90	0.61	0.00	8.48	0.68	1.84	0.65	0.00	9.16	0.73	1.98
DCE-01 (crane)	RECIP <600hp diesel	525	25.3575	608.58	3	365	1.16	0.01	16.19	1.30	3.50	0.63	0.00	8.86	0.71	1.92
DCE-02 (crane)	RECIP <600hp diesel	525	25.3575	608.58	3	365	1.16	0.01	16.19	1.30	3.50	0.63	0.00	8.86	0.71	1.92
PE-01 (firewater)	RECIP <600hp diesel	572	27.6276	663.06	2	36	1.26	0.01	17.64	1.41	3.82	0.05	0.00	0.63	0.05	0.14
PE-02 (firewater)	RECIP <600hp diesel	572	27.6276	663.06	2	36	1.26	0.01	17.64	1.41	3.82	0.05	0.00	0.63	0.05	0.14
GE-05 (emergency gen	RECIP >600hp diesel	1019	49.2177	1181.22	2	52	0.72	0.01	24.69	0.74	5.39	0.04	0.00	1.28	0.04	0.28
GE-06 (emergency gen	RECIP >600hp diesel	1340	64.722	1553.33	2	52	0.94	0.02	32.47	0.97	7.08	0.05	0.00	1.69	0.05	0.37
Temporary 1	RECIP >600hp diesel	1000	48.3	1159.20	24	180	0.70	0.01	24.23	0.73	5.29	1.52	0.03	52.33	1.57	11.42
Supply Boat	SUPPORT VESSEL diesel	9266	447.5478	10741.15	12	52	6.53	0.11	224.51	6.74	48.98	2.04	0.04	70.05	2.10	15.28
CE-01 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76	24	365		0.01	37.00	0.52	31.82		0.03	162.08	2.27	139.39
CE-02 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76	24	365		0.01	37.00	0.52	31.82		0.03	162.08	2.27	139.39
CT-01 (turbine)	TURBINE nat gas	13222	125926.328	3022231.87	24	240		0.07	37.86	0.29	24.17		0.21	109.04	0.84	69.62
CT-02 (turbine)	TURBINE nat gas	15000	125926.328	3022231.87	24	240		0.08	42.95	0.33	27.42		0.24	123.70	0.95	78.98
HeatMediaPump	TURBINE nat gas	1291	142860	3428640.00	24	365		0.01	3.70	0.03	2.36		0.03	16.19	0.12	10.34
GT-01A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-01B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
GT-02A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-02B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
GT-03A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19	2	365	0.79	0.10	58.49	0.03	0.22	0.29	0.04	21.35	0.01	0.08
GT-03B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06	24	365		0.04	19.01	0.15	12.14		0.16	83.27	0.64	53.16
	BURNER nat gas		0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MISC.	BPD	SCF/HR	COUNT												
	TANK-	27000			24	365				33.75					147.83	
	FLARE- Routine		516.42		24	365		0.00	0.04	0.03	0.20		0.00	0.16	0.14	0.88
	FLARE- Upset		1,416,666.67		12	6		0.84	101.15	85.43	550.38		0.03	3.64	3.08	19.81
	PROCESS VENT- Routine		473.03		24	365				1.61					7.04	
	PROCESS VENT- Upset		1,416,666.67		12	6				4816.67					173.40	
	FUGITIVES-			10000.0		365				5.00					21.90	
	GLYCOL STILL VENT-		1500000		24	365				9.90					43.36	
DRILLING	OIL BURN	0			0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WELL TEST	GAS FLARE		0		0	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
2028 YEAR TOTAL							17.80	1.62	889.51	4971.08	791.77	8.72	1.24	1075.06	413.63	658.24
EXEMPTION CALCULATION	DISTANCE FROM LAND IN MILES											2197.80	2197.80	2197.80	2197.80	55527.51
	66.0															

SUMMARY

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL
Anadarko Petroleum Corporation	Viosca Knoll	915	OCS-G06894	A-Marlin TLP	VK 915 #007

Year	Emitted		Substance		
	PM	SOx	NOx	VOC	CO
2018	10.25	1.26	1127.36	409.86	669.44
2019-2027	8.72	1.24	1075.02	408.29	658.02
2028	8.72	1.24	1075.06	413.63	658.24
Allowable	2197.80	2197.80	2197.80	2197.80	55527.51

OMB Control No. 1010-0151
OMB Approval Expires: 03/31/2018

COMPANY	Anadarko Petroleum Corporation
AREA	Viosca Knoll
BLOCK	915
LEASE	OCS-G06894
PLATFORM	A-Marlin TLP
WELL	VK 915 #007
COMPANY CONTACT	Jill Fowler
TELEPHONE NO.	832-636-1554
REMARKS	Plan totals with placing VK 915 #007 on production, and installation of subsea infrastructure.

LEASE TERM PIPELINE CONSTRUCTION INFORMATION:

YEAR	NUMBER OF PIPELINES	TOTAL NUMBER OF CONSTRUCTION DAYS

AIR EMISSIONS COMPUTATION FACTORS

Fuel Usage Conversion Factors	Natural Gas Turbines		Natural Gas Engines		Diesel Recip. Engine		REF.	DATE
	SCF/hp-hr	9.524	SCF/hp-hr	7.143	GAL/hp-hr	0.0483	AP42 3.2-1	4/76 & 8/84

Equipment/Emission Factors	units	PM	SOx	NOx	VOC	CO	REF.	DATE
NG Turbines	gms/hp-hr		0.00247	1.3	0.01	0.83	AP42 3.2-1& 3.1-1	10/96
Diesel Turbines[1]	gms/hp-hr	0.054	0.007	4	0.002	0.015	AP42 3.1-1 & 3.1-2a	4/00
NG 2-cycle lean	gms/hp-hr		0.00185	10.9	0.43	1.5	AP42 3.2-1	10/96
NG 4-cycle lean	gms/hp-hr		0.00185	11.8	0.72	1.6	AP42 3.2-1	10/96
NG 4-cycle rich	gms/hp-hr		0.00185	10	0.14	8.6	AP42 3.2-1	10/96
Diesel Recip. < 600 hp.	gms/hp-hr	1	0.005505	14	1.12	3.03	AP42 3.3-1	10/96
Diesel Recip. > 600 hp.	gms/hp-hr	0.32	0.005505	11	0.33	2.4	AP42 3.4-1	10/96
Diesel Boiler	lbs/bbl	0.084	0.009075	0.84	0.008	0.21	AP42 1.3-12,14	9/98
NG Heaters/Boilers/Burners	lbs/mmscf	7.6	0.593	100	5.5	84	AP42 1.4-1, 14-2, & 14-3	7/98
NG Flares	lbs/mmscf		0.593	71.4	60.3	388.5	AP42 11.5-1	9/91
Liquid Flaring	lbs/bbl	0.42	6.83	2	0.01	0.21	AP42 1.3-1 & 1.3-3	9/98
Tank Vapors	lbs/bbl				0.03		E&P Forum	1/93
Fugitives	lbs/hr/comp.				0.0005		API Study	12/93
Glycol Dehydrator Vent	lbs/mmscf				6.6		La. DEQ	1991
Gas Venting	lbs/scf				0.0034			

Diesel Turbine Fuel Usage based on data from AP-42,
(10,000 BTU/hp-hr)(1 gal diesel/139,000 BTU) = 0.072 GAL/hp-hr

Sulphur Content Source	Value	Units
Fuel Gas	3.33	ppm
Diesel Fuel[2]	0.0015	% weight
Produced Gas(Flares)	3.33	ppm
Produced Oil (Liquid Flaring)	1	% weight

[1]Diesel Turbine Factors from AP-42 used for periods when diesel fuel burned by Generator Turbines (GT-01, GT-02, GT-03).

[2]Diesel Fuel factor adjusted based on use of ultra-low sulfur diesel.

AIR EMISSIONS CALCULATIONS -
2018

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL	CONTACT	PHONE	REMARKS
Anadarko Petroleum Corporation	Viosca Knoll	915	OCS-G06894	A-Marlin TLP	VK 915 #007	Jill Fowler	832-636-1554	Plan totals with placing VK 915 #007 on production, and installation of subsea infrastructure.

OPERATIONS	EQUIPMENT	RATING	MAX. FUEL	ACT. FUEL	RUN TIME		MAXIMUM POUNDS PER HOUR					ESTIMATED TONS				
	Diesel Engines	HP	GAL/HR	GAL/D												
	Nat. Gas Engines	HP	SCF/HR	SCF/D												
	Burners	MMBTU/HR	SCF/HR	SCF/D	HR/D	DAYS	PM	SOx	NOx	VOC	CO	PM	SOx	NOx	VOC	CO
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FACILITY SS Installation	VESSELS>600hp	12000	579.6	13910.40	24	15	8.46	0.15	290.75	8.72	63.44	1.52	0.03	52.33	1.57	11.42
INSTALLATION	MATERIAL TUG diesel		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(crew)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	VESSELS>600hp diesel(supply)		0	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PRODUCTION																
PW-01 (pressure washer)	RECIP.<600hp diesel	10	0.483	11.59			0.02	0.00	0.31	0.02	0.07	0.00	0.00	0.00	0.00	0.00
PW-02 (presure washer)	RECIP.<600hp diesel	10	0.483	11.59			0.02	0.00	0.31	0.02	0.07	0.00	0.00	0.00	0.00	0.00
LB-01 (life boat)	RECIP.<600hp diesel	30	1.449	34.78			0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.00	0.00	0.00
LB-02 (life boat)	RECIP.<600hp diesel	30	1.449	34.78			0.07	0.00	0.93	0.07	0.20	0.00	0.00	0.00	0.00	0.00
Air Compressor #1	RECIP.<600hp diesel	140	6.762	162.29			0.31	0.00	4.32	0.35	0.93	0.00	0.00	0.00	0.00	0.00
UHP-01 (paint)	RECIP.<600hp diesel	275	13.2825	318.78			0.61	0.00	8.48	0.68	1.84	0.00	0.00	0.00	0.00	0.00
UHP-02 (paint)	RECIP.<600hp diesel	275	13.2825	318.78			0.61	0.00	8.48	0.68	1.84	0.00	0.00	0.00	0.00	0.00
DCE-01 (crane)	RECIP.<600hp diesel	525	25.3575	608.58			1.16	0.01	16.19	1.30	3.50	0.00	0.00	0.00	0.00	0.00
DCE-02 (crane)	RECIP.<600hp diesel	525	25.3575	608.58			1.16	0.01	16.19	1.30	3.50	0.00	0.00	0.00	0.00	0.00
PE-01 (firewater)	RECIP.<600hp diesel	572	27.6276	663.06			1.26	0.01	17.64	1.41	3.82	0.00	0.00	0.00	0.00	0.00
PE-02 (firewater)	RECIP.<600hp diesel	572	27.6276	663.06			1.26	0.01	17.64	1.41	3.82	0.00	0.00	0.00	0.00	0.00
GE-05 (emergency generator)	RECIP.>600hp diesel	1019	49.2177	1181.22			0.72	0.01	24.69	0.74	5.39	0.00	0.00	0.00	0.00	0.00
GE-06 (emergency generator)	RECIP.>600hp diesel	1340	64.722	1553.33			0.94	0.02	32.47	0.97	7.08	0.00	0.00	0.00	0.00	0.00
Temporary 1	RECIP.>600hp diesel	1000	48.3	1159.20			0.70	0.01	24.23	0.73	5.29	0.00	0.00	0.00	0.00	0.00
Supply Boat	SUPPORT VESSEL diesel	9266	447.5478	10741.15			6.53	0.11	224.51	6.74	48.98	0.00	0.00	0.00	0.00	0.00
CE-01 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76				0.01	37.00	0.52	31.82		0.00	0.00	0.00	0.00
CE-02 (compressor)	RECIP.4 cycle rich nat gas	1680	12000.24	288005.76				0.01	37.00	0.52	31.82		0.00	0.00	0.00	0.00
CT-01 (turbine)	TURBINE nat gas	13222	125926.328	3022231.87				0.07	37.86	0.29	24.17		0.00	0.00	0.00	0.00
CT-02 (turbine)	TURBINE nat gas	15000	125926.328	3022231.87				0.08	42.95	0.33	27.42		0.00	0.00	0.00	0.00
HeatMediaPump	TURBINE nat gas	1291	142860	3428640.00				0.01	3.70	0.03	2.36		0.00	0.00	0.00	0.00
GT-01A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19			0.79	0.10	58.49	0.03	0.22	0.00	0.00	0.00	0.00	0.00
GT-01B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06				0.04	19.01	0.15	12.14		0.00	0.00	0.00	0.00
GT-02A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19			0.79	0.10	58.49	0.03	0.22	0.00	0.00	0.00	0.00	0.00
GT-02B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06				0.04	19.01	0.15	12.14		0.00	0.00	0.00	0.00
GT-03A (generator)	TURBINE Dual Fuel-diesel	6639	478.008	11472.19			0.79	0.10	58.49	0.03	0.22	0.00	0.00	0.00	0.00	0.00
GT-03B (generator)	TURBINE Dual Fuel-natural gas	6639	63229.836	1517516.06				0.04	19.01	0.15	12.14		0.00	0.00	0.00	0.00
	BURNER nat gas		0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MISC.	BPD	SCF/HR	COUNT												
	TANK-	27000								33.75					0.00	
	FLARE- Routine		516.42					0.00	0.04	0.03	0.20		0.00	0.00	0.00	0.00
	FLARE- Upset		1,416,666.67					0.84	101.15	85.43	550.38		0.00	0.00	0.00	0.00
	PROCESS VENT- Routine		473.03							1.61					0.00	
	PROCESS VENT- Upset		1,416,666.67							4816.67					0.00	
	FUGITIVES-			10000.0						5.00					0.00	
	GLYCOL STILL VENT-		1500000							9.90					0.00	
DRILLING	OIL BURN	0					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WELL TEST	GAS FLARE		0					0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
2018	YEAR TOTAL						26.25	1.76	1180.26	4979.81	855.21	1.52	0.03	52.33	1.57	11.42
EXEMPTION CALCULATION	DISTANCE FROM LAND IN MILES											2197.80	2197.80	2197.80	2197.80	55527.51
	66.0															

SUMMARY

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL
Anadarko Petroleum Corporation	Viosca Knoll	915	OCS-G06894	A-Marlin TLP	VK 915 #007

Year	Emitted		Substance		
	PM	SOx	NOx	VOC	CO
2018	1.52	0.03	52.33	1.57	11.42
Allowable	2197.80	2197.80	2197.80	2197.80	55527.51

I
OIL SPILL INFORMATION

(a) Oil Spill Response Planning

(i) OSRP Information

All the proposed activities and facilities in this DOCD are covered by the Regional Oil Spill Response Plan (OSRP) approved on August 14, 2015 for Anadarko Petroleum Corporation and its subsidiaries, Anadarko US Offshore Corporation and Anadarko E&P Company L.P. (Company Numbers 00981, 02219 and 00148, respectively) in accordance with 30 CFR Part 254. The June 2017 biennial updates were acknowledged by BSEE July 12, 2017, and October 5, 2017 updates were acknowledged by BSEE November 2, 2017. Per BSEE the OSRP is in compliance with 30 CFR 254.30.

(ii) Spill Response Sites

Primary Response Equipment Location(s)	Preplanned Staging Location(s)
Houma, Louisiana	Fourchon, Louisiana
Harvey, Louisiana	Harvey, Louisiana
Venice, Louisiana	Venice, Louisiana
Lake Charles, Louisiana	Cameron, Louisiana
Galveston, Texas	Galveston, Texas

(iii) OSRO Information

Anadarko maintains a contract with Clean Gulf Associates (CGA) for spill response equipment. Various equipment locations are staged throughout the Gulf of Mexico. CGA equipment can be referenced on their website: http://www.cleangulfassoc.com/. Personnel would be obtained from the Marine Spill Response Corporation's (MSRC) STARS network, including a supervisor to operate the equipment.

In addition Anadarko has a contract with the Marine Spill Response Corporation (MSRC) for spill response equipment. MSRC stages equipment throughout the Gulf of Mexico and has recently completed a large expansion of its resources, with particular focus on deepwater. The expansion is known as "Deep Blue". MSRC capabilities and a complete equipment listing is available on-line at: http://www.msrc.org/.

Anadarko is also a member of the Marine Well Containment Company (MWCC), which provides access to containment response capabilities and includes subsea dispersant injection equipment.

(iv) Worst-Case Scenario Determination

Category	Regional OSRP	DOCD
Type of Activity	Production	Production
Facility Location (area/block)	GC 680	VK 915
Facility Designation	Platform A	Well #007
Distance to Nearest Shoreline	120 Miles	66 miles
Storage Tanks (total)	5,735 bbls	NA
Flowlines (on facility)	1,892 bbls	NA
Lease Term Pipelines	11,682 bbls	5 BOPD
Uncontrolled Blowout	47,380 BOPD	20,315 BOPD
Total Volume	66,689 BOPD	20,320 BOPD
Type of Oil(s)	Oil	Oil
API Gravity	30	35.4

Anadarko has determined that the worst-case scenario from the activities proposed in this Supplemental DOCD do not supersede the worst-case scenario for Green Canyon Block 680.

Since Anadarko has the capability to respond to the worst-case spill scenario included in our Regional OSRP approved on August 14, 2015 (and update acknowledged on November 2, 2017), I hereby certify that Anadarko Petroleum Corporation has the capability to respond, to the maximum extent practicable, to a worst-case discharge, or a substantial threat of such a discharge, resulting from the activities proposed in our DOCD.

(b) Oil Spill Response Discussion

For the purpose of NEPA analysis, the largest spill volume originating from the proposed activity would be an uncontrolled blowout of the well during production operations at 20,315 BOPD with an API gravity of 35.4°. A discussion of the blowout scenario from this proposed activity is included within this Supplemental DOCD under Section B.

Land Segment and Resource Identification Modeling

Trajectory of a spill and the probability of its impacting a land segment have been projected utilizing information in the BOEM Oil Spill Risk Analysis Model (OSRAM) for the Central Gulf of Mexico. Additional information may be referenced in the "Oil-Spill Risk Analysis:

Contingency Planning Statistics for Gulf of Mexico OCS Activities" (OCS Report MMS 2004-026), using the average conditional probability for 3, 10, and 30 day impacts.

Viosca Knoll Block 915 is located within Launch Area C55. According to the BOEM OSRAM, the trajectory indicates a 17% probability of potential impact to the shoreline in Plaquemines Parish, Louisiana. The results are shown in Table I-2.

Plaquemines Parish is identified as the most probable potential impacted parish or county within the Gulf of Mexico for this operation. Plaquemines Parish includes Barataria Bay, the Mississippi River Delta, Breton Sound and the affiliated islands and bays. This region is an extremely sensitive habitat and serves as a migratory, breeding, feeding and nursery habitat for numerous species of wildlife. Beaches in this area vary in grain particle size and can be classified as fine sand, shell or perched shell beaches. Sandy and muddy tidal flats are also abundant.

Response

Anadarko will make every effort to respond to the worst-case discharge as effectively as possible. Response equipment available to respond to the worst-case discharge and the estimated time of a spill response from oil spill detection to equipment deployment on-site is included in **Table I-3.** The table estimates individual times needed for procurement, load out, travel time to the site and deployment. In the event of an actual incident equipment and times can vary.

For the purpose of response scenario discussion, an uncontrolled blowout of the well would be considered the largest potential spill volume at 20,315 BOPD. An ADIOS weathering model was run based on a similar type of oil expected to be produced from this well. Based on this information, approximately 33% (6,704 bbls) of the initial volume would be evaporated/dispersed within 24 hours.

If approved and appropriate, 4 sorties (8,000 gallons) from the Basler aircraft and 8 sorties (9,600 gallons) from two DC-3 aircrafts could disperse approximately 7,540 barrels of oil.

If the conditions are appropriate, and the necessary approvals and permits have been obtained, in-situ burning may be utilized. Based on in-situ burn operations during Deepwater Horizon, approximately 5% (1,016 bbls) of the total initial worst case discharge could be burned.

Although unlikely in a spill lasting thirty (30) days, potential shoreline impact in Plaquemines Parish, Louisiana could occur depending on environmental conditions (wind, currents and temperature) at the time of an incident. Nearshore response may include the use of shoreline boom on beach areas, or protection/sorbent boom on vegetated areas. Surveillance and real time trajectories would aide in determining the most appropriate strategies to respond to a spill.

Table I.3 provides an example of offshore and nearshore equipment, response times, and personnel to respond to a spill of 13,611 bbls, which is the estimated amount that would remain considering natural evaporation/dispersion at 24 hours. This amount could be further reduced through the application of aerial and subsea dispersants, and in-situ burning provided such applications/actions were approved.

Anadarko's contingency plan for dealing with this worst-case discharge would be to activate its Spill Management Team and equipment resources as described in its Gulf of Mexico Regional Oil Spill Response Plan (OSRP) and provide continuous support for the duration of the event. Response resources are activated and supplemented according to need. These resources would remain engaged in the response until the incident is deemed complete or until released by Unified Command.

Anadarko is a member of the Marine Well Containment Company (MWCC), which provides access to containment response capabilities and includes subsea dispersant injection equipment.

In the event of a blowout, Anadarko may:

1. Evacuate personnel, if necessary. Deploy emergency responders in an effort to preserve human life, if necessary.

2. Assess the damage and attempt to stop the flow at the source, if safe to do so, to reduce the amount of oil discharged.

3. Notify agencies.

4. Assess the amount of oil that has been spilled and calculate additional potential of oil flow. A continuous aerial surveillance program would be used to assess the growth of the slick and the volume of oil on the water. Observations of the size of the slick on the water, combined with observations at the source, would be used to provide a constant update. Additional potential to release fuel from the remaining tanks onboard the drilling rig would be determined by marine surveyors. Operations and Unified Command would continue to assess the adequacy of response equipment capacities based on this continually updated mass balance.

5. Convene the Spill Management Team (SMT). Organize Unified Command and establish objectives and priorities.

6. Monitor the oil spill with aerial surveillance and obtain trajectories. If oil is seaward bound, going away from land, discuss additional strategies with Unified Command.

7. If oil is moving in the direction of a shoreline and weather conditions are favorable, request approval to utilize dispersants.

   a. Prior to commencing application operations, conduct an on-site survey in consultation with natural resource specialists to determine if any threatened or endangered species are present in the projected application area or otherwise at risk from dispersant application.

   b. Upon approval, mobilize one Basler aircraft and two DC-3 aircrafts from Houma, with surveillance aircraft and spotter. Rotate aircraft, spraying the leading edge of the spill and working back to the source. Monitor/sample for effectiveness (USCG SMART Team). Truck additional dispersants from CGA or MSRC stockpile if necessary.

c. Dispersants are most effective when applied as soon after discharge as possible, since weathering of the oil decreases dispersant effectiveness. The estimated window of opportunity for most effective use of dispersants is within 48-72 hours post-release. The oil may still be dispersible after 72 hours on the water surface, but the effectiveness of dispersant use would likely be diminished after the oil has been on the water for more than three days. Ultimately, the USCG SMART monitoring protocol will be used to determine whether or not dispersant operations are effective.

d. Once the CGA HOSS barge is on location and in the skimming mode, dispersants would only be used if required and approved.

8. Deploy offshore mechanical oil containment and recovery equipment. Attempt to recover as much oil at sea as possible, utilizing:

a. The CGA HOSS barge, will be positioned in a stationary mode, will be situated down-wind and down-current from location for long-duration, high-volume skimming. Based on average travel times, the HOSS barge could be on location within approximately 48 hours of the release. The de-rated skimming capacity of the HOSS barge is 43,000 bbls per day. However, only the oil encountered by a skimmer can be recovered. In order to maximize oil encounter rate, boom will be deployed in a V-configuration in front of the HOSS barge to funnel oil to the skimmers. If necessary, temporary barges can be activated to support continuous skimming operations. (These barges arrive on-site at approximately the same time as the HOSS barge.) For an on-going release, multiple barges are deployed to provide for continuous off-loading of skimmer storage vessels and shuttling of recovered oil to an onshore waste handling facility. Sufficient barges are available to provide enough temporary storage for continuous recovery operations.

b. CGA's Fast Response Units (FRU) would arrive on-scene between approximately 20-25 hours of the initial release. These skimmers operate downstream of the HOSS barge and are used to recover pockets and streamers of oil that may move past the large stationary skimmer. The FRU's has approximately 200 barrels of on-board storage. Approval will be requested to decant water after gravity separation, through a hose forward of the skimmer, to optimize temporary storage capacity. Auto boom will be utilized to concentrate oil so that it is thick enough to be skimmed.

9. Dispersants, Fast Response Units (FRU), Oil Spill Response Vessels (OSRV or R/V) would typically work daylight hours only. The HOSS barge can operate continuously, including night operations. Available technology will be considered such as remote sensing devices that will enable 24 hour surveillance, trajectories, and planning. All response vessels are designed to be able to remain offshore continuously throughout the response. Even if sea conditions prohibit effective skimming, these resources would

remain offshore until skimming operations could be commenced again. Safety would remain the first priority.

10. Prepare site-specific Waste Management Plan, Site Safety Plan, Decontamination Plans, Communications and Medical Plans.

11. If oil becomes a threat to any shoreline, data from the aerial surveillance, weather reports, and trajectories would be used to direct onshore teams to deploy protection/containment boom with reference to Area Contingency Plans and in coordination with State and Federal On-Scene Coordinators.

    a. Implement pre-designated strategies.

    b. Identify resources at risk in spill vicinity.

    c. Develop/implement appropriate protection tactics.

12. Establish site-specific Wildlife Rescue and Rehabilitation Plan.

The following types of additional support may be required for a blowout lasting 120 days.

- Additional Oil Spill Removal Organization (OSRO) personnel to relieve equipment operators
- Vessels for supporting offshore operations
- Field safety personnel
- Continued surveillance and monitoring of oil movement
- Helicopter, video cameras
- Infra-red (night time spill tracking) capabilities, X-band radar
- Barge to transport recovered oil from offshore skimming system, and temporary storage barges to onshore disposal sites that are identified in Area Contingency Plans (ACP)
- Logistics needed to support equipment:
  - Staging areas
  - Parts, trailers, and mechanics to maintain skimmers and boom
  - Fueling facilities
  - Decontamination stations
  - Dispersant stockpile transported from Houston to Houma or other potential command post locations
  - Communications equipment and technicians
- Logistics needed to support responder personnel
  - Medical aid stations
  - Safety personnel
  - Food
  - Berthing
  - Additional clothing/safety supplies
  - Decontamination stations

Louisiana CZM Containment Response Information

Anadarko has the capability to respond and contain, to the maximum extent practicable as defined in 30 CFR 254.6 and 30 CFR 250.26(d)(1), to the estimated worst case discharge (WCD) associated with the proposed activity within 30 days. Deployment time for surface containment equipment is subject to availability and location, weather conditions, potential security zones around the spill site, and site/well specific assessment data. Personnel safety is always first and foremost. Refer to further details on equipment and timing provided in **Section I–Oil Spill Information** and **Table I-3** of the DOCD.

There will be no new or unusual technology deployed that has not been previously deployed for Gulf of Mexico oil spill prevention, control, and/or cleanup.

Table I-1

Worst Case Discharge Calculation
(Based on Blowout during Production Operations)

Calculations for Uncontrolled Blowout> 10 miles from shore:		**Block 915**
i.	Type of Oil (crude, condensate, diesel)	Crude
ii.	API Gravity	35.4°
iii.	DOCD Location Used for VK 915 WCD	Well #007
iv.	Largest Anticipated WCD Rate during blowout	20,315 BOPD
v.	**WCD Total for Production Operations for VK 915 (> 10 miles from shore):**	**20,315 BOPD**

Table I-2

<table>
<tr><th colspan="7">Trajectory by Land Segment

Following are the average conditional probabilities (expressed as percent chance) that an oil spill starting at a particular launch area will contact a land segment as included in the BOEM Oil Spill Risk Analysis Model (OSRAM) for the Central Gulf of Mexico. This information can be found on the BOEM website using 3/10/30 day potential impact, as applicable. The results are listed below.</th></tr>
<tr><th rowspan="2">Area/Block</th><th rowspan="2">OCS-G</th><th rowspan="2">Launch Area</th><th rowspan="2">Land Segment and/or Resource</th><th colspan="3">Conditional Probability (%)</th></tr>
<tr><th>3 days</th><th>10 days</th><th>30 days</th></tr>
<tr><td>Viosca Knoll Block 915

(66 miles from shore)</td><td>G06894</td><td>C55

Central Planning Area</td><td>Terrebonne, LA
Lafourche, LA
Plaquemines, LA
St. Bernard, LA
Hancock & Harrison, MS
Jackson, MS
Mobile, AL
Baldwin, AL
Escambia, FL
Okaloosa, FL
Walton, FL
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</table>

Table I-3

WCD Scenario Production Activities – Based on a single well uncontrolled blowout (66 miles from shore)
Viosca Knoll Block 915
20,315 BOPD (initial volume)
13,611 BOPD (after evaporation/dispersion)
API Gravity 35.4º

Offshore Equipment from Spill Detection to Equipment Deployment Response Time: Viosca Knoll Block 915

Dispersants/Surveillance

Dispersant/Surveillance	Dispersant Capacity (gal)	Storage Capacity	Persons Req.	From	Hrs to Procure	Hrs to Loadout	Travel to site	Total Hrs
CGA								
Basler 67T	2000	NA	2	Houma	1	1	0.9	2.9
ASI								
DC 3	1200	NA	2	Houma	1	1	1.1	3.1
DC 3	1200	NA	2	Houma	1	1	1.1	3.1
Aero Commander	NA	NA	2	Houma	1	1	0.9	2.9

Offshore Response

Offshore Equipment Pre-determined Staging	EDRC	Storage Capacity	VOO	Persons Req.	From	Hrs to Procure	Hrs to Loadout	Hrs to GOM	Travel to Spill Site	Hrs to Deploy	Total Hrs
CGA											
HOSS Barge	43000	4000	3 Tugs	5	Harvey	7	0	5	15.0	1	28.0
Boom Barge (CGA-3000 42" Auto Boom (25000')	NA	NA	1 Tug 50 Crew	4 (Barge) 2 (Per Crew)	Leeville	4	0	6	18.6	1.5	30.1
T&T Marine (available through contract with CGA)											
Koseq Skimming Arms (5)	89145	10000	5 Utility	30	Galveston	4	12	4	23.3	2	45.3
Koseq Skimming Arms (3)	53487	6000	3 Utility	18	Leeville	4	12	10	10.8	2	38.8
Koseq Skimming Arms (1)	17829	2000	1 Utility	6	Fourchon	4	12	9.5	10.8	2	38.3
Koseq Skimming Arms (2)	35658	4000	2 Utility	12	Venice	4	12	11	11.7	2	40.7
Enterprise Marine Services LLC (available through contract with CGA)											
CTCo 2604	NA	20000	1 Tug	6	Amelia	4	12	4	18.13	1	39.13
CTCo 2605	NA	20000	1 Tug	6	Amelia	4	12	4	18.13	1	39.13
CTCo 2606	NA	20000	1 Tug	6	Amelia	4	12	4	18.13	1	39.13
CTCo 2607	NA	23000	1 Tug	6	Amelia	4	12	4	18.13	1	39.13
CTCo 5001	NA	47000	1 Tug	6	Amelia	4	12	4	18.13	1	39.13
K-Sea Operating (available through contract with CGA)											
Pacific 996165	NA	80000	1 Tug	6	Fourchon	4	12	2	16.25	1	35.25
DBL 76 1212984	NA	83937	1 Tug	6	Fourchon	4	12	2	16.25	1	35.25
DBL 101 1119760	NA	107285	1 Tug	6	Fourchon	4	12	2	16.25	1	35.25

Spill Team Area Responders (STARS) called out by Marine Spill Response Corporation (MSRC)
Vessel of Opportunity=VOO
EMS=Enterprise Marine Services
K-Sea=K-Sea Operating Partnership

Offshore Equipment Pre-determined Staging	EDRC	Storage Capacity	VOO	Persons Required	From	Hrs to Procure	Hrs to Loadout	Hrs to GOM	Travel to Spill Site	Hrs to Deploy	Total Hrs
					MSRC						
Louisiana Responder Transrec 350 + OSRV *2,640' 44" Sea Sentry II Boom* *5,280' 67" LAMOR*	10567	4000	NA	14	Fort Jackson	2	0	1	5.6	1	9.6
MSRC 452 Offshore Barge 1 Crucial Disk 88/30 *1,980' 44" Sea Sentry II Boom* *660 ' 67" LAMOR*	11122	45000	3 Tugs	6	Fort Jackson	2	0	2	20	1	25
Mississippi Responder Transrec 350 + OSRV *5,280' 44" Sea Sentry II Boom* *2,640' 67" LAMOR*	10567	4000	NA	14	Pascagoula	2	0	1	10	1	14
MSRC 402 Offshore Barge 2 Crucial Disk 88/30 *660' 44" Sea Sentry II Boom* *1,980' 67" LAMOR*	22244	40300	3 Tugs	6	Pascagoula	2	0	2	35.7	1	40.7
Deep Blue Responder LFF 100 Brush + OSRV *6,600' 44" Sea Sentry II Boom* *660' 67" LAMOR*	18086	4000	NA	14	Fourchon	2	0	1	5.2	1	9.2
PSV – HOS Centerline 1 Crucial Disk 88/30 *1,320' EFC (cont inflate)*	11122	24300	NA	14	Fourchon	12	12	1	10.8	1	36.8
PSV – HOS Strongline 1 Crucial Disk 88/30 *1,320' EFC (cont inflate)*	11122	24300	NA	14	Fourchon	12	12	1	10.8	1	36.8
PSV – C-Freedom 1 LFF 100 Brush *1,320' EFC (cont inflate)*	18086	11756	NA	14	Fourchon	12	12	1	10.8	1	36.8
MSRC Lightning 2 LORI Brush Pack	5000	50	3 Tugs	6	Tampa	2	0	2	20	1	25
MSRC 360 Offshore Barge 1 Crucial Disk 88/30 *1,320' 44" Sea Sentry II Boom*	11122	36000	3 Tugs	6	Tampa	2	0	2	71.4	1	76.4

Offshore Equipment Pre-determined Staging	EDRC	Storage Capacity	VOO	Persons Required	From	Hrs to Procure	Hrs to Loadout	Hrs to GOM	Travel to Spill Site	Hrs to Deploy	Total Hrs
					MSRC						
Gulf Coast Responder Transrec 350 + OSRV *5,280' 44" Sea Sentry II Boom* *2,640' 67" LAMOR*	10567	4000	NA	14	Lake Charles	2	0	1	9.2	1	13.2
Texas Responder Transrec 350 + OSRV *4,620' 44" Sea Sentry II Boom* *3,300' 67" LAMOR*	10567	4000	NA	14	Galveston	2	0	1	11.2	1	15.2
MSRC 570 Offshore Barge 2 Crucial Disk 88/30 *2,640' 44" Sea Sentry II Boom*	22244	56900	3 Tugs	6	Galveston	2	0	2	40	1	45
Southern Responder Transrec 350 + OSRV *4,290' 44" Sea Sentry II Boom* *2,970' 67" LAMOR*	10567	4000	NA	14	Ingleside	2	0	1	15.2	1	19.2
MSRC 403 Offshore Barge 1 Crucial Disk 88/30 *660' 44" Sea Sentry II Boom* *660' 67" LAMOR*	11122	40300	3 Tugs	6	Ingleside	2	0	2	54.3	1	59.3
MSRC Quick Strike 2 LORI Brush Pack	5000	50	3 Tugs	6	Ingleside	2	0	2	15.2	1	20.2

Staging Area: Fourchon

Offshore Equipment Preferred Staging	EDRC	Storage Capacity	VOO	Persons Req.	From	Hrs to Procure	Hrs to Loadout	Travel to Staging	Travel to Site	Hrs to Deploy	Total Hrs
T&T Marine (Available through contract with CGA)											
Aqua Guard Triton RBS (2)	45560	4000	2 Utility	12	Galveston	4	12	6	23.3	1	46.3
CGA											
FRU (1) + 100 bbl Tank (2)	4251	200	1 Utility	6	Galveston	1	2	6	10.0	1	20.0
FRU (1) + 100 bbl Tank (1)	4251	100	1 Utility	6	Harvey	1	2	1.25	10.0	1	15.3
FRU (1) + 100 bbl Tank (2)	4251	200	1 Utility	6	Ingleside	1	2	9	10.0	1	23.0
FRU (1) + 100 bbl Tank (2)	4251	200	1 Utility	6	Lake Charles	1	2	3	10.0	1	17.0
FRU (2) + 100 bbl Tank (2)	8502	400	2 Utility	12	Leeville	1	2	1.25	10.0	1	15.3
FRU (1) + 100 bbl Tank (2)	4251	200	1 Utility	6	Morgan City	1	2	0.75	10.0	1	14.8
FRU (2) + 100 bbl Tank (4)	8502	400	2 Utility	12	Venice	1	2	3	10.0	1	17.0
MSRC											
Stress I (1) + Storage Bladder	15840	500	1 Utility	6	Ingleside	1	2	9.5	10.8	1	24.3
Stress I (1) + Storage Bladder	15840	500	1 Utility	6	Galveston	1	2	7	10.8	1	21.8
Stress I (1) + Storage Bladder	15840	500	1 Utility	6	Lake Charles	1	2	4	10.8	1	18.8
Stress I (1) + Storage Bladder	15840	500	1 Utility	6	Fourchon	1	2	0	10.8	1	14.8
Stress I (1) + Storage Bladder	15840	500	1 Utility	6	Fort Jackson	1	2	3.75	10.8	1	18.55
Stress I (1) + Storage Bladder	15840	500	1 Utility	6	Pascagoula	1	2	4	10.8	1	18.8
Stress I (1) + Storage Bladder	15840	500	1 Utility	6	Tampa	1	2	13	10.8	1	27.8
LFF 100 Brush (1) + Storage Bladder	18086	500	1 Utility	6	Lake Charles	1	2	4	10.8	1	18.8
LFF 100 Brush (2) + Storage Bladder	36172	6000	2 Utility	12	Fourchon	1	2	0	10.8	1	14.8
Crucial Disk 88/30 + Storage Bladder	11122	500	1 Utility	6	Fourchon	1	2	0	10.8	1	14.8
GT-185 w Adap + Storage Bladder	1371	500	1 Utility	6	Fourchon	1	2	0	10.8	1	14.8
Desmi Ocean + Storage Bladder	3017	500	1 Utility	6	Fort Jackson	1	2	0	10.8	1	14.8
Foilex 200 + Storage Bladder	1989	500	1 Utility	6	Fort Jackson	1	2	0	10.8	1	14.8

Offshore Equipment Preferred Staging	EDRC	Storage Capacity	VOO	Persons Req.	From	Hrs to Procure	Hrs to Loadout	Travel to Staging	Travel to Site	Hrs to Deploy	Total Hrs
CGA											
Hydro-Fire Boom	NA	NA	8 Utility	40	Harvey (HFB)	1	4	1.25	10.0	6	22.3
MSRC											
44" Sea Sentry II Boom (2860')	NA	NA	6 Crew	12	Ingleside	1	2	9.5	10.8	1	24.3
44" Sea Sentry II Boom (4290')	NA	NA	10 Crew	20	Galveston	1	2	7	10.8	1	21.8
44" Sea Sentry II Boom (6679')	NA	NA	10 Crew	20	Lake Charles	1	2	4	10.8	1	18.8
44" Sea Sentry II Boom (1980')	NA	NA	6 Crew	12	Fort Jackson	1	2	3.75	10.8	1	18.55
44" Sea Sentry II Boom (3190')	NA	NA	10 Crew	20	Pascagoula	1	2	4	10.8	1	18.8
2000' Hydro-Fire Boom	NA	NA	16 Utility	80	Lake Charles	1	2	4	10.8	1	18.8

Nearshore Equipment from Spill Detection to Equipment Deployment Response Time: Viosca Knoll Block 915

Nearshore Response

Nearshore Equipment Pre-determined Staging	EDRC	Storage Capacity	VOO	Persons Required	From	Hrs to Procure	Hrs to Loadout	Hrs to GOM	Travel to Site	Hrs to Deploy	Total Hrs
CGA											
46' FRV	5000	65	NA	4	Galveston	1	0	0	11.2	0	12.2
46' FRV	5000	65	NA	4	Leeville	1	0	2	5.2	0	8.2
46' FRV	5000	65	NA	4	Lake Charles	1	0	1	9.2	0	11.2
46' FRV	5000	65	NA	4	Venice	1	0	1	5.6	0	7.6
Trinity SWS	21500	249	NA	4	Galveston	1	2	2	11.2	0	16.2
Trinity SWS	21500	249	NA	4	Leeville	1	2	2	5.2	0	10.2
Trinity SWS	21500	249	NA	4	Morgan City	1	2	2	5.2	0	10.2
Trinity SWS	21500	249	NA	4	Venice	1	2	2	5.6	0	10.6
K-Sea Operating (available through contract with CGA)											
DBL 82 1137538	NA	86948	1 Tug	6	Houma	4	12	2	16.88	1	35.88
Enterprise Marine Services LLC (available through contract with CGA)											
CTCo 2603	NA	25000	1 Tug	6	Amelia	4	12	4	18.13	1	39.13
CTCo 2608	NA	23000	1 Tug	6	Amelia	4	12	4	18.13	1	39.13
CTCo 2609	NA	23000	1 Tug	6	Amelia	4	12	4	18.13	1	39.13

Staging Area: Fourchon

Nearshore Equipment Preferred Staging	EDRC	Storage Capacity	VOO	Persons Req.	From	Hrs to Procure	Hrs to Load Out	Travel to Staging	Travel to Deployment	Hrs to Deploy	Total Hrs
CGA											
SWS Egmopol	3000	100	NA	3	Galveston	1	2	6.5	2	0	11.5
SWS Egmopol	3000	100	NA	3	Morgan City	1	2	1.8	2	0	6.8
SWS Marco	3588	20	NA	3	Lake Charles	1	2	4	2	0	9
SWS Marco	3588	34	NA	3	Leeville	1	2	.3	2	0	5.3
Rope Mop	77	2	0	3	Harvey	1	2	2	2	0	7

Nearshore Equipment Preferred Staging	EDRC	Storage Capacity	VOO	Persons Req.	From	Hrs to Procure	Hrs to Load Out	Travel to Staging	Travel to Deployment	Hrs to Deploy	Total Hrs
MSRC											
Foilex 250 Skimmer+ Storage Bladder	3977	500	1 Crew	3	Fort Jackson	2	.5	3	2	.5	8
Foilex 250 Skimmer+ Storage Bladder	3977	500	1 Crew	3	Lake Charles	2	.5	4	2	.5	9
Foilex 250 Skimmer+ Storage Bladder	3977	500	1 Crew	3	Galveston	2	.5	6.5	2	.5	11.5
Foilex 250 Skimmer+ Storage Bladder	3977	500	1 Crew	3	Ingleside	2	.5	9	2	.5	14
WP-1 Skimmer+ Storage Bladder	3017	500	1 Utility	3	Ingleside	2	.5	9	2	.5	14
Aardvac 800 Skimmer+ Storage Bladder	3840	500	NA	3	Pascagoula	2	.5	3.5	2	.5	8.5

Shoreline Protection

Staging Area: Cameron

Shoreline Protection Boom	VOO	Persons Req.	Storage/Warehouse Location	Hrs to Procure	Hrs to Load Out	Travel to Staging	Travel to Deployment	Hrs to Deploy	Total Hrs
OMI Environmental (available through MSA)									
10,000' 18" Boom	4 Crew	10	New Iberia, LA	1	1	3.5	2	3	10.5
10,000' 18" Boom	4 Crew	10	Houston, TX	1	1	7	2	3	14
10,000' 18" Boom	4 Crew	10	Port Arthur, TX	1	1	5.75	2	3	12.75
20,000' 18" Boom	8 Crew	20	Belle Chasse, LA	1	1	3	2	6	13
10,000' 18" Boom	4 Crew	10	Port Allen, LA	1	1	3.5	2	3	10.5
10,000' 18" Boom	4 Crew	10	Houma, LA	1	1	2	2	3	9
15,000' 18" Boom	6 Crew	14	Gretna, LA (Warehouse)	2	2	2.75	2	4	12.75
AMPOL (available through MSA)									
42,000' 18" Boom	16 Crew	40	New Iberia, LA	2	2	3.5	2	12	21.5
20,000' 18" Boom	8 Crew	20	New Orleans, LA	2	2	2.75	2	6	14.75
ES&H									
50,000' 18" Shoreline	20 Crew	50	Houston, TX	.5	.5	7	2	15	25
50,000' 18" Shoreline	20 Crew	50	Lake Charles, LA	.5	.5	5	2	15	23
20,000' 18" Shoreline	8 Crew	20	New Iberia, LA	.5	.5	3.5	2	6	12.5
1,000' 18" Shoreline	2 Crew	6	Morgan City, LA	.5	.5	2.5	2	1	6.5
20,000' 18" Shoreline	8 Crew	20	Belle Chasse, LA	.5	.5	3	2	6	12
15,000' 18" Shoreline	6 Crew	14	Mobile, AL	.5	.5	5	2	4	12
5,000' 18" Shoreline	2 Crew	6	Dallas Ft. Worth, TX	.5	.5	9.75	2	2	14.75
50,000' 18" Shoreline	20 Crew	50	Houma, LA	.5	.5	2	2	15	20

Beach Boom	EDRC	Storage Capacity	VOO	Persons Req.	From	Hrs to Procure	Hrs to Load Out	Travel to Staging	Travel to Deployment	Hrs to Deploy	Total Hrs
CGA											
Beach Boom (2000')	NA	NA	NA	6	Galveston	1	2	6	1	2	12
Beach Boom (1000')	NA	NA	NA	4	Ingleside	1	2	9	1	2	15
Beach Boom (2000')	NA	NA	NA	6	Pascagoula	1	2	3	1	2	9

Wildlife Response	EDRC	Storage Capacity	VOO	Persons Req.	From	Hrs to Procure	Hrs to Load Out	Travel to Staging	Travel to Deployment	Hrs to Deploy	Total Hrs
CGA											
Wildlife Support Trailer	NA	NA	NA	2	Houma	1	2	0	1	2	6
Bird Scare Guns (24)	NA	NA	NA	2	Belle Chasse	1	2	1.25	1	2	7.25
Bird Scare Guns (12)	NA	NA	NA	2	Galveston	1	2	6	1	2	12
Bird Scare Guns (24)	NA	NA	NA	2	Houma	1	2	0	1	2	6
Bird Scare Guns (12)	NA	NA	NA	2	Ingleside	1	2	9	1	2	15
Bird Scare Guns (24)	NA	NA	NA	2	Lake Charles	1	2	3	1	2	9
Bird Scare Guns (24)	NA	NA	NA	2	Pascagoula	1	2	3	1	2	9

Response Asset	Total
Offshore EDRC	704,680
Offshore Recovered Oil Storage	747,878
Nearshore / Shallow Water EDRC	142,018
Nearshore / Shallow Water Recovered Oil Storage	162,460

**Some equipment may be used offshore up to approximately 25 miles from shore*

Operational Limitations of Response Equipment

- HOSS Barge–8 foot seas
- Fast Response Unit (FRU)–8 foot seas
- Oil Spill Response Vessel (OSRV and R/V)–4 foot seas
- Boom–3 foot seas, 20 knot winds
- Dispersants–winds more than 25 knots, visibility less than 3 nautical miles or ceiling less than 1,000 feet

J
Environmental Monitoring Information

(a) Monitoring Systems

Anadarko Petroleum Corporation will monitor loop currents per NTL 2005-G05.

Anadarko subscribes to Wilkens Weather Service which provides real-time weather conditions such as tropical depressions, storms and/or hurricanes entering the Gulf.

(b) Incidental Takes

Although marine mammals may be seen in the area, Anadarko does not believe that its operations proposed under this DOCD will result in the harassment, capture, collection or killing of any mammals covered by the Marine Mammal Protection Act.

Anadarko will operate in accordance with applicable regulations and guidance, including:

> *NTL No. 2016-G02 – "Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program"
>
> *BSEE NTL No. 2015-G03 "Marine Trash and Debris Awareness and Elimination", and
>
> *JOINT NTL No. 2016-G01 "Vessel Strike Avoidance and Injured/Dead Protected Species Reporting"

(c) Environmental Mitigation Measures

The Environmental Impact Analysis in Section P of this plan further discusses potential impacts and mitigation measures related to threatened and endangered species.

This DOCD does not propose activities for which the State of Florida is an affected State. Therefore, the discussion required per NTL 2008-G04 is not applicable to this DOCD.

K
LEASE STIPULATIONS INFORMATION

Lease Sale # 81

Protected Species Stipulation: This stipulation requires operators to collect and remove flotsam resulting from their activities; to post signs detailing why release of debris must be eliminated; watch for protected marine mammals and see turtles (includes speed and distance parameters if mammals or turtles are sited); reports sightings and locations of dead or injured marine mammals or turtles and if the operators activities are responsible remain available to assist in the recovery and comply with applicable mitigation measures when conducting seismic operations. It also requires operators to comply with applicable Notices to Lessees which contain further restrictions regarding protection of marine mammals and turtles.

All activities will be conducted in accordance to NTL 2015-G03 “Marine Trash and Debris Awareness Training and Elimination” and NTL 2016-G01 “Vessel Strike Avoidance and Injured/Dead Protected Species Reporting”.

Military Warning Area Stipulation: Viosca Knoll Block 915 is located within MWA W-155B Military Test Area. Anadarko will contact this office in order to coordinate and control the electromagnetic emissions during these proposed operations.

Cultural Resources: Viosca Knoll Block 915 has been determined to be located in an area where cultural resources may exist.

Based on the information provided in the C&C Technologies Survey Services Archaeological Assessment Report (C&C Technologies, 2007) submitted with Freeport-McMorran’s Exploration Plan (Control No. R-4782) approved on February 1, 2008, no known shipwrecks and no archaeological avoidances exist within 2,000 feet of the locations proposed in this EP.

If Anadarko discovers any cultural resource while conducting operations on the lease area, the discovery will be immediately reported to the BOEM GOMR Regional Manager. Anadarko will make every reasonable effort to preserve the cultural resource if encountered.

L
RELATED FACILITIES AND OPERATIONS INFORMATION

(a) Related OCS Facilities and Operations

One new subsea well in VK 915 will be tied back to the existing Marlin TLP in VK Block 915. The well will be equipped with a subsea wellhead and subsea tree. The well will be tied in to an existing pipeline In-Line-Sled (ILS) in VK 915 with a new well jumper, a new subsea manifold, and a new flowline jumper. The subsea well will flow back to the Marlin TLP via the existing Dorado pipe-in-pipe riser Segment No. 16151 (inner pipe) and 16152 (casing). The well will be controlled via an existing electro-hydraulic umbilical (S-17662). A new subsea router module (SRM) will be installed on the sea bed to distribute power and communications from the umbilical to the well.

The pipeline boarding shut down valves will close in 45 seconds. Only minor modifications to the Marlin TLP will be needed to accommodate the handling of the new production proposed in this plan.

(b) Transportation System

Oil and gas from the VK 915 development departs the Marlin TLP via the existing export pipelines. The gas will depart the platform via the existing 14-inch gas export pipeline (Segment No. 11766) operated by Anadarko to Platform P in Main Pass Block 260 with ultimate delivery into the Destin Pipeline Operations System DTN. The liquid hydrocarbons will depart the TLP via the existing 10-inch oil export pipeline (Segment No. 11765) operated by Anadarko and will be transported to Platform A in Main Pass Block 225 for ultimate delivery to the Odyssey Pipeline (Operations System No. 51.1). No new or expanded onshore processing plants are proposed. No changes to the transportation system are proposed as a part of this plan.

(c) Produced Liquid Hydrocarbons Transportation Vessels

No produced liquid hydrocarbons are anticipated to be transported by means other than a pipeline for the activities proposed as a part of this plan.

(d) Decommissioning Information

Subsequent to applicable lease expirations, abandonment activities will be conducted in accordance with all state and federal regulations.

M
Support Vessels and Aircraft Information

(a) General

Type	Max. Total Fuel Tank Storage Capacity	Max. No. in Area at any Time	Trip Frequency or Duration
Supply Vessel	336,227 gallons	1	2 trips/week
Helicopter	735.3 gallons	1	10 trips/week
Crew Vessel	70,000 gallons	1	3 trips/week
DP Construction Vessel	241,408 gallons*	1	Duration of operation

assumptions based off of vessel similar to Harvey Intervention Vessel

(b) Diesel Oil Supply Vessels

Fuel for the DP Construction Vessel will be transported via a supply vessel as follows:

a. Size of fuel supply vessel:	230 feet
b. Carrying capacity of fuel supply vessel:	336,227 gallons
c. Frequency that fuel supply vessel will visit the facilities:	twice per week
d. Routes the fuel supply vessel will use to travel between the onshore support base and proposed facility:	Shortest route from shore-base to block

(c) Solid and Liquid Wastes Transporation

Type of Waste	Composition	Total Projected Amount	Rate	Transport Method	Name/Location of Facility	Disposal Method
Synthetic-based drilling fluid or mud	Synthetic-based drilling muds	N/A	N/A	Re-use and/or transport to shore in DOT approved containers.	An approved waste disposal facility will be utilized, such as Port Fourchon, LA and on to Newpark Fourchon Transfer Station #1 & #2. Newpark Transfer Station Morgan City. Newpark Transfer Station Port Arthur. USLL Galveston and Fourchon Transfer Station. If recycled, returned to vendor (Bariod or MI).	Re-used and/or recycled; if can't be reused and/or recycled the waste is disposed of at an approved waste disposal facility, such as Newpark (injection disposal facility) or USLL (landfarm).

Cuttings wetted with synthetic-based muds	Cuttings coated with synthetic drilling muds, including drilled out cement	N/A	N/A **An estimated 5-10% of cuttings may be transported to shore*	Re-use and/or transport to shore in DOT approved containers.	An approved waste disposal facility will be utilized, such as Port Fourchon, LA and on to Newpark Fourchon Transfer Station #1 & #2. Newpark Transfer Station Morgan City. Newpark Transfer Station Port Arthur. USLL Galveston and Fourchon Transfer Station. If recycled, returned to vendor (Bariod or MI).	Re-used and/or recycled; if can't be reused and/or recycled the waste is disposed of at an approved waste disposal facility, such as Newpark (injection disposal facility) or USLL (landfarm).
Produced Sand	Oil-contaminated formation sand	50 bbls/ year	50 bbls/ well/year	Transport in DOT approved containers by vessel to shorebase for pickup.	An approved waste disposal facility will be utilized, such as Port Fourchon, LA and on to Newpark Fourchon Transfer Station #1 & #2. Newpark Transfer Station Morgan City. Newpark Transfer Station Port Arthur. USLL Galveston and Fourchon Transfer Station. If recycled, returned to vendor (Bariod or MI).	Disposed of at an approved waste disposal facility, such as Newpark (injection disposal facility) or USLL (landfarm).
Chemical product waste (well treatment fluids)	Ethylene glycol Methanol *Xylene** *Diesel** **An estimated 5-10% of product total volume used during ops is sent back to shore for disposal. Volume shown reflects volume to be disposed of.*	89.91 bbls 22.41 bbls 450.09 bbls 50 bbls/ year	100 bbls/month 25 bbls/month 50 bbls/well/year 50 bbls/well/year	Transport to shore in DOT approved containers by vessel for pick up	An approved waste disposal facility will be utilized, such as Chemwaste in Sulphur, LA and Veolia Port Arthur, TX or to Ecoserv, Port Arthur as non-hazardous waste.	Can be returned to vendor and/or used at another facility; MEG is solidified and disposed of in a landfill. Methanol is incinerated or used for fuels blending.
Completion fluids	Brine, spent acid, prop sand, debris, gelled fluids, dead oil	3,000 bbls	3,000 bbls/well	Transport to shore in DOT approved containers	An approved waste disposal facility will be utilized, such as Port Fourchon, LA and	Unused brine can be returned to vendor and/or stored for use on another job. Used brine and

				and/or vessel tanks by vessel for pick up	on to Ecoserv Fourchon Transfer Station #1 & #2. Ecoserv Transfer Station Morgan City. Ecoserv Transfer Station Port Arthur. USLL Galveston and Fourchon Transfer Station	spent acid is transferred to an approved waste disposal facility, such as Ecoserv's Processing & Transfer facility for injection.
Workover fluids/ Stim fluids	Brine, spent acid, prop sand, debris, gelled fluids, dead oil	3,000 bbls	3,000 bbls/well	Transport to shore in DOT approved containers and/or vessel tanks by vessel for pick up	An approved waste disposal facility will be utilized, such as Port Fourchon, LA and on to Ecoserv Fourchon Transfer Station #1 & #2. Ecoserv Transfer Station Morgan City. Ecoserv Transfer Station Port Arthur. USLL Galveston and Fourchon Transfer Station	Unused brine can be returned to vendor and/or stored for use on another job. Used brine and spent acid is transferred to an approved waste disposal facility, such as Ecoserv's Processing & Transfer facility for injection.
Trash and debris	Refuse generated during operations	12,000 lbs	12,000 lbs/well	Transport to shore in disposal bags by vessel to shorebase for pickup by municipal operations	An approved waste disposal facility will be utilized, such as Recycled Material in ARC, New Iberia, LA, or trash disposal at SWDI landfill.	Recycled and/or disposed in landfill.
Used oil	Excess oil from engines	60 bbls	60 bbls/ well	Transport in DOT approved containers to shore for pick up	An approved waste disposal facility will be utilized, such as American Recovery Fourchon, LA	Recycled

Total amounts assume operations associated with 1 well will take 27 days total to complete

(d) Vicinity Map

A vicinity map is included in this section as **Attachment M-1.**

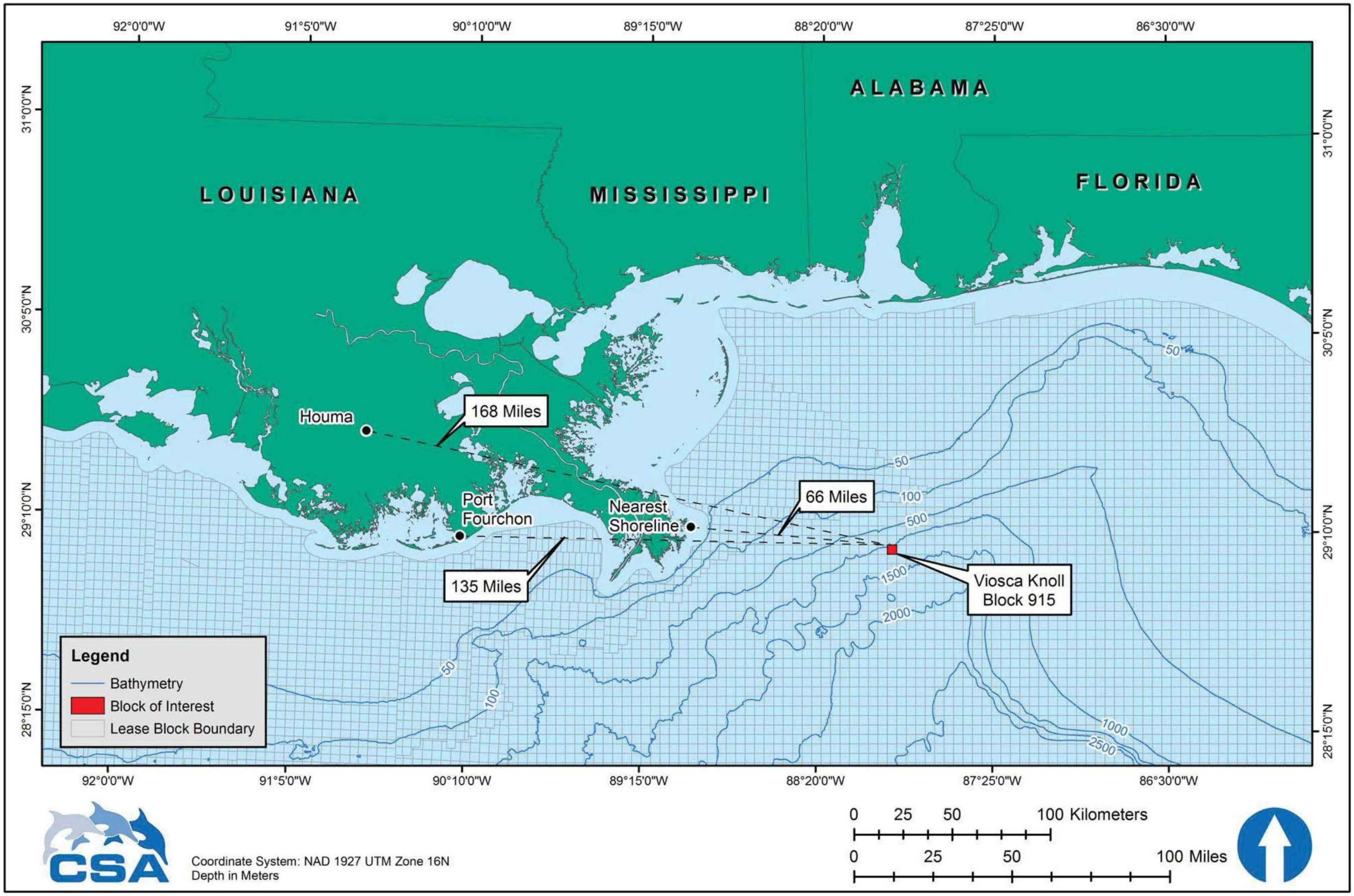

Figure 1. Location of Viosca Knoll Block 915, offshore Alabama.

N
ONSHORE SUPPORT FACILITIES INFORMATION

(a) General

Per NTL No. 2008-G04, the following tables reflect the onshore facilities Anadarko may utilize to provide supplies and service support for the activities proposed in this DOCD.

Name	Primary Location	Existing/New/Modified
Anadarko Service Base	Fourchon, Louisiana	Existing

Name	*Alternate Locations	Existing/New/Modified
Anadarko Service Base	Galveston, TX	Existing
Anadarko Service Base	Cameron, LA	Existing
Anadarko Service Base	Lake Charles, LA	Existing
Anadarko Service Base	Houma, LA	Existing
Anadarko Service Base	Pascagoula, MS**	Existing

***In the unlikely event Anadarko's primary service base cannot be utilized Anadarko will exercise the use of an alternate service base during drilling and/or completion operations.**

****Helicopter base only**

(b) Support Base

No support base construction or expansion is planned for these activities.

(c) Waste Disposal

Disposed wastes describe those wastes generated by the proposed activity that are disposed of by means other than by release into the water of the GOM at the site where they are generated. These wastes can be disposed of by offsite release, injection, encapsulation, or placement at either onshore or offshore permitted locations for the purposes of returning them back to the environment.

Type of Waste	Composition	Total Projected Amount	Rate	Transport Method	Name/Location of Facility	Disposal Method
Synthetic-based drilling fluid or mud	Synthetic-based drilling muds	N/A	N/A	Re-use and/or transport to shore in DOT approved containers.	An approved waste disposal facility will be utilized, such as Port Fourchon, LA and on to Newpark Fourchon Transfer Station #1 & #2. Newpark Transfer Station Morgan City. Newpark Transfer Station Port Arthur. USLL Galveston and Fourchon Transfer	Re-used and/or recycled; if can't be reused and/or recycled the waste is disposed of at an approved waste disposal facility, such as Newpark (injection disposal facility) or USLL (landfarm).

					Station. If recycled, returned to vendor (Bariod or MI).	
Cuttings wetted with synthetic-based muds	Cuttings coated with synthetic drilling muds, including drilled out cement	N/A	N/A **An estimated 5-10% of cuttings may be transported to shore*	Re-use and/or transport to shore in DOT approved containers.	An approved waste disposal facility will be utilized, such as Port Fourchon, LA and on to Newpark Fourchon Transfer Station #1 & #2. Newpark Transfer Station Morgan City. Newpark Transfer Station Port Arthur. USLL Galveston and Fourchon Transfer Station. If recycled, returned to vendor (Bariod or MI).	Re-used and/or recycled; if can't be reused and/or recycled the waste is disposed of at an approved waste disposal facility, such as Newpark (injection disposal facility) or USLL (landfarm).
Produced Sand	Oil-contaminated formation sand	50 bbls/ year	50 bbls/ well/year	Transport in DOT approved containers by vessel to shorebase for pickup.	An approved waste disposal facility will be utilized, such as Port Fourchon, LA and on to Newpark Fourchon Transfer Station #1 & #2. Newpark Transfer Station Morgan City. Newpark Transfer Station Port Arthur. USLL Galveston and Fourchon Transfer Station. If recycled, returned to vendor (Bariod or MI).	Disposed of at an approved waste disposal facility, such as Newpark (injection disposal facility) or USLL (landfarm).
Chemical product waste (well treatment fluids)	Ethylene glycol Methanol *Xylene** *Diesel** **An estimated 5-10% of product total volume used during ops is sent back to shore for disposal. Volume shown reflects volume to be disposed of.*	89.91 bbls 22.41 bbls 450.09 bbls 50 bbls/ year	100 bbls/month 25 bbls/month 50 bbls/well/year 50 bbls/well/year	Transport to shore in DOT approved containers by vessel for pick up	An approved waste disposal facility will be utilized, such as Chemwaste in Sulphur, LA and Veolia Port Arthur, TX or to Ecoserv, Port Arthur as non-hazardous waste.	Can be returned to vendor and/or used at another facility; MEG is solidified and disposed of in a landfill. Methanol is incinerated or used for fuels blending.

Completion fluids	Brine, spent acid, prop sand, debris, gelled fluids, dead oil	3,000 bbls	3,000 bbls/well	Transport to shore in DOT approved containers and/or vessel tanks by vessel for pick up	An approved waste disposal facility will be utilized, such as Port Fourchon, LA and on to Ecoserv Fourchon Transfer Station #1 & #2. Ecoserv Transfer Station Morgan City. Ecoserv Transfer Station Port Arthur. USLL Galveston and Fourchon Transfer Station	Unused brine can be returned to vendor and/or stored for use on another job. Used brine and spent acid is transferred to an approved waste disposal facility, such as Ecoserv's Processing & Transfer facility for injection.
Workover fluids/ Stim fluids	Brine, spent acid, prop sand, debris, gelled fluids, dead oil	3,000 bbls	3,000 bbls/well	Transport to shore in DOT approved containers and/or vessel tanks by vessel for pick up	An approved waste disposal facility will be utilized, such as Port Fourchon, LA and on to Ecoserv Fourchon Transfer Station #1 & #2. Ecoserv Transfer Station Morgan City. Ecoserv Transfer Station Port Arthur. USLL Galveston and Fourchon Transfer Station	Unused brine can be returned to vendor and/or stored for use on another job. Used brine and spent acid is transferred to an approved waste disposal facility, such as Ecoserv's Processing & Transfer facility for injection.
Trash and debris	Refuse generated during operations	12,000 lbs	12,000 lbs/well	Transport to shore in disposal bags by vessel to shorebase for pickup by municipal operations	An approved waste disposal facility will be utilized, such as Recycled Material in ARC, New Iberia, LA, or trash disposal at SWDI landfill.	Recycled and/or disposed in landfill.
Used oil	Excess oil from engines	60 bbls	60 bbls/ well	Transport in DOT approved containers to shore for pick up	An approved waste disposal facility will be utilized, such as American Recovery Fourchon, LA	Recycled

Total amounts assume operations associated with 1 well will take 27 days total to complete

O
COASTAL ZONE MANAGEMENT ACT INFORMATION

ALABAMA COASTAL ZONE MANAGEMENT
CONSISTENCY CERTIFICATION
DOCD – VIOSCA KNOLL BLOCK 915

The OCS related oil and gas development activities having potential impact on the Alabama Coastal Zone are based on the location of the proposed facilities, access to those sites, best practical techniques for operations and production equipment, guidelines for the prevention of adverse environmental effects, effective environmental protection, emergency plans and contingency plans. Alabama policies have been addressed below or are cross referenced to the appropriate sections of the plan:

Topic	Cross Reference	Comments
Coastal Resource Use Policies		
Coastal Development		Dock and port facilities in LA will be used. There will be no new construction, dredging, or filling in Alabama state waters. There will be no new commercial development or capital improvements in Alabama's coastal zone, nor will there be any employment effects.
Mineral Resource Exploration and Extraction		Proposed exploration operations will take place 94 miles from Alabama's shore.
Commercial Fishing	Section N	
Hazard Management	Section C	A Shallow Hazards Report has been prepared and previously submitted to BOEM in order to identify and assess the seafloor and shallow geologic conditions in this block(s).
Shoreline Erosion	Section N	Proposed exploration operations will take place 78 miles from Alabama's shore.
Recreation	Section N	
Transportation	Section K, L, N	
Natural Resource Protection Policies		
Biological Productivity	Section N	
Water Quality	Section N	
Water Resources	Section N	
Air Quality	Section N	
Wetlands and Submerged Grassbeds	Section N	
Beach and Dune Protection	Section N	
Wildlife Habitat Protection	Section N	
Endangered Species	Section N	
Cultural Resources Protection	Section N	Viosca Knoll Block 915 is located in an area where historic shipwrecks may exist. The archaeological report was included with Exploration Plan Control No. R-6011, approved March 21, 2014. No areas in Viosca Knoll Block 915 are recommended for investigation or avoidance on the basis of archaeological potential.

STATE OF ALABAMA

CONSISTENCY CERTIFICATION FOR

SUPPLEMENTAL DEVELOPMENT OPERATIONS COORDINATION PLAN

VIOSCA KNOLL BLOCK 915 OCS-G06894

The proposed activities described in detail in this OCS Plan comply with Alabama's approved Coastal Zone Management Program(s) and will be conducted in a manner consistent with such Program(s).

Anadarko Petroleum Corporation

Jill Fowler, Certifying Official
February, 2018

TEXAS COASTAL MANAGEMENT PROGRAM

The following is an evaluation that includes findings relating the coastal effects of the proposed activities and associated facilities to the relevant enforceable policies of the Texas' Coastal Management Program (TCMP), Title 31, Part 16, Chapter 501, Subchapter B:

(Category 2)
Construction, Operation & Maintenance of Oil & Gas Exploration & Production Facilities

No operations are proposed in or near any critical areas. The proposed activities are explorative in nature, so no facility construction is proposed. The proposed activities are located approximately 335 miles from the Texas shoreline; therefore we expect no adverse impacts to CNRAs or beach access and use rights of the public. All activities shall be conducted in a manner that minimizes significant impacts to coastal resources. No adverse effects to Texas' coastal area are expected in association with the proposed activities.

(Category 3)
Discharges of Wastewater and Disposal of Waste from Oil and Gas Exploration and Production Activities

No discharge of wastewater or disposal of waste from the proposed activities will occur in the Texas' coastal zone; therefore no impact to Texas' coastal waters is expected.

(Category 4)
Construction and Operation of Solid Waste Treatment, Storage, and Disposal Facilities

No construction of solid waste facilities or expansion of existing facilities in the coastal zone are proposed in the attached plan, therefore, no adverse effects on any features of Texas' coastal cone are expected.

(Category 5)
Prevention, Response, and Remediation of Oil Spills

The proposed activities will be covered under an approved Regional Oil Spill Response Plan. The plan is in place, practiced, and updated as necessary. The best practical techniques shall be utilized to prevent the release of pollutants or toxic substances into the environment. All involved vessels and facilities are designed to be capable of prompt response and adequate removal of accidental discharges of oil. In addition, the proposed activities are 335 miles from shore; therefore no damages to natural resources are expected as the result of an unauthorized discharge of oil into coastal waters.

(Category 6)
Discharge of Municipal and Industrial Waste Water to Coastal Waters

No discharges from the proposed activities will occur in coastal waters. The proposed activities are 335 miles from shore; therefore there will be no effect on coastal waters.

(Category 8)
Development in Critical Areas

None of the proposed activities will occur in a critical area; therefore no effects to Texas' coastal zone are expected. The activity will not jeopardize the continued existence of species listed as endangered or threatened, and will not result in likelihood of the destruction or adverse modification of a habitat determined to be a critical habitat under the Endangered Species Act. The activity will not cause or contribute to violation of any applicable surface water quality standards. The activity will not violate any requirement imposed to protect a marine sanctuary.

(Category 9)
Construction of Waterfront Facilities and Other Structures on Submerged lands

No waterfront facilities or other structures are proposed on submerged lands in the Texas coastal zone, therefore the proposed activities are not expected to have any adverse impacts on submerged lands.

(Category 10)
Dredging and Dredged Material Disposal and Placement

No dredging or disposal/placement of dredged material is proposed; therefore no adverse effects to coastal waters, submerged lands, critical areas, coastal shore areas, or Gulf beaches are expected.

(Category 11)
Construction in the Beach / Dune System

The proposed activities do not include any construction projects in critical dune areas or areas adjacent to or on Gulf beaches, therefore, no impact to Texas' beach or dune systems are expected.

(Category 15)
Alteration of Coastal Historic Areas

The proposed activities do not include any alteration or disturbance of a coastal historic area; therefore, no impacts are expected to adversely affect any historical, architectural, or archaeological site in Texas' coastal zone.

(Category 16)
Transportation

The proposed activities do not include any transportation construction projects within the coastal zone; therefore, no impacts to Texas' coastal zone are expected.

(Category 17)
Emission of Air Pollutants

The proposed activities shall be carried out in conformance with applicable air quality laws, standards, and regulations. Emissions from the proposed activities are not expected to have significant impacts on onshore air quality because of the prevailing atmospheric conditions, emission heights, emission rates, and the distance of these emissions from the coastline. The proposed activities will occur approximately 335 miles from shore and will be within the exemption limits set by BOEM, therefore, no impacts to Texas' coastal zone is expected.

(Category 18)
Appropriations of Water

The proposed activities do not include the impoundment or diversion of state water, therefore, no impacts to Texas' coastal zone is expected.

(Category 20)
Marine Fishery Management

The proposed activities are located approximately 335 miles from shore and are not expected to have any effect on marine fishery management or fishery migratory patterns within waters in the coastal zone of Texas.

(Category 22)
Administrative Policies

The necessary information for applicable agencies to make an informed decision on the proposed activities has been provided In conclusion, all activities shall be consistent with Texas' coastal management program and shall comply with all relevant rules and regulations. No activities are planned within any critical areas. Activities will be carried out avoiding unnecessary conflicts with other uses of the vicinity.

STATE OF TEXAS

CONSISTENCY CERTIFICATION FOR

SUPPLEMENTAL DEVELOPMENT OPERATIONS COORDINATION PLAN

VIOSCA KNOLL BLOCK 915
OCS-G06894

The proposed activities described in detail in this OCS Plan comply with Texas's approved Coastal Zone Management Program(s) and will be conducted in a manner consistent with such Program(s).

Anadarko Petroleum Corporation

Jill Fowler, Certifying Official
February, 2018

MISSISSIPPI COASTAL ZONE MANAGEMENT ACT INFORMATION

As authorized by the Federal Coastal Zone Management Act (CZMA), The State of Mississippi developed a Coastal Management Program (CMP) to allow for the review of proposed Federal license and permit activities affecting any coastal use or resources, in or outside of the Mississippi Coastal Zone.

The OCS related oil and gas exploratory and development activities having potential impact on the Mississippi Coastal Zone are based on the location of the proposed facilities, access to those sites, best practical techniques for drilling locations, drilling equipment guidelines for the prevention of adverse environmental effects, effective environmental protection, emergency plans and contingency plans.

Below are goals identified by the State of Mississippi and our comments and/or corresponding cross references:

<u>Goal 1</u>: To provide for reasonable industrial expansion in the coastal area and to ensure the efficient utilization of waterfront industrial sites so that suitable sites are conserved for water dependent industry.

The activities proposed in this plan are based out of Fourchon, Louisiana. The activities will not provide any industrial expansion on the coastal area of Mississippi. Therefore Mississippi coastal areas will be conserved for water dependent industry.

<u>Goal 2</u>: To favor the preservation of the coastal wetlands and ecosystems, except where a specific alteration of specific coastal wetlands would serve a higher public interest in compliance with the public purposes of the public trust in which the coastal wetlands are held.

Goal 2 is addressed in Section P, Environmental Impact Analysis. The nearest proposed activities will be 110 miles from the Mississippi coast.

<u>Goal 3</u>: To protect, propagate and conserve the state's seafood and aquatic life in connection with the revitalization of the seafood industry of the State of Mississippi.

Goal 3 is addressed in Section P, Environmental Impact Analysis. Little impact to the seafood industry can be expected due to the activities occurring 110 miles from the Mississippi coast.

<u>Goal 4</u>: To conserve the air and waters of the state, and to protect, maintain and improve the quality thereof for public use, for the propagation of wildlife, fish and aquatic life, and for domestic, agricultural, industrial, recreational and other legitimate beneficial uses.

Goal 4 is addressed in Section B, General Information, Section H, Air Emissions Information, and Section P, Environmental Impact Analysis.

<u>Goal 5</u>: To put to beneficial use to the fullest extent of which they are capable the water resources of the state, and to prevent the waste, unreasonable use, or unreasonable method of use of water.

The activities proposed in this plan are based in Fourchon, Louisiana. As such, Mississippi's water resources should not be impacted by the proposed activities. Activities occurring at the sites in the OCS will be conducted in accordance with our Regional Oil Spill Response Plan referenced in Section I of this plan.

<u>Goal 6</u>: To preserve the state's historical and archaeological resources, to prevent their destruction, and to enhance these resources wherever possible.

Goal 6 is addressed in Section F, Biological, Physical and Socioeconomic Information, and Section P, Environmental Impact Analysis.

<u>Goal 7</u>: To encourage the preservation of natural scenic qualities in the coastal area.

Goal 7 is addressed in Section G, Waste Discharges Information, Section I, Oil Spill Information, Section H, Air Emissions Information, and Section P, Environmental Impact Analysis.

<u>Goal 8</u>: To assist local governments in the provision of public facilities services in a manner consistent with the coastal program.

As the proposed activities are located 110 miles from the Mississippi coast and are based out of a shorebase in Fourchon, Louisiana, local governments should not be affected.

STATE OF MISSISSIPPI

CONSISTENCY CERTIFICATION FOR

SUPPLEMENTAL DEVELOPMENT OPERATIONS COORDINATION PLAN

VIOSCA KNOLL BLOCK 915 OCS-G06894

The proposed activities described in detail in this OCS Plan comply with Mississippi's approved Coastal Zone Management Program(s) and will be conducted in a manner consistent with such Program(s).

Anadarko Petroleum Corporation

Jill Fowler

Jill Fowler, Certifying Official
February, 2018

P
ENVIRONMENTAL IMPACT ANALYSIS

Environmental Impact Analysis

For a

SUPPLEMENTAL DEVELOPMENT OPERATIONS COORDINATION DOCUMENT

Viosca Knoll Block 915

(OCS-G 06894)

Offshore Alabama

January 2018

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Environmental Impact Analysis

For a

SUPPLEMENTAL DEVELOPMENT OPERATIONS COORDINATION DOCUMENT
for
Viosca Knoll Block 915

(OCS-G 06894)

DOCUMENT NO. CSA-ANADARKO-FL-18-3234-01-REP-01-FIN

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Acronyms and Abbreviations

ADIOS2	Automated Data Inquiry for Oil Spills 2
Anadarko	Anadarko Petroleum Corporation
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BOP	blowout preventer
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CGA	Clean Gulf Associates
DOCD	Development Operations Coordination Document
DP	dynamically positioned
DPS	distinct population segment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIA	Environmental Impact Analysis
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAD	fish aggregating device
GMFMC	Gulf of Mexico Fishery Management Council
GPS	global positioning system
H_2S	hydrogen sulfide
HAPC	Habitat Area of Particular Concern
HOSS	high-volume open sea skimmer
IPF	impact-producing factor
LARS	launch and recovery system
MARPOL	International Convention for the Prevention of Pollution from Ships
MMC	Marine Mammal Commission
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MSRC	Marine Spill Response Corporation
MWCC	Marine Well Containment Company
NAAQS	National Ambient Air Quality Standards
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRDA	Natural Resource Damage Assessment
NTL	Notice to Lessees and Operators
NWR	National Wildlife Refuge
OCS	Outer Continental Shelf
OSRA	Oil Spill Risk Analysis
OSRP	Oil Spill Response Plan
PAH	polycyclic aromatic hydrocarbon
PM	particulate matter
SO_x	sulfur oxides
UME	Unusual Mortality Event
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
VK	Viosca Knoll
WCD	worst-case discharge

Introduction

Anadarko Petroleum Corporation (Anadarko) is submitting a Supplemental Development Operations Coordination Document (DOCD) for Viosca Knoll (VK) Block 915 (VK 915). Under this DOCD, Anadarko proposes to install subsea infrastructure and place the previously permitted VK 915-007 well onto production. The Environmental Impact Analysis (EIA) provides information on potential environmental impacts of Anadarko's proposed activities in VK 915.

The lease area is approximately 66 miles (106 km) from the nearest shoreline (Louisiana), 135 miles (217 km) from the onshore support base at Port Fourchon, Louisiana, and 168 miles (270 km) from the helicopter base at Houma, Louisiana (**Figure 1**). The water depth at the location of the proposed activities is approximately 3,561 ft (1,085 m). The subsea wellhead will be installed with a dynamically positioned (DP) construction vessel. The proposed activities are expected to require a total of 27 days, inclusive of installation operations and placing the well onto production.

The EIA for this DOCD was prepared for submittal to the Bureau of Ocean Energy Management (BOEM) in accordance with applicable regulations, including 30 Code of Federal Regulations (CFR) 550.242(s) and 550.261. The EIA is a project- and site-specific analysis of Anadarko's planned activities under this DOCD. The EIA complies with guidance provided in existing Notices to Lessees and Operators (NTL) issued by BOEM and its predecessors, Minerals Management Service (MMS) and Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), including NTL 2008-G04 (extended by 2015-N02) and NTL 2015-N01. Potential impacts have been analyzed at a broader level in the 2017 to 2022 Programmatic Environmental Impact Statement (EIS) for the Outer Continental Shelf (OCS) Oil and Gas Leasing Program (BOEM, 2016a) and in lease sale EISs for the Western and Central Gulf of Mexico Planning Areas (BOEM, 2012 a,b, 2013a, 2014a, 2015, 2016b, 2017 a,b). The most recent lease sale EISs update environmental baseline information in light of the Macondo (*Deepwater Horizon*) incident and address potential impacts of a catastrophic spill (BOEM, 2012 a,b, 2013a, 2014a, 2015, 2016b, 2017a). The analyses from those documents are incorporated here by reference.

All the proposed activities and facilities discussed in this DOCD are covered by Anadarko's Gulf of Mexico Regional Oil Spill Response Plan (OSRP) last approved on 14 August 2015 for Anadarko and its subsidiary, Anadarko US Offshore LLC (Company Numbers 00981 and 02219 respectively), in accordance with 30 CFR Part 254. The June 2017 biennial updates were acknowledged by the Bureau of Safety and Environmental Envorcement (BSEE) 12 July 2017; and 5 October 2017 updates were acknowledged by BSEE on 2 November 2017. Per BSEE, the OSRP is in compliance with 30 CFR 254.30(a). The OSRP details Anadarko's plan to rapidly and effectively manage oil spills that may result from drilling and production operations. Anadarko has designed its spill response program based on a regional capability of response to spills ranging from small operational spills to a worst-case discharge (WCD) from a well blowout. Anadarko's spill response program meets the response planning requirements of the relevant coastal states and applicable federal oil spill planning regulations. The OSRP also includes information regarding Anadarko's regional oil spill organization and dedicated response assets, potential spill risks, and local environmental sensitivities. It describes personnel and equipment mobilization, incident management team organization, and an overview of actions and notifications to be taken in the event of a spill.

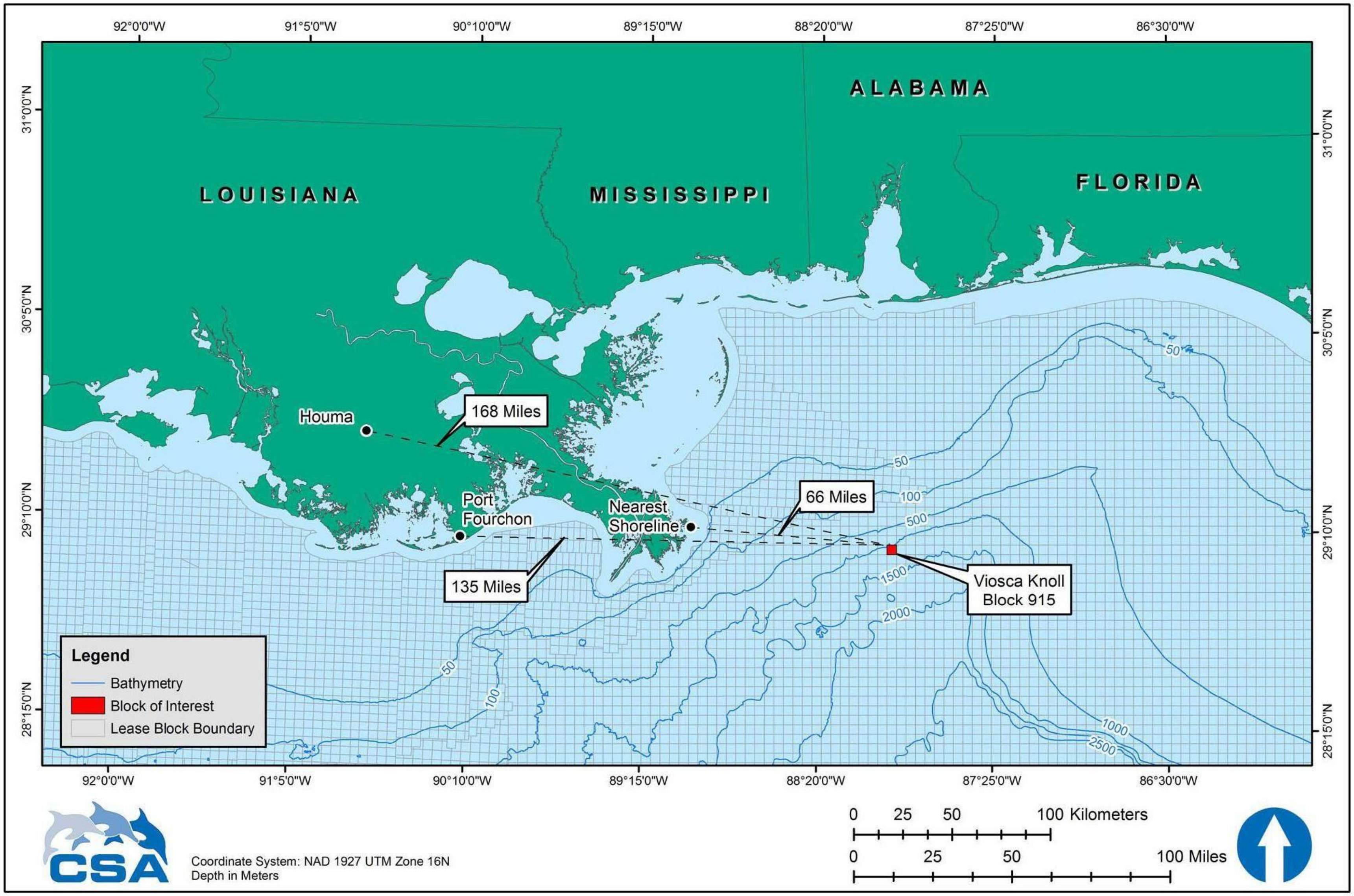

Figure 1. Location of Viosca Knoll Block 915, offshore Alabama.

The EIA is organized into **Sections A** through **I**, corresponding to the information required by NTLs 2008-G04 (extended by NTL 2015-N02) and 2015-N01. The main impact-related discussions are in **Section A** (Impact-Producing Factors) and **Section C** (Impact Analysis). **Table 1** lists and summarizes the NTLs applicable to the EIA.

Table 1. Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and Environmental Enforcement (BSEE) Notices to Lessees and Operators (NTLs) applicable to this Environmental Impact Analysis (EIA).

NTL	Title	Summary
BOEM-2016-G01	Vessel Strike Avoidance and Injured/Dead Protected Species Reporting	Recommends protected species identification training; recommends that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel movement to avoid striking protected species; and requires operators to report sightings of any injured or dead protected species.
BSEE-2015-G03	Marine Trash and Debris Awareness and Elimination	Instructs operators to exercise caution in the handling and disposal of small items and packaging materials; requires the posting of instructional placards at prominent locations on offshore vessels and structures; and mandates a yearly marine trash and debris awareness training and certification process.
BOEM 2015-N02	Elimination of Expiration Dates on Certain Notices to Lessees and Operators Pending Review and Reissuance	Eliminates expiration dates (past or upcoming) of all NTLs currently posted on the BOEM website.
BOEM 2015-N01	Information Requirements for Exploration Plans, Development and Production Plans, and Development Operations Coordination Documents on the OCS for Worst-Case Discharge (WCD) and Blowout Scenarios	Provides guidance regarding information required in WCD descriptions and blowout scenarios.
BOEM 2014-G04	Military Warning and Water Test Areas	Provides contact links to individual command headquarters for the military warning and water test areas in the Gulf of Mexico.
BSEE-2012-N06	Guidance to Owners and Operators of Offshore Facilities Seaward of the Coast Line Concerning Regional Oil Spill Response Plans (OSRP)	Provides clarification, guidance, and information for preparation of regional OSRP; and recommends description of response strategy for WCD scenarios to ensure capability to respond to oil spills is both efficient and effective.
2011-JOINT-G01	Revisions to the List of Outer Continental Shelf (OCS) Blocks Requiring Archaeological Resource Surveys and Reports	Provides new information of which OCS blocks require archaeological surveys and reports; and identifies required survey line spacing in each block. This NTL augments NTL 2005-G07.

Table 1. (Continued).

NTL	Title	Summary
2010-N10	Statement of Compliance with Applicable Regulations and Evaluation of Information Demonstrating Adequate Spill Response and Well Containment Resources	Informs operators using subsea or surface blowout preventers on floating facilities that applications for well permits must include a statement signed by an authorized company official stating that the operator will conduct all activities in compliance with all applicable regulations, including the increased safety measures regulations (75 *FR* 63346). Informs operators that BOEM will be evaluating whether each operator has submitted adequate information demonstrating that it has access to and can deploy containment resources to promptly respond to a blowout or other loss of well control.
2009-G40	Deepwater Benthic Communities	Provides guidance for avoiding and protecting high-density deepwater benthic communities (including chemosynthetic and deepwater coral communities) from damage caused by OCS oil and gas activities in water depths greater than 984 ft (300 m). Prescribes separation distances of 2,000 ft (610 m) from each mud and cuttings discharge location and 250 ft (76 m) from all other seafloor disturbances.
2009-G39	Biologically Sensitive Underwater Features and Areas	Provides guidance for avoiding and protecting biologically sensitive features and areas (i.e., topographic features, pinnacles, low relief live bottom areas, and other potentially sensitive biological features) when conducting OCS operations in water depths less than 984 ft (300 m) in the Gulf of Mexico.
2008-G04	Information Requirements for Exploration Plans and Development Operations Coordination Documents	Provides guidance on information requirements for OCS plans, including EIA requirements and information regarding compliance with the provisions of the Endangered Species Act and Marine Mammal Protection Act.
2005-G07	Archaeological Resource Surveys and Reports	Provides guidance on regulations regarding archaeological discoveries, specifies requirements for archaeological resource surveys and reports, and outlines options for protecting archaeological resources.

A. Impact-Producing Factors

Based on the description of Anadarko's proposed activities, a series of impact-producing factors (IPFs) have been identified. **Table 2** identifies the environmental resources that may be affected in the left column, and identifies sources of impacts associated with the proposed project across the top. **Table 2**, adapted from Form BOEM-0142, has been developed *a priori* to focus the impact analysis on those environmental resources that may be impacted as a result of one or more IPFs. The tabular matrix indicates which of the routine activities and accidental events could affect specific resources. An "X" indicates that an IPF could reasonably be expected to affect a certain resource, and a dash (--) indicates no impact or negligible impact. Where there may be an effect, an analysis is provided in **Section C**. Potential IPFs for the proposed activities are listed below and briefly discussed in the following sections.

- Construction vessel presence (including noise and lights)
- Physical disturbance to the seafloor
- Air pollutant emissions
- Effluent discharges
- Water intake
- Onshore waste disposal
- Marine debris
- Support vessel and helicopter traffic
- Accidents

A.1 Construction Vessel Presence (Including Noise and Lights)

The subsea wellhead will be installed with a DP construction vessel. DP vessels use a global positioning system (GPS), specific computer software, and sensors in conjunction with their own propellers and thrusters to maintain position. The precise location of the vessel is monitored by operators using satellite navigation. Thrusters positioned at various locations around the vessel's hull are activated as needed to maintain position. This process, known as station-keeping, allows operations at sea in water depths or locations where mooring or anchoring is impractical or not feasible. The DP construction vessel will be on site for an estimated 27 days total and will maintain exterior lighting in accordance with applicable federal navigation and aviation safety regulations (International Regulations for Preventing Collisions at Sea, 1972 [72 COLREGS], Part C).

The installation operations and DP construction vessel can be expected to produce noise associated with propulsion machinery that transmits directly to the water during station-keeping, wellhead installation, and maintenance operations. Additional sound and vibration will be transmitted through the hull to the water from auxiliary machinery, such as generators, pumps, and compressors onboard the construction vessel (Richardson et al., 1995). The noise levels produced by DP vessels for station-keeping are largely dependent on the level of thruster activity required to keep position and, therefore, vary based on local ocean currents, sea and weather conditions, and operational requirements. Representative source levels for vessels in DP mode range from 184 to 190 dB re 1 µPa, with a primary amplitude frequency below 600 Hz (Blackwell and Greene Jr., 2003, Kyhn et al., 2011, McKenna et al., 2012).

Table 2. Matrix of impact-producing factors and environmental resources (Modified from: Form BOEM-0142).

Environmental Resources	Impact-Producing Factors									
	Construction Vessel Presence (including noise and lights)	Physical Disturbance to Seafloor	Air Pollutant Emissions	Effluent Discharges	Water Intake	Onshore Waste Disposal	Marine Debris	Support Vessel/Helicopter Traffic	Accidents	
									Small Diesel Fuel Spill	Large Oil Spill
Physical/Chemical Environment										
Air quality	--	--	X(9)	--	--	--	--	--	X(6)	X(6)
Water quality	--	--	--	X	--	--	--	--	X(6)	X(6)
Seafloor Habitats and Biota										
Soft bottom benthic communities	--	X	--	--	--	--	--	--	--	X(6)
High-density deepwater benthic communities	--	-- (4)	--	--(4)	--	--	--	--	--	X(6)
Designated topographic features	--	-- (1)	--	--(1)	--	--	--	--	--	--
Pinnacle trend area live bottoms	--	-- (2)	--	--(2)	--	--	--	--	--	--
Eastern Gulf live bottoms	--	-- (3)	--	--(3)	--	--	--	--	--	--
Threatened, Endangered, and Protected Species, and Critical Habitat										
Sperm whale (endangered)	X(8)	--	--	--	--	--	--	X(8)	X(6,8)	X(6,8)
West Indian manatee (endangered)	--	--	--	--	--	--	--	X(8)	--	X(6,8)
Non-endangered marine mammals (protected)	X	--	--	--	--	--	--	X	X(6)	X(6)
Sea turtles (endangered/threatened)	X(8)	--	--	--	--	--	--	X(8)	X(6,8)	X(6,8)
Piping Plover (threatened)	--	--	--	--	--	--	--	--	--	X(6)
Whooping Crane (endangered)	--	--	--	--	--	--	--	--	--	X(6)
Gulf sturgeon (threatened)	--	--	--	--	--	--	--	--	--	X(6)
Beach mouse (endangered)	--	--	--	--	--	--	--	--	--	X(6)
Threatened coral species	--	--	--	--	--	--	--	--	--	X(6)
Coastal and Marine Birds										
Marine birds	X	--	--	--	--	--	--	X	X(6)	X(6)
Shorebirds and coastal nesting birds	--	--	--	--	--	--	--	X	--	X(6)
Fisheries Resources										
Pelagic communities and ichthyoplankton	X	--	--	X	X	--	--	--	X(6)	X(6)
Essential Fish Habitat	X	--	--	X	X	--	--	--	X(6)	X(6)
Archaeological Resources										
Shipwreck sites	--	--(7)	--	--	--	--	--	--	--	X(6)
Prehistoric archaeological sites	--	--(7)	--	--	--	--	--	--	--	X(6)
Coastal Habitats and Protected Areas										
Barrier beaches and dunes	--	–	--	--	--	--	--	X	--	X(6)
Wetlands and seagrass beds	--	–	--	--	--	--	--	X	--	X(6)
Coastal wildlife refuges and wilderness areas	--	–	--	--	--	--	--	--	--	X(6)
Socioeconomic and Other Resources										
Recreational and commercial fishing	X	--	--	--	--	--	--	--	X(6)	X(6)
Public health and safety	--	--	--	--	--	--	--	--	--	X(5,6)
Employment and infrastructure	--	--	--	--	--	--	--	--	--	X(6)
Recreation and tourism	--	--	--	--	--	--	--	--	--	X(6)
Land use	--	--	--	--	--	--	--	--	--	X(6)
Other marine uses	--	--	--	--	--	--	--	--	--	X(6)

X indicates potential impact; dashes (--) indicates no impact or negligible impact; numbers refer to table footnotes.

Table 2 Footnotes and Applicability to this Program:

*Footnotes are numbered to correspond to entries in **Table 2**; applicability to this case is noted by a bullet point following the footnote.*

(1) *Activities that may affect a marine sanctuary or topographic feature. Specifically, if the well, rig site, or any anchors will be on the seafloor within the following:*
   (a) *4-mile zone of the Flower Garden Banks or the 3-mile zone of Stetson Bank;*
   (b) *1,000 m, 1-mile, or 3-mile zone of any topographic feature (submarine bank) protected by the Topographic Features Stipulation attached to an Outer Continental Shelf (OCS) lease;*
   (c) *Essential Fish Habitat (EFH) criteria of 500 ft from any no-activity zone; or*
   (d) *Proximity of any submarine bank (500 ft buffer zone) with relief greater than 2 m that is not protected by the Topographic Features Stipulation attached to an OCS lease.*
   - None of these conditions (a through d) are applicable. The lease is not within or near any marine sanctuary, topographic feature, submarine bank, or no-activity zone.

(2) *Activities with any bottom disturbance within an OCS lease block protected through the Live Bottom (Pinnacle Trend) Stipulation attached to an OCS lease.*
   - The Live Bottom (Pinnacle Trend) Stipulation is not applicable to the lease area.

(3) *Activities within any Eastern Gulf OCS block where seafloor habitats are protected by the Live Bottom (Low-Relief) Stipulation attached to an OCS lease.*
   - The Live Bottom (Low-Relief) Stipulation is not applicable to the lease area.

(4) *Activities on blocks designated by the Bureau of Ocean Energy Management (BOEM) as being in water depths 1,312 ft (400 m) or greater.*
   - No impacts to high-density deepwater benthic communities are anticipated. No high or low positive seafloor amplitude anomalies representing potential benthic communities were noted within 2,000 ft (610 m) of the location of the proposed activities (Geoscience Earth & Marine Services Inc., 2014).

(5) *Exploration or production activities where hydrogen sulfide (H_2S) concentrations greater than 500 parts per million (ppm) might be encountered.*
   - Viosca Knoll Block 915 was classified as H_2S absent under a previously approved Initial Exploration Plan.

(6) *All activities that could result in an accidental spill of produced liquid hydrocarbons or diesel fuel that would potentially impact these environmental resources. If the proposed action is located a sufficient distance from a resource that no impact would occur, the EIA can note that in a sentence or two.*
   - Accidental hydrocarbon spills could affect the resources marked "X" in the table matrix, and potential impacts are analyzed in **Section C**.

(7) *All activities that involve seafloor disturbances, including anchor emplacements, in any OCS block designated by the BOEM as having high probability for the occurrence of shipwrecks or prehistoric sites, including such blocks that will be affected that are adjacent to the lease block in which your planned activity will occur. If the proposed activities are located a sufficient distance from a shipwreck or prehistoric site that no impact would occur, the EIA can note that in a sentence or two.*
   - No impacts on archaeological resources are expected. The lease area is on BOEM's list of archaeology survey blocks (BOEM, 2011); however, the locations of the proposed activities are well beyond the 197 ft (60 m) depth contour used by BOEM as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. A dynamically positioned construction vessel will be used; therefore, seafloor disturbances due to anchoring will not occur. No archaeologically significant side-scan sonar targets are located within 2,000 ft (610 m) of the proposed activities (Geoscience Earth & Marine Services Inc., 2014).

(8) *All activities that you determine might have an adverse effect on endangered or threatened marine mammals or sea turtles or their critical habitats.*
   - Impact-producing factors that may affect marine mammals, sea turtles, or their critical habitats include construction vessel presence, support vessel and helicopter traffic, and accidents. See **Section C**.

(9) *Production activities that involve transportation of produced fluids to shore using shuttle tankers or barges.*
   - Not applicable.

A.2 Physical Disturbance to the Seafloor

There will be minimal disturbance to the seafloor and soft bottom communities during installation of the subsea wellhead. Physical disturbance of the seafloor will be limited to the area immediately surrounding the wellhead.

A.3 Air Pollutant Emissions

Offshore air pollutant emissions will result from construction vessel operations as well as support vessel (both supply and crew vessels) and helicopter transits. These emissions occur mainly from combustion of diesel and aviation fuel (Jet-A). The combustion of fuels occurs in diesel-powered generators, pumps, or motors and from lighter fuel motors. Primary air pollutants typically associated with emissions from internal combustion engines are suspended particulate matter (PM), sulfur oxides (SO_x), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and carbon monoxide (CO).

The Air Quality Emissions Report (see **DOCD Section H**) prepared in accordance with BOEM requirements demonstrates that the projected emissions are below exemption levels set by the applicable regulations in 30 CFR 550.303. Based on this and the distance from shore, it can be concluded that the emissions will not significantly affect the air quality of the onshore area for any of the criteria pollutants. No further analysis or control measures are required.

A.4 Effluent Discharges

Effluent discharges are summarized in **DOCD Section G**. The discharges will include treated sanitary and domestic wastes, deck drainage, desalination unit brine, subsea production control fluid, produced water, non-pollutant completion fluids, uncontaminated ballast and bilge water, noncontact cooling water, and fire water. All offshore discharges will be in accordance with requirements of the National Pollutant Discharge Elimination System (NPDES) General Permit No. GMG290006 issued by the U.S. Environmental Protection Agency (USEPA), including permit compliance terms, discharge volumes, discharge rates, and associated monitoring requirements.

A.5 Water Intake

Seawater will be drawn from the ocean for once-through, non-contact cooling of machinery on the construction vessel. Section 316(b) of the Clean Water Act requires NPDES permits to ensure that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available to minimize adverse environmental impact from impingement and entrainment of aquatic organisms. The current NPDES General Permit No. GMG290006 does not specify requirements for facilities that started construction before 17 July 2006. The construction vessel ultimately selected for this project will be in compliance with all cooling water intake structure requirements.

A.6 Onshore Waste Disposal

Wastes generated during the proposed activities are tabulated in **DOCD Section G**. A total of approximately 12,000 bbl of trash and debris will be generated over the life of the project. Trash will be transported to shore in disposal bags for final disposal by municipal operators in accordance with applicable regulations. Other wastes transported to shore for re-use, recycling, or disposal includes, chemical product waste (well treatment fluids), completion fluids, workover fluids, used oil, and produced sand. All wastes will be transported to shore in containers approved by the U.S. Department of Transportation for re-use, recycling, or disposal in accordance with applicable regulations.

A.7 Marine Debris

Anadarko will comply with all regulations relating to solid waste handling, transporation and disposal, including the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) Annex V requirements as well as USEPA, U.S. Coast Guard (USCG), and BOEM regulations. These regulations include prohibitions and compliance requirements regarding the deliberate discharging of containers and other similar materials (i.e., trash and debris) into the marine environment as well as the protective measures to be implemented to prevent the accidental loss of solid materials into the marine environment. For example, the BSEE regulations 30 CFR 250.300(a) and (b)(6) prohibit operators from deliberately discharging containers and other similar materials (i.e., trash and debris) into the marine environment, and 30 CFR 250.300(c) requires durable identification markings on equipment, tools, containers (especially drums), and other materials. The USEPA and USCG regulations require operators to be proactive in avoiding accidental loss of solid materials by developing waste management plans, posting informational placards, manifesting trash sent to shore, and using special precautions such as covering outside trash bins to prevent accidental loss of solid waste. In addition to the regulations in 30 CFR 250, BSEE issued NTL BSEE-2015-G03, which instructs operators to exercise caution in the handling and disposal of small items and packaging materials, requires the posting of placards at prominent locations on offshore vessels and structures, and mandates a yearly training and certification process for marine trash and debris awareness.

A.8 Support Vessel and Helicopter Traffic

The project will be supported by one supply vessel and one crew vessel in addition to the DP construction vessel. All vessels will be based out of Port Fourchon, Louisiana. The supply vessel will make an estimated two round trips per week between the port and the project area while the crew vessel will make an estimated three round trips per week between the port and the project area.

The vessels typically will transit to and from the project area via the most direct route from the shorebase. Anadarko will use existing shorebase facilities at Port Fourchon, Louisiana, for the onshore support of crew and supply vessel activities. No port terminal expansion or construction is planned.

Offshore support vessels associated with the proposed project will contribute to the overall acoustic environment by transmitting noise through both air and water. The support vessels will use conventional diesel-powered screw propulsion. Vessel noise is a combination of narrow-band (tonal) and broadband sound (Richardson et al., 1995, Hildebrand, 2009, McKenna et al., 2012). Tones typically dominate up to approximately 50 Hz, whereas broadband sounds may extend to 100 kHz. The primary sources of vessel noise are propeller cavitation, propeller singing, and propulsion; other sources include auxiliary engine noise, flow noise from water dragging along the hull, and bubbles breaking in the vessel's wake (Richardson et al., 1995). The intensity of noise from support vessels is roughly related to ship size, weight, and speed. Broadband source levels for smaller boats (a category that include supply and other service vessels) are in the range of 150 to 180 dB re 1 μPa m (Richardson et al., 1995, Hildebrand, 2009, McKenna et al., 2012).

The project will be supported by one helicopter that will make an estimated 10 round trips per week between the project area and the heliport in Houma, Louisiana. The helicopter will be used to transport personnel as well as small supplies and will take the most direct route of travel between the heliport and the lease area when air traffic and weather conditions permit. Helicopters typically maintain a minimum altitude of 700 ft (213 m) while in transit offshore, 1,000 ft (305 m) over unpopulated areas or across coastlines, and 2,000 ft (610 m) over populated areas and sensitive habitats such as wildlife refuges and park properties (BOEM, 2012a). Additional guidelines and regulations specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals (BOEM, 2017a). Anadarko will use existing air transportation (helicopter) facilities in Houma, Louisiana. No terminal expansion or construction is planned.

Dominant tones in noise spectra from helicopters are below 500 Hz with a source level of approximately 149 to 151 dB re 1 Pa m (for a Bell 212 helicopter) (Richardson et al., 1995). Levels of noise received underwater from passing aircraft depend on the aircraft's altitude, the aspect (direction and angle) of the aircraft relative to the receiver, receiver depth, water depth, and seafloor type (Richardson et al., 1995). Received level diminishes with increasing receiver depth when an aircraft is directly overhead, but may be stronger at mid-water than at shallow depths when an aircraft is not directly overhead (Richardson et al., 1995). Because of the relatively high expected airspeeds during transits and these physical variables, aircraft-related noise (including both airborne and underwater noise) is expected to be very brief in duration.

A.9 Accidents

The EIA focuses on two potential accidents:

- a small diesel fuel spill, which is the most likely type of spill during OCS activities (discussed in **Section A.9.1**); and
- a large oil spill, up to and including the WCD for this DOCD (as detailed in **DOCD Section I**), which is an oil spill resulting from an uncontrolled blowout (discussed in **Section A.9.2**).

The following subsections summarize details regarding the sizes and fates of these spill scenarios. Impacts are analyzed in **Section C**.

Recent EISs (BOEM, 2014b, 2015, 2016b, 2017 a,b) analyzed other types of accidents relevant to offshore operations that could lead to potential impacts to the marine environment: loss of well control, vessel collision, and chemical spills. These types of accidents, along with a hydrogen sulfide (H_2S) release, are discussed briefly below.

<u>Loss of Well Control</u>. A loss of well control is the uncontrolled flow of a reservoir fluid that may result in the release of gas, condensate, oil, drilling fluids, sand, or water. Loss of well control is a broad term that includes very minor up to the most serious well control incidents, while blowouts are considered to be a subset of more serious incidents with greater risk of oil spill or human injury (BOEM, 2016a, 2017a). Loss of well control may result in the release of drilling fluid or loss of oil. Not all loss of well control events result in blowouts (BOEM, 2017c). In addition to the potential release of gas, condensate, oil, sand, or water, the loss of well control

can also resuspend and disperse bottom sediments (BOEM, 2012a, 2017 a,b). BOEM (2016a) noted that most OCS blowouts have resulted in the release of gas.

Anadarko has a robust system in place to prevent loss of well control. Measures to prevent a blowout, reduce the likelihood of a blowout, and conduct effective and early intervention in the event of a blowout are described in the NTL 2015-N01 package submitted with this DOCD, as required by BOEM. The potential for a loss of well control event will be minimized by adhering to the requirements of applicable regulations such as the Well Control Rule (75 *FR* 63365) and NTL 2010-N10, which specify additional safety measures for OCS activities.

Vessel Collisions. BSEE data show that there were 119 OCS-related collisions between 2009 and 2016 (BSEE, 2016). Most collision mishaps are the result of support vessels colliding with platforms or vessel collisions with pipeline risers. Approximately 10% of vessel collisions with platforms in the OCS resulted in diesel spills, and in several collision incidents, fires resulted from hydrocarbon releases. To date, the largest diesel spill associated with a collision occurred in 1979 when an anchor-handling vessel collided with a drilling platform in the Main Pass lease area, spilling 1,500 bbl of diesel fuel. Diesel fuel is the product most frequently spilled, but oil, natural gas, corrosion inhibitor, hydraulic fluid, and lube oil also have been released as a result of vessel collisions. Human error accounted for approximately half of all reported vessel collisions from 2006 to 2010. As summarized by BOEM (2017c), vessel collisions occasionally occur during routine operations. Some of these collisions have caused spills of diesel fuel or chemicals. Anadarko will comply with all USCG- and BOEM-mandated safety requirements to minimize the potential for vessel collisions.

Chemical Spills. Chemicals are stored and used for pipeline hydrostatic testing and during drilling and in well completion operations. The relative quantities of their use is reflected in the largest volumes spilled (BOEM, 2017c). Completion, workover, and treatment fluids are the largest quantity used and comprise the largest releases. Between 2007 and 2014, an average of two chemical spills <50 bbl in volume and three checmical spills >50 bbl in volume occurred each year (BOEM, 2017a).

H_2S Release. VK 915 was classified as H_2S absent under a previously approved Initial Exploration Plan.

A.9.1 Small Diesel Fuel Spill

Spill Size. According to the analysis by BOEM (2017b), the most likely type of small spill (<1,000 bbl) resulting from OCS activities is a failure related to the storage of oil or diesel fuel. Historically, most diesel spills have been ≤1 bbl, and this is predicted to be the most common spill volume in ongoing and future OCS activities in the Western and Central Gulf of Mexico Planning Areas (Anderson et al., 2012). As the spill volume increases, the incident rate declines dramatically (BOEM, 2017a). The median size for spills ≤1 bbl is 0.024 bbl, and the median volume for spills of 1 to 10 bbl is 3 bbl (Anderson et al., 2012). For the EIA, a small diesel fuel spill of 3 bbl is used. Operational experience suggests that the most likely cause of such a spill would be a rupture of the fuel transfer hose resulting in a loss of contents (<3 bbl of fuel) (BOEM, 2012a).

Spill Fate. The fate of a small diesel fuel spill in the lease area would depend on meteorological and oceanographic conditions at the time of the spill as well as the effectiveness of spill response activities. However, given the open ocean location of the lease area and response actions required to be implemented by the responsible party, it is expected that impacts from a small spill would be minimal (BOEM, 2016a).

The water-soluble fractions of diesel are dominated by two- and three-ringed polycyclic aromatic hydrocarbons (PAHs), which are moderately volatile (National Research Council, 2003a). The constituents of these oils are light to intermediate in molecular weight and can be readily degraded by aerobic microbial oxidation. Due to its low density, diesel will not sink to the seafloor. Diesel dispersed in the water column can adhere to suspended sediments, but this generally occurs only in coastal areas with high suspended solids loads (National Research Council, 2003a) and would not be expected to occur to any appreciable degree in offshore waters of the Gulf of Mexico. The National Oceanic and Atmospheric Administration (NOAA) has reported that diesel oil is readily and completely degraded by naturally occurring microbes (NOAA, 2006).

Oil slicks from diesel spills within the marine environment are expected to persist for relatively short periods of time, ranging from minutes (for a <1 bbl spill) to hours (for a 1 to 10 bbl spill) to a few days (for a 10 to 1,000 bbl spill), and will rapidly spread out, evaporate, and disperse into the water column (BOEM, 2012a).

For the purposes of the EIA, the fate of a small diesel fuel spill was estimated using NOAA's Automated Data Inquiry for Oil Spills 2 (ADIOS2) model (NOAA, 2016a). This model uses the physical properties of various oil types in its database to predict the rate of evaporation and dispersion over time as well as changes in the density, viscosity, and water content of the spilled product. Based on model results, it is estimated that more than 90% of a small diesel spill would evaporate or disperse within 24 hours. The area of sea surface exhibiting floating diesel fuel during this 24-hour period would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions.

The ADIOS2 results, coupled with spill trajectory information for a large spill, indicate that a small diesel fuel spill would not impact coastal or shoreline resources because of the distance of the lease area to the nearest shoreline (66 miles [106 km]). Modeling results indicate that a spill in the lease area would have a <0.5% conditional probability of reaching coastal Louisiana within 3 days of a spill and up to a 7% conditional probability within 10 days following a spill. By that time, essentially 100% of a small diesel fuel spill is expected to have dispersed or evaporated through natural processes, without taking into account Anadarko's spill response measures. Because of the lack of persistence of small oil spills in the environment and the project's distance from shore, it is unlikely that a small spill within the project area would make landfall prior to dissipating (BOEM, 2012a, 2017a).

Spill Response. In the unlikely event that shipboard prevention procedures fail to circumvent a fuel spill, response equipment and trained personnel will be activated so that spill effects will be localized and will result only in short-term environmental consequences. **DOCD Section I** provides a detailed discussion of Anadarko's response to a spill.

A.9.2 Large Oil Spill (Worst-Case Discharge)

Spill Size. The WCD scenario for this project is defined as an uncontrollable oil discharge from the subsea wellbore resulting from a blowout incident during installation operations. The scenario assumes that the wellhead fails mechanically and a blowout occurs at the seafloor, allowing the entire wellbore fluid to flow up the existing production string. Based on NTL 2015-N01 guidance, the WCD at the seafloor for the well scenario was estimated to be 23,761 bbl per day.

Blowout Scenario. In accordance with NTL 2015-N01 and as required by 30 CFR 550.213g, a scenario for a potential blowout of a well, and the highest volume of liquid hydrocarbons potentially released, has been detailed and is provided within this DOCD. An estimated 120 days will be required to mobilize equipment and drill a relief well under the blowout scenario. The maximum total volume of liquid hydrocarblons released during a blowout is potentially 2,437,800 bbl, assuming 120 days for the duration of a blowout, multiplied by the worst-case daily uncontrolled volume (20,315 bbl per day).

The detailed analysis of the WCD calculations can be found in **DOCD Section I**, as required by NTL 2015-N01 and 30 CFR 550.219(a)(2)(iv). Descriptions of the measures to be undertaken by Anadarko to prevent a blowout, reduce the likelihood of a blowout, and conduct effective and early intervention in the event of a blowout are included in the analysis. Anadarko will also comply with NTL 2010-N10 and the Well Control Rule (75 *FR* 63365) which specify additional safety measures for OCS activities.

Spill Probability. Holand (1997) estimated a probability of 0.0021 for a deep drilling blowout during exploration drilling based on U.S. Gulf of Mexico data. The International Association of Oil & Gas Producers (2010) conducted an analysis using the SINTEF[1] database and estimated a blowout frequency of 0.0017 per exploratory well for non-North Sea locations. BOEM updated OCS spill frequencies (barrels spilled per barrels produced) to include the Macondo incident. Spill rates for OCS platforms have decreased in recent years as the volume of oil handled has increased with no large spills since the Macondo spill. According to ABS Consulting Inc. (2016), the spill rate for spills >1,000 bbl dropped to 0.22 spills per billion barrels. According to BSEE's Well Control Rule (75 *FR* 63365), issued following the Macondo spill, the baseline risk of a catastrophic blowout is estimated to be once every 26 years.

Spill Trajectory. The fate of a large oil spill in the lease area would depend on meteorological and oceanographic conditions at the time of the spill. The Oil Spill Risk Analysis (OSRA) model is a computer simulation of oil spill transport that uses realistic data for winds and currents to estimate spill trajectory. The OSRA report by Ji et al. (2004) provides conditional contact probabilities for shoreline segments along the Gulf of Mexico.

The results for the 30-day OSRA model for Launch Area 55 (where VK 915 is located) are presented in **Table 3**. The model predicts a <0.5% chance of shoreline contact within 3 days and up to a 7% chance of shoreline contact within 10 days, with the highest probability of shoreline contact occuring in Plaquemines Parish, Louisiana. Shoreline contact is predicted within 30 days of a spill for shorelines ranging from Terrebonne Parish, Louisiana, to Franklin County, Florida. The conditional probability of shoreline contact for all shorelines with predicted contact within 30 days is low (1% to 7%) with the exception of Plaquemines Parish, Louisiana (17% probability within 30 days of a spill) (**Table 3**).

[1] Stiftelsen for Industriell og Teknisk Forskning (Foundation for Scientific and Industrial Research, Norwegian Institute of Technology).

Table 3. Conditional probabilities of a spill in the lease area contacting shoreline segments. From: Ji et al. (2004).

Shoreline Segment	County or Parish, State	Conditional Probability of Contact[1] (%)		
		3 Days	10 Days	30 Days
C17	Terrebonne Parish, Louisiana	--	--	1
C18	Lafourche Parish, Louisiana	--	--	1
C20	Plaquemines Parish, Louisiana	--	7	17
C21	St. Bernard Parish, Louisiana	--	2	7
C22	Hancock and Harrison Counties, Mississippi	--	--	2
C23	Jackson County, Mississippi	--	1	2
C24	Mobile County, Alabama	--	1	2
C25	Baldwin County, Alabama	--	1	3
C26	Escambia County, Florida	--	--	2
C28	Okaloosa County, Florida	--	--	1
C29	Walton County, Florida	--	--	1
C30	Bay County, Florida	--	--	2
C31	Gulf County, Florida	--	--	1
C32	Franklin County, Florida	--	--	1

[1] Conditional probability refers to the probability of contact within the stated time period, assuming that a spill has occurred (-- indicates <0.5%). Values are conditional probabilities that a hypothetical spill in Viosca Knoll Block 915 (represented by OSRA Launch Area 55) could contact shoreline segments within 3, 10, or 30 days.

The 30-day OSRA modeling results reported reported by Ji et al. (2004) did not evaluate the fate of a spill over time periods exceeding 30 days, nor did they estimate the fate of a release that continues over a period of weeks or months. As noted by Ji et al. (2004), the OSRA model does not consider the chemical composition or biological weathering of oil spills, the spreading and splitting of oil spills, or spill response activities. The model does not specify a particular spill size but has been used by BOEM to evaluate contact probabilities for spills of more than 1,000 bbl.

BOEM (2017c) presents additional OSRA modeling to simulate a spill that continues for 90 consecutive days, with each trajectory tracked for 60 days during four seasons. In this updated OSRA model, 60 days was chosen as a conservative estimate of the maximum duration that spilled oil would persist on the sea surface following a spill (BOEM, 2017c). The spatial resolution is limited, with seven launch points in the entire Western, Central, and Eastern Planning Areas of the Gulf of Mexico. These launch points were deliberately located in areas identified as having a high possibility of containing large oil reserves. The launch point most appropriate for modeling a spill in the lease area is Launch Point 2. The 60-day OSRA results for Launch Point 2 are presented in **Table 4**.

Table 4. Shoreline segments with a 1% or greater conditional probability of contact from a spill starting at Launch Point 2 based on the 60-day Oil Spill Risk Analysis. Values are conditional probabilities that a hypothetical spill in the lease area could contact shoreline segments within 60 days.

Season	Spring				Summer				Fall				Winter			
Day	3	10	30	60	3	10	30	60	3	10	30	60	3	10	30	60
County or Parish	Conditional Probability of Contact[1] (%)															
Matagorda, Texas	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Vermilion, Louisiana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Terrebonne, Louisiana	--	--	--	--	--	--	--	1	--	--	--	--	--	--	2	2
Lafourche, Louisiana	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	1
Jefferson, Louisiana	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1
Plaquemines, Louisiana	--	2	3	3	2	9	17	19	2	17	24	24	1	12	18	20
St. Bernard, Louisiana	--	5	6	6	1	8	13	14	1	8	10	10	1	5	8	8
Hancock, Mississippi	--	2	3	3	11	2	2	2	1	2	3	3	--	1	2	3
Harrison, Mississippi	2	5	5	5	1	4	5	5	1	2	3	3	2	3	4	4
Jackson, Mississippi	7	13	14	14	3	6	8	8	6	11	12	13	6	10	12	13
Mobile, Alabama	13	18	19	19	4	9	10	10	8	12	12	13	9	12	12	13
Baldwin, Alabama	8	15	18	18	2	8	9	9	1	2	3	3	3	6	7	7
Escambia, Florida	1	6	9	10	1	4	6	6	--	1	1	1	--	2	2	3
Okaloosa, Florida	--	1	2	2	--	1	2	2	--	--	--	--	--	--	--	--
Walton, Florida	--	--	1	1	--	1	1	1	--	--	--	1	--	--	--	--
Bay, Florida	--	2	3	3	--	1	2	3	--	--	--	--	--	--	--	1
Gulf, Florida	--	1	3	4	--	--	2	2	--	--	--	--	--	--	--	--
Franklin, Florida	--	--	1	2	--	--	1	1	--	--	--	--	--	--	--	--
Dixie, Florida	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
Levy, Florida	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
State Coastline	Conditional Probability of Contact[1] (%)															
Texas	--	--	--	--	--	--	--	1	--	--	1	2	--	--	--	2
Louisiana	--	6	8	9	3	17	30	35	3	25	36	36	2	18	29	33
Mississippi	9	20	22	22	5	12	15	15	8	15	18	19	8	15	18	20
Alabama	21	33	37	37	6	17	20	20	9	14	15	15	12	18	20	20
Florida	1	11	19	26	1	7	14	16	--	1	3	3	--	2	4	5

[1] Conditional probability refers to the probability of contact within the stated time period assuming that a spill has occurred (-- indicates <0.5%). Values are conditional probabilities that a hypothetical spill in the lease area could contact shoreline segments within 60 days. Modified from BOEM (2017c).

From Launch Point 2, potential shoreline contacts within 60 days range from Matagorda County, Texas, to Levy County, Florida. Based on statewide contact probabilities within 60 days, Louisiana has the highest likelihood of contact during summer, fall and winter (ranging from 33% to 36% within 60 days), while Alabama has the highest probability of contact in spring (37% within 60 days). The model predicts potential contact with Mississippi shorelines in any season ranging from a 15% probability in summer to a 22% probability in spring (within 60 days of a spill). Texas shorelines are predicted to be potentially contacted only during summer, fall, or winter, with probabilities of contact 2% or less within 60 days. Florida shorelines are predicted to be potentially contacted during any season, with a probability up to 26% in spring. Based on the 60-day trajectories, counties or parishes with greater than 10% contact probability during any season include Plaquemines and St. Bernard Parishes in Louisiana; Hancock and Jackson counties in Mississippi; Mobile and Baldwin counties in Alabama; and Escambia County, Florida (**Table 4**).

OSRA is a preliminary risk assessment model. In the event of an actual oil spill, real-time monitoring and trajectory modeling would be conducted using current and wind data available from the rigs and permanent production structures in the area. Satellite and aerial monitoring of the plume and real-time trajectory modeling using wind and current data would continue on a daily basis to help position equipment and human resources throughout the duration of any major spill or uncontrolled release.

Weathering. Following an oil spill, several physical, chemical, and biological processes, collectively called weathering, interact to change the physical and chemical properties of the oil, influencing potential effects to marine organisms and ecosystems. The most important weathering processes include spreading, evaporation, dissolution, dispersion into the water column, formation of water-in-oil emulsions, photochemical oxidation, microbial degradation, adsorption to suspended particulate matter, and stranding on shore or sedimentation to the seafloor (National Research Council, 2003a).

Weathering decreases the concentration of oil and produces changes in its chemical composition, physical properties, and toxicity (Tarr et al., 2016). The more toxic, light aromatic and aliphatic hydrocarbons are lost rapidly by evaporation and dissolution from a slick on the water surface. For example, the light, paraffinic crude oil spilled during the *Deepwater Horizon* incident lost approximately 55 wt. % to evaporation during the first 3 to 5 days while floating on the sea surface (Daling et al., 2014). Several studies in the aftermath of the Macondo spill concluded that approximately 25% of mass below n-C_8 was lost during the oil's ascent to the surface, before an increased rate of weathering occurred once on the surface due to photo-oxidation (Lewan et al., 2014, Faksness et al., 2015, Stout and Payne, 2016, Stout et al., 2016).

Evaporated hydrocarbons are degraded rapidly by sunlight. Biodegradation of oil on the water surface and in the water column by marine bacteria is a dynamic process; microbes have been shown to first degrade the n-alkanes and then the light aromatics from the oil. Other petroleum components are biodegraded more slowly (Hazen et al., 2016). Photo-oxidation affects mainly the medium and high molecular weight PAHs in the oil on the water surface.

Spill Response. Anadarko's Regional OSRP was last approved on 14 August 2015. The June 2017 biennial updates were acknowledged by BSEE 12 July 12; 5 October 5 2017 updates were acknowledged by BSEE on 2 November 2017. Per BSEE, the OSRP is in compliance with 30 CFR 254.30(a). The OSRP provides a detailed plan that enables Anadarko to respond rapidly and effectively manage response efforts for oil spills that may result from drilling and production operations. The OSRP contains detailed information on "Quick Response" procedures, including:

- responsibilities of all Anadarko and contract personnel to report any observed discharge from known or unknown sources;
- procedures to locate and determine the size of a discharge; and
- contact information for alerting the spill management team, complete with names, phone numbers, and locations.

In the event of a large oil spill up to and including a WCD, Anadarko has access to surface and subsea response/containment capabilities that could be implemented through various organizations under contract. Anadarko's primary spill response equipment provider is Clean Gulf Associates (CGA).

CGA has several skimming vessels capable of operating in shallow waters, nearshore areas, and offshore areas. These vessels have oleophilic brush pack skimming systems operating in troughs built into the hulls; below-deck storage; and marine electronics packages including marine, aircraft, and company-frequency radios, radar, moving map plotters, GPS, satellite phones, and depth finders. CGA also offers Fast Response Systems staged throughout the Gulf of Mexico available for offshore use.

The CGA high-volume open sea skimmer (HOSS) barge consists of a skimming system built into an oil recovery barge. There are four 1,000-bbl recovered oil storage tanks built into the hull where oil can be separated and offloaded. Skimming operations are conducted from the control room overlooking the skimmer deck. The estimated daily recovery capacity for the HOSS barge is approximately 43,000 bbl of surface oil.

CGA is currently adding to its equipment stockpile and has acquired Koseq skimming arms and Aqua Guard skimmers. In addition, an x-band radar/infrared tracking system is installed on the HOSS barge. Additional CGA equipment can be referenced online at http://www.cleangulfassoc.com/equipment.

Anadarko also has a contract with the Marine Spill Response Corporation (MSRC) for additional spill response equipment. MSRC has a dedicated fleet for the Atlantic/Gulf of Mexico region and additional available equipment staged throughout the U.S. MSRC equipment staged throughout the Gulf of Mexico includes oil spill response vessels, ast response vessels, oil spill response barges, platform supply vessels, and shallow water barges. Various equipment is outfitted with x-band radar and infrared technology for detecting surface oil.

MSRC expanded its resources and capability in the Gulf of Mexico with particular focus on deep water, known as "Deep Blue." Additional MSRC capabilities and a complete equipment listing are available online at http://www.msrc.org/.

Anadarko is a member of the Marine Well Containment Company (MWCC). In the event of an incident, MWCC can provide a 15,000-psi single ram capping stack and dispersant injection capability. MWCC can install and operate the interim containment system, including subsea flowlines, manifolds, and risers. The interim system is engineered to be used in depths up to 10,000 ft (3,048 m) and has the capacity to contain 60,000 bbl of liquid per day (and 120 million standard cubic feet per day of gas) with potential for expansion.

Additionally, MWCC offers its members access to equipment, instruments, and supplies for marine environmental sampling and monitoring in the event of an oil spill in the Gulf of Mexico. Members have access to a mobile Laboratory Container, Operations Container, and Launch and Recovery System (LARS) that enable water sampling and monitoring to water depths of 9,843 ft (3,000 m). The two 8 ft × 20 ft (2.4 m × 6.1 m) containers that have been certified for offshore use by Det Norske Veritas and the American Bureau of Shipping. The LARS is a combined winch, A-frame, and 9,843 ft (3,000 m) long cable, customized for the instruments in the containers.

The containers are designed to enable rapid mobilization of required equipment to an incident site, including redundant systems to avoid downtime and supplies for sample handling and storage. Once deployed on a suitable vessel, the mobile containers then act as work spaces for scientists and operations personnel.

See **DOCD Section I** for a detailed description of Anadarko's site-specific spill response measures for the plan.

B. Affected Environment

The lease area is approximately 66 miles (106 km) from the nearest shoreline (Louisiana), 135 miles (217 km) from the onshore support base at Port Fourchon, Louisiana, and 168 miles (270 km) from the helicopter base at Houma, Louisiana (**Figure 1**). The water depth at the location of the proposed activities is approximately 3,561 ft (1,085 m) (**Figure 2**).

The site clearance letter for the wellsite where the proposed activities will occur noted one well, one umbilical, and two pipelines within 2,000 ft (610 m) of the location of the proposed activities (Geoscience Earth & Marine Services Inc., 2014).

The location of the wellsite where the proposed activities will occcur is free of constraining seafloor conditions and is relatively smooth and featureless. No high-density deepwater benthic or chemosynthetic communities or archaeological avoidance zones were noted within 2,000 ft (610 m) of the proposed project location (Geoscience Earth & Marine Services Inc., 2014).

A detailed description of the regionally affected environment, including meteorology, oceanography, geology, air and water quality, benthic communities, threatened and endangered species, biologically sensitive resources, archaeological resources, socioeconomic conditions, and other marine uses is provided by BOEM (2012a, 2013a, 2014a, 2015, 2016b, 2017 a,b). These regional descriptions remain valid and are incorporated by reference. Brief descriptions of each potentially affected resource, including site-specific or new information if available, are presented in **Section C**.

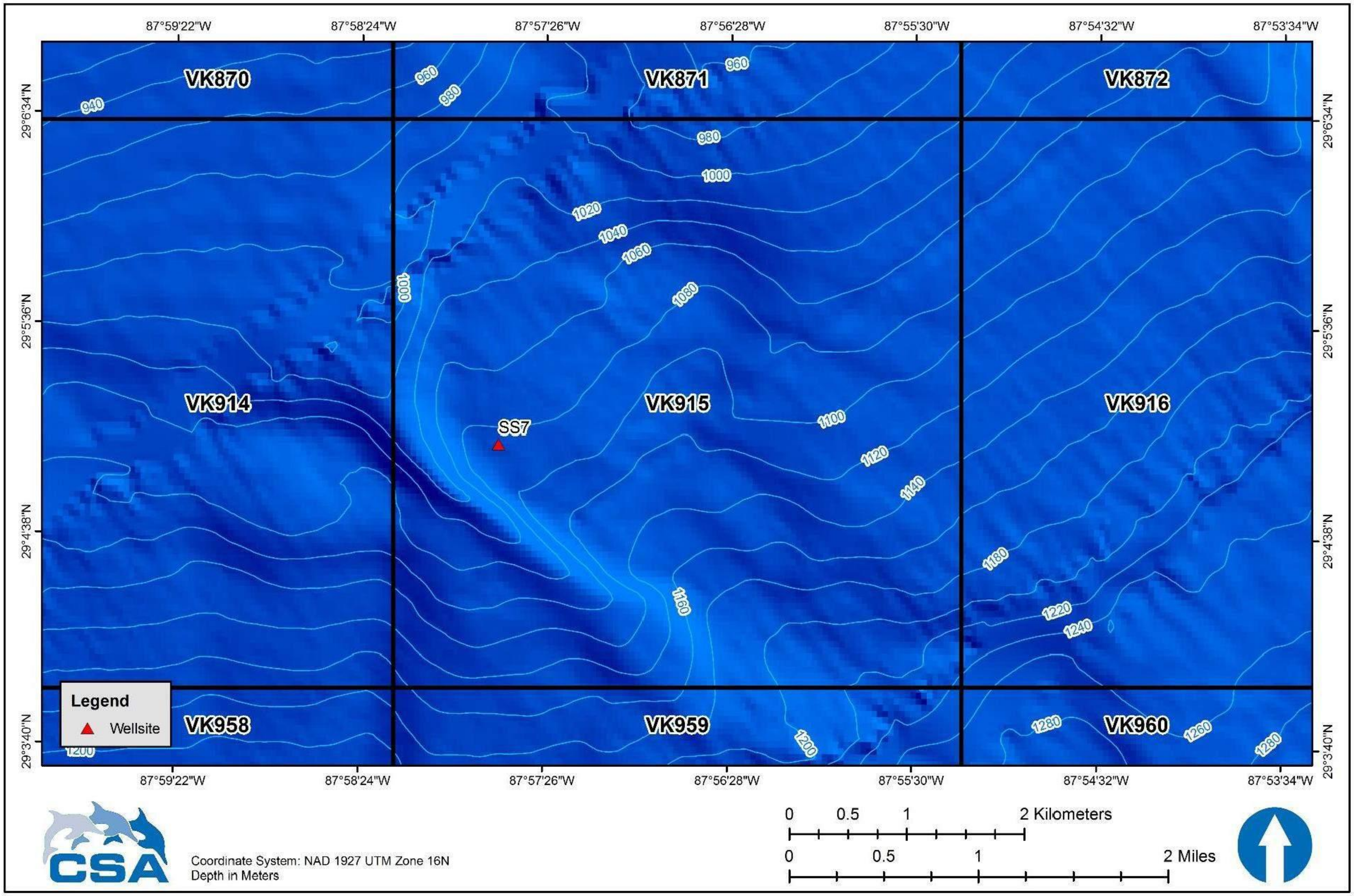

Figure 2. Bathymetric profile of the lease area showing the surface hole location of the wellsite where the proposed installation activities will occur in Viosca Knoll Block 915.

C. Impact Analysis

This section analyzes the potential direct and indirect impacts of routine activities and accidents. Impacts have been analyzed extensively in lease sale EISs for the Western and Central Gulf of Mexico Planning Areas (BOEM, 2012a, 2013b, 2014a, 2015, 2017 a,b). The information in these documents is incorporated by reference. Potential site-specific issues are addressed in this section. The following sections are organized by the Environmental Resources identified in **Table 2**, and address each potential IPF. Potential site-specific issues are addressed in this section.

C.1 Physical/Chemical Environment

C.1.1 Air Quality

There are no site-specific air quality data for the project area due to the distance from shore. However, because of the distance from shore-based pollution sources and the lack of sources of pollutants offshore, air quality at the wellsites is expected to be good. The attainment status of federal OCS waters is unclassified because there is no provision in the Clean Air Act for classification of areas outside state waters (BOEM, 2012a).

In general, the ambient air quality of coastal counties along the Gulf of Mexico is relatively good (BOEM, 2012a). As of December 2017, Mississippi, Alabama, and Florida Panhandle coastal counties are in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants. St. Bernard Parish in Louisiana is a nonattainment area for sulfur dioxide based on the 2010 standard. Houston-Galveston-Brazoria in Texas is a nonattainment area for 8-hr ozone based on the 1997 and 2008 standards, and one coastal metropolitan area in Florida (Tampa) is a nonattainment area for lead based on the 2008 standard (USEPA, 2017).

As noted earlier, based on calculations made pursuant to applicable regulations, emissions from installation activities are not expected to be significant because they are below exemption levels. Therefore, the only potential effects to air quality would be from air pollutant emissions associated with routine operations, and accidental spills (a small diesel fuel spill or a large oil spill). These IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Air Pollutant Emissions

Offshore air pollutant emissions are the only routine IPF likely to affect air quality. Offshore air pollutant emissions will result from construction vessel, helicopter, and support vessel operations. These emissions occur mainly from combustion or burning of diesel fuel and Jet-A aircraft fuel. The combustion of fuels occurs primarily in diesel-powered generators, pumps, or motors as well as from lighter fuel motors. Primary air pollutants typically associated with OCS activities are suspended PM, SO_x, NO_x, VOCs, and CO. As noted by BOEM (2017b), air pollutant emissions from routine activities are projected to have minimal impacts to onshore air quality because of the prevailing atmospheric conditions, anticipated emission rates, anticipated heights of emission sources, and the distance from shore of the proposed activities and associated pollutant concentrations. The Air Quality Emissions Report (**DOCD Section H**) prepared in accordance with BOEM requirements shows that the projected emissions are below exemption levels. Given the levels of expected emissions and the distance of the project from shore, emissions from the proposed activities described in this DOCD are not likely to contribute to violations of any NAAQS on shore. Therefore, according to 30 CFR 550.303, the emissions will not significantly affect the air quality of the onshore area for any of the criteria pollutants.

Greenhouse gas emissions contribute to climate change, with important impacts on temperature, rainfall, frequency of severe weather, ocean acidification, and sea level rise (Intergovernmental Panel on Climate Change, 2014). Greenhouse gas emissions from the proposed project represent a negligible contribution to the total greenhouse gas emissions from reasonably foreseeable activities in the Gulf of Mexico area and would not significantly alter or exceed any climate change impacts evaluated in the Programmatic EIS (BOEM, 2016a). Carbon dioxide (CO_2) and methane (CH_4) emissions from the project would constitute a small incremental contribution to greenhouse gas emissions from all OCS activities. According to Programmatic and OCS lease sale EISs (BOEM, 2012a, 2016a), estimated CO_2 emissions from OCS oil and gas sources represent 0.4% of the U.S. total. Greenhouse gas emissions from the proposed project represent a negligible contribution to the total greenhouse gas emissions from reasonably foreseeable activities in the Gulf of Mexico area and would not significantly alter any climate change impacts evaluated in the Programmatic EIS (BOEM, 2016a).

The Breton Wilderness Area, which is part of the Breton National Wildlife Refuge (NWR), is designated under the Clean Air Act as a Prevention of Significant Deterioration Class I air quality area. BOEM is required to notify the National Park Service and U.S. Fish and Wildlife Service (USFWS) if emissions from proposed projects may affect the Breton Class I area. Additional review and mitigation measures may be required for sources that exceed emission limits agreed upon by the administering agencies within 186 miles (300 km) of the Breton Class I area (National Park Service, 2010). The lease area is approximately 70 miles (113 km) from the Breton Wilderness Area. Based on Anadarko's Air Quality Emissions report (**DOCD Section H**), no significant impacts on coastal air quality are expected, including in the Breton Wilderness Area. Anadarko will comply with all BOEM requirements regarding air emissions.

Impacts of a Small Diesel Fuel Spill

Potential impacts of a small diesel spill on air quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017 a,b). The probability of a small spill occurring would be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Anadarko's Regional OSRP could reduce the potential impacts. **DOCD Section I** includes a detailed discussion of the spill response measures that would be employed. Given the open ocean location of the lease area, the extent and duration of air quality impacts from a small spill would not be significant.

A small diesel fuel spill would affect air quality near the spill site by introducing VOCs into the atmosphere through evaporation. The ADIOS2 model (**Section A.9.1**) indicates that more than 90% of a small diesel spill would evaporate or disperse within 24 hours. The sea surface area covered with small diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions.

A small diesel fuel spill would not affect coastal air quality because the spill would not be expected to make landfall or reach coastal waters prior to natural dispersion (**Section A.9.1**).

Impacts of a Large Oil Spill

Potential impacts of a large oil spill on air quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017 a,b).

A large oil spill could affect air quality by introducing VOCs into the atmosphere through evaporation from the slick. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. Real-time wind and current data from the project area would be available at the time of a spill and would be used to assess the fate and effects of VOCs released. Additional air quality impacts could occur if response measures included *in situ* burning of the floating oil. Burning would generate a plume of black smoke and result in emissions of NO_x, SO_x, CO, and PM as well as greenhouse gases. However, *in situ* burning would occur as a response measure only if authorized by the USEPA.

Based on the 30-day OSRA modeling (**Table 3**), Plaquemines Parish in Louisiana is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Alabama, or Mississippi shorelines may be affected within 10 days, and shorelines in Florida could be affected within 30 days. Based on the 60-day OSRA modeling estimates (**Table 4**), the potential shoreline contacts range from Matagorda County, Texas, to Levy County, Florida. However, due to the lease area's distance from the nearest shoreline, most air quality impacts are likely to occur in offshore waters, and substantial impacts to onshore air quality are not expected.

C.1.2 Water Quality

There are no site-specific baseline water quality data for the lease area. Due to the lease location in deep, offshore waters, water quality is expected to be good, with low levels of contaminants. Deepwater areas in the northern Gulf of Mexico are relatively homogeneous with respect to temperature, salinity, and oxygen (BOEM, 2017a). Kennicutt (2000) noted that the deepwater region has little evidence of contaminants in the dissolved or particulate phases of the water column. However, there are localized occurrences of natural seepage of oil, gas, and brines in near-surface sediments and up through the water column. Based on the site clearance letters for proposed wellsites, no natural seeps were noted in the vicinity of the wellsite where the proposed activities will occur (Geoscience Earth & Marine Services Inc., 2014).

IPFs that could affect water quality are effluent discharges associated with routine operations and two types of accidents (a small diesel fuel spill and a large oil spill). These IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Effluent Discharges

Treated sanitary and domestic wastes, including those from support vessels, may have a slight transient effect on water quality in the immediate vicinity of these discharges. Treated sanitary and domestic wastes may have elevated levels of nutrients, organic matter, and chlorine but should dilute rapidly to undetectable levels within tens to hundreds of meters from the source. All NPDES permit limitations and requirements, as well as USCG regulations (as applicable), will be met; therefore, little or no impact on water quality from the overboard release of treated sanitary and domestic wastes is anticipated.

Deck drainage includes all effluents resulting from rain, deck washings, and runoff from curbs, gutters, and drains, including drip pans in work areas. Rainwater that falls on uncontaminated areas of the construction vessel will flow overboard without treatment. However, rainwater that falls on the other areas such as chemical storage areas and places where equipment is exposed will be collected and oil and water separated prior to discharge to meet NPDES permit requirements. Based on adherence to permit limits and applicable regulations, little or no impact on water quality from deck drainage is anticipated.

Other discharges in accordance with the NPDES permit, such as non-pollutant completion fluids, subsea production control fluid, uncontaminated wash, ballast and bilge water, and non-contact cooling and fire water are expected to dilute rapidly, resulting in little or no impact on water quality.

Impacts of a Small Diesel Fuel Spill

Potential impacts of a small diesel spill on water quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017 a,b). The probability of a small spill occuring would be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfers. In the unlikely event of a spill, implementation of Anadarko's Regional OSRP will help mitigate and thus reduce potential impacts. **DOCD Section I** provides detail on spill response measures in addition to the summary information provided in the EIA.

The water-soluble fractions of diesel are dominated by two- and three-ringed PAHs, which are moderately volatile (National Research Council, 2003a). The molecular weight of diesel oil constituents are light to intermediate and can be readily degraded by aerobic microbial oxidation. Diesel oil is much lighter than water (specific gravity is between 0.83 and 0.88, compared to 1.03 for seawater). When spilled on water, diesel oil spreads very quickly to a thin film of rainbow and silver sheens, except for marine diesel, which may form a thicker film of dull or dark colors. However, because diesel oil has a very low viscosity, it is readily dispersed into the water column when winds reach 5 to 7 knots or with breaking waves (NOAA, 2017a). It is possible for the diesel oil that is dispersed by wave action to form droplets that are small enough be kept in suspension and moved by the currents.

Diesel dispersed in the water column can adhere to suspended sediments, but this generally occurs only in coastal areas with high suspended solid loads (National Research Council, 2003a) and would not be expected to occur to any appreciable degree in offshore waters of the Gulf of Mexico.

The extent and persistence of water quality impacts from a small diesel fuel spill would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. It is estimated that more than 90% of a small diesel spill would evaporate or disperse within 24 hours (**Section A.9.1**). The sea surface area covered with a very thin layer of diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions. In addition to removal by evaporation, constiuents of diesel oil are readily and completely degraded by naturally occurring microbes (NOAA, 2006). Given the open ocean location of the lease area, the extent and duration of water quality impacts from a small spill are not expected to be significant.

A small diesel fuel spill would not substantially affect coastal water quality because the spill would not be expected to make landfall or reach coastal waters due to both response efforts that would be undertaken as well as natural attenuation (**Section A.9.1**).

Impacts of a Large Oil Spill

Potential impacts of a large oil spill on water quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017 a,b). Additional air quality impacts could occur if response measures included *in situ* burning of the floating oil. Burning would generate a plume of black smoke and result in emissions of NO_x, SO_x, CO, and PM as well as greenhouse gases. However, *in situ* burning would occur only if authorized by the USEPA. Most of the spilled oil would be expected to form a slick at the surface, though small droplets in the water may adhere to suspended sediments and be removed from the water column (Operational Science Advisory Team, 2010). Information from the Macondo spill indicates that plumes of submerged oil droplets can be produced when subsea dispersants are applied at the wellhead (Camilli et al., 2010, Hazen et al., 2010, NOAA, 2011a,b,c). Subsea dispersants would be applied only after approval from the USEPA.

Analyses of the full set of samples associated with the Macondo spill have confirmed that the application of subsurface dispersants resulted in subsurface hydrocarbon plumes (Spier et al., 2013). A report by Kujawinski et al. (2011) indicates that chemical components of subsea dispersants used during the Macondo spill persisted for up to 2 months and were detected up to 186 miles (300 km) from the wellsite in water depths of 3,280 to 3,937 ft (1,000 to 1,200 m). Although dispersants were detected by laboratory analysis in 353 of the 4,114 water samples, concentrations were significantly below the chronic screening level for dispersants (BOEM, 2012a).

Hazen et al. (2010) studied the impacts and fate of deepwater oil. Initial studies suggested that the potential exists for rapid intrinsic bioremediation (bacterial degradation) of subsea dispersed oil in the water column by deep-sea indigenous microbial activity without significant oxygen depletion (Hazen et al., 2010), although other studies showed that oil bioremediation caused oxygen drawdown in deep waters (Kessler et al., 2011, Dubinsky et al., 2013). Additional studies investigated the effects of deepwater dissolved hydrocarbon gases (e.g., methane, propane, and ethane) and the microbial response to a deepwater oil spill. Results suggest deepwater dissolved hydrocarbon gases may promote rapid hydrocarbon respiration by low-diversity bacterial blooms, thus priming indigenous bacterial populations for rapid hydrocarbon degradation of subsea oil (Kessler et al., 2011, Du and Kessler, 2012, Valentine et al., 2014). A 2017 study identified water temperature, taxonomic composition of the initial bacterial community, and dissolved nutrient levels as factors that may regulate oil degradation rates by deep-sea indigenous microbes (Liu et al., 2017).

The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. Real-time wind and current data from the project area would be available at the time of a spill and would be used to assess the fate and effects of VOCs released. Weathering processes that affect spilled oil on the sea include adsorption (sedimentation), biodegradation, dispersion, dissolution, emulsification, evaporation, and photo oxidation. Most crude oil blends will emulsify quickly when spilled, creating a stable mousse that presents a more persistent cleanup and removal challenge (NOAA, 2017b).

Because of the lease area's distance from the nearest shoreline, it is expected that most water quality impacts would occur in offshore waters. Depending on the spill trajectory and the effectiveness of spill response measures, coastal water quality could be affected. Based on the 30-day OSRA modeling estimates (**Table 3**), nearshore waters and embayments of Plaquemines Parish, Louisiana are the coastal areas with the most potential for water quality to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Mississippi, and Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. However, the 60-day OSRA model estimates potential shoreline contacts ranging from Matagorda County, Texas, to Levy County, Florida (**Table 4**).

C.2 Seafloor Habitats and Biota

According to BOEM (2016a), existing information for the deepwater Gulf of Mexico indicates that the seafloor is composed primarily of soft sediments; exposed hard substrate habitats and associated biological communities are rare. The water depth at the location of the proposed activities is approximately 3,561 ft (1,085 m). Based on the site clearance letter for wellsite where the installation activities will occur, no high-density deepwater benthic or chemosynthetic communities are located within 2,000 ft (610 m) of the proposed activity location (Geoscience Earth & Marine Services Inc., 2014).

C.2.1 Soft Bottom Benthic Communities

There are no site-specific benthic community data from the lease area. However, data from the Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology Study (Wei, 2006, Rowe and Kennicutt, 2009, Wei et al., 2010, Carvalho et al., 2013) can be used to describe typical baseline benthic communities that occur at similar water depths elsewhere in the region. **Table 5** summarizes data collected at nearby stations in water depths similar to the proposed activities area.

Table 5. Baseline benthic community data from stations near the lease area and in similar water depths sampled during the Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology Study. Adapted from: Wei (2006) and Rowe and Kennicutt (2009).

Station	Faunal Zone	Water Depth (m)	Abundance		
			Meiofauna (individuals m^{-2})	Macroinfauna (individuals m^{-2})	Megafauna (individuals ha^{-1})
S36	2E	1,839	799,963	4,481	359
HiPro	1	1,565	343,118	5,076	--

Meiofaunal and megafaunal abundances from Rowe and Kennicutt (2009); macroinfaunal abundance from Wei (2006). -- = Data not available.

Densities of meiofauna (animals passing through a 0.5-mm sieve but retained on a 0.062-mm sieve) at sampling stations in the vicinity of the lease area typically range from approximately 340,000 to 800,000 individuals m^{-2} (Rowe and Kennicutt, 2009). Nematodes, nauplii (crustacean larvae), and harpacticoid copepods were the three dominant meiofaunal groups, accounting for approximately 90% of total abundance.

The benthic macroinfauna is characterized by small mean individual sizes and low densities, both of which reflect the intrinsically low primary production in surface waters of the Gulf of Mexico continental slope (Wei, 2006). Based on an equation presented by Wei (2006) in which densities decrease exponentially with water depth, the macroinfaunal density at a water depth of 3,561 ft (1,085 m) is expected to be approximately 3,041 individuals m^{-2}; however, actual densities at the proposed project location are unknown (**Table 5**).

Polychaetes typically are the most abundant macroinfaunal group on the northern Gulf of Mexico continental slope, followed by amphipods, tanaids, bivalves, and isopods. Carvalho et al. (2013) found polychaete abundance to be higher in the central region compared to the eastern and western regions. Wei (2006) recognized four depth-dependent faunal zones (1 through 4), two of which are divided horizontally. The lease area is in Zone 1, which includes stations on the upper Texas-Louisiana Slope, the west flank of the upper Mississippi Fan, the head of Mississippi Canyon, and the upper West Florida Terrace. The most abundant species in this zone were the polychaetes *Litocorsa antennata*, *Prionospio cirrifera*, and *Aricidea suecica*; the amphipod *Ampelisca mississippina*; and the bivalve *Heterodonta* sp. A.

Megafaunal density from a nearby station was 359 individuals ha^{-1} (**Table 5**). Common megafauna included motile groups such as decapods, ophiuroids, holothurians, and demersal fishes, as well as sessile groups such as sponges and anemones.

Bacteria also are an important component in terms of biomass and cycling of organic carbon (Cruz-Kaegi, 1998). For example, in deep-sea sediments, Main et al. (2015) observed that microbial oxygen consumption rates increased and bacterial biomass decreased with hydrocarbon contamination. Bacterial biomass at the depth range of the lease area typically is 1 to 2 g C m^{-2} in the top 6 in. (15 cm) of sediments (Rowe and Kennicutt, 2009).

The only IPFs that may affect benthic communities from this project are the physical disturbance to the seafloor where the subsea wellhead will be installed, from seafloor effluent discharges, and potential effects from a large oil spill resulting from a well blowout at the seafloor. Effluent discharges at the surface and a small diesel fuel spill would not affect benthic communities because both would float and dissipate on the sea surface. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Physical Disturbance to the Seafloor

In water depths such as those encountered in the lease area, the areal extent of seafloor impacts will be small compared to the lease area itself. Subsea wellhead and pipeline installation will disturb only the seafloor in the immediate vicinity of the location of placement on the seafloor.

Soft bottom communities are ubiquitous along the northern Gulf of Mexico continental slope (Gallaway, 1988, Gallaway et al., 2003, Rowe and Kennicutt, 2009), and impacts from the physical disturbance of the seafloor during this project will be localized and likely will have no significant impact on soft bottom benthic communities in the region due to distance of the wellsites from these communities.

Impacts of a Large Oil Spill

The most likely effects on benthic communities of a subsea blowout of oil would be within a few hundred meters of the wellsite. BOEM (2012b) estimated that a severe subsurface blowout could resuspend and disperse sediments within a 984 ft (300 m) radius. While coarse sediments (sands) would probably settle at a rapid rate within 1,312 ft (400 m) of the blowout site, fine sediments (silts and clays) could be resuspended for more than 30 days and dispersed over a much wider area. Based on previous studies, surface sediments at the project area are assumed to largely be silt and clay (Rowe and Kennicutt, 2009).

While impacts on benthic communities from large oil spills are anticipated to be confined to the immediate vicinity of the wellhead, depending on the specific circumstances of the incident, additional benthic community impacts could extend beyond the immediate vicinity of the wellhead (BOEM, 2016b). During the Macondo spill, the use of subsea dispersants at the wellhead caused the formation of subsurface plumes (NOAA, 2011c). The subsurface plumes were reported in water depths of approximately 3,600 ft (1,100 m), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface oil plumes apparently resulted from the use of subsea dispersants at the wellhead (NOAA, 2011c, Spier et al., 2013). Montagna et al. (2013) mapped the benthic footprint of the Macondo spill and estimated that the most severe impacts to soft bottom benthic communities (e.g., reduction of faunal abundance and diversity) extended 4.8 miles (3 km) from the wellhead in all directions, covering an area of approximately 9.3 miles^2 (24 km^2). Moderate impacts were observed up to 10.6 miles (17 km) to the southwest and 5.3 miles (8.5 km) to the northeast of the wellhead, covering an area of 57 miles^2 (148 km^2). NOAA (2016b) documented a footprint of over 772 miles^2 (2,000 km^2) of impacts to benthic habitats surrounding the Macondo spill site. The analysis also identified a larger area of approximately 3,552 miles^2 (9,200 km^2) of potential exposure and uncertain impacts to benthic communities (NOAA, 2016b).

While the behavior and impacts of subsurface oil plumes are not well known, the Macondo findings indicate that benthic impacts could extend beyond the immediate vicinity of the wellsite, depending on the extent, trajectory, and persistence of the plume. Baguley et al. (2015) studied the meiofaunal benthic community response to the Macondo spill and noted that while nematode abundance increased with proximity to the Macondo wellhead, copepod abundance, relative species abundance, and diversity decreased. Baguley et al. (2015) hypothesized that the increase in nematode abundance with the proximity to the spill location could potentially represent a balance between organic enrichment and toxicity.

Oil contact could result in smothering or toxicity to benthic organisms. Any affected area would be recolonized by benthic organisms over a period of months to years (National Research Council, 1983).

C.2.2 High-Density Deepwater Benthic Communities

As defined by NTL 2009-G40, high-density deepwater benthic communities are features or areas that could support chemosynthetic communities, deepwater corals, and other associated hard bottom communities. Chemosynthetic communities were discovered in the central Gulf of Mexico in 1984 and have been studied extensively (MacDonald, 2002). Deepwater coral communities are also known from numerous locations in the Gulf of Mexico (Brooke and Schroeder, 2007, CSA International, 2007, Brooks et al., 2012). These communities occur almost exclusively on exposed authigenic carbonate rock created by a biogeochemical (microbial) process.

In water depths such as those encountered in the project area, the DP construction vessel will disturb the seafloor only in the immediate vicinity of the installation activities. Based on the site clearance letter (Geoscience Earth & Marine Services Inc., 2014), there is no evidence of the presence of high-density deepwater benthic or chemosynthetic communities within 2,000 ft (610 m) of the project area. The nearest known high-density deepwater benthic community site is located in Viosca Knoll Block 826, approximately 5 miles (8 km) northwest of the project area (MacDonald et al., 1995, U.S. Geological Survey, 2011, BOEM, nd).

The only IPF identified for this project that could affect high-density deepwater benthic communities is a large oil spill from a well blowout at the seafloor. A small diesel fuel spill would not affect benthic communities because the diesel fuel would float and dissipate on the sea surface. Physical disturbance and effluent discharge are not considered to be IPFs for deepwater benthic communities, because these communities are not known to be present within the area around the location of installation activities.

Impacts of a Large Oil Spill

A large oil spill caused by a seafloor blowout could cause direct physical alteration of the seafloor (e.g., formation of a caldera) within approximately 984 ft (300 m) of the wellhead (BOEM, 2012a). Based on the site clearance letters for the wellsite where the proposed activites will occur (Geoscience Earth & Marine Services Inc., 2014), there is no evidence of the presence of high-density deepwater benthic or chemosynthetic communities within 2,000 ft (610 m) of the installation location. Therefore, this type of impact is expected to be avoided.

Additional benthic community impacts could extend beyond the immediate vicinity of the blowout location, depending on the specific circumstances (BOEM, 2016b). During the Macondo spill, subsurface plumes were reported at a water depth of approximately 3,600 ft (1,100 m), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface plumes apparently resulted from the use of subsea dispersants at the wellhead (NOAA, 2011c). While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could have the potential to contact high-density deepwater benthic communities beyond the 984 ft (300 m) radius estimated by BOEM (2012a), depending on its extent, trajectory, and persistence (Spier et al., 2013). Oil plumes that contact sensitive benthic communities before degrading could potentially impact the resource (BOEM, 2017a). Potential impacts on sensitive resources would be an integral part of the decision and approval process for the use of dispersants, and such approval would be obtained from the USEPA prior to the use of dispersants.

Potential impacts of oil on high-density deepwater benthic communities are discussed in recent EISs (BOEM, 2012a, 2015, 2016b, 2017 a,b). Although chemosynthetic communities live among hydrocarbon seeps, natural seepage is very consistent and occurs at low rates compared to the potential rates of oil release from a blowout. In addition, seep organisms also require unrestricted access to oxygenated water at the same time as exposure to hydrocarbon energy sources (MacDonald, 2002). Oil droplets or oiled sediment particles could come into contact with chemosynthetic organisms or deepwater corals. As discussed by BOEM (2012a, 2017 a,b), impacts could include loss of habitat, biodiversity, and live coral coverage; destruction of hard substrate; change in sediment characteristics; and reduction or loss of one or more commercial and recreational fishery habitats. Sublethal effects could be long-lasting and affect the resilience of coral colonies to natural disturbances (e.g., elevated water temperature and diseases) (BOEM, 2012a, 2015, 2016b, 2017 a,b). Based on information learned from the Macondo spill, a few patches of habitats may be affected by a large oil spill, but the Gulf-wide ecosystem of live bottom communities would not be expected to suffer significant effects (BOEM, 2016b).

The potential for a large spill to affect deepwater corals can also be inferred based on the impacts of the Macondo spill during an October 2010 survey of deepwater coral habitats near the Macondo spill site (BOEMRE, 2010). Government and academic researchers were working at a site 4,600 ft (1,400 m) deep and approximately 7 miles (11 km) southwest of the Macondo wellhead when they observed dead and dying corals with sloughing tissue and discoloration. Much of the soft coral observed in an area measuring approximately 50 ft × 130 ft (15 m × 40 m) was covered by what appeared to be a brown flocculent substance. Of 40 large corals, 90% were heavily affected, showing dead or dying parts and discoloration. Another site 1,312 ft (400 m) farther away had a colony of stony corals similarly affected and partially covered with a similar brown substance. Based on hopanoid petroleum biomarkers from the brown flocculent substance, researchers concluded that the colony contained oil from the Macondo spill. The injured and dead corals were in an area where a subsea plume of oil had been documented during the spill in June 2010. Corals elsewhere in the Gulf of Mexico outside the area affected by the plume did not appear to be experiencing higher mortality. The research team concluded that the observed coral injuries likely resulted from exposure to the subsurface oil plume (White et al., 2012). Apparent recovery of some affected areas by March 2012 correlated negatively with the proportion of the coral covered with flocculent in late 2010 (Hsing et al., 2013). Fisher et al. (2014b) reported two additional coral areas affected by the Macondo spill, one 4 miles (6 km) south of the Macondo wellsite and the other 14 miles (22 km) to the southeast; the authors also hypothesized that other hard bottom sites probably were exposed to deepwater plumes, sinking oil residues from surface burning, or oil and dispersant contained in marine snow. In addition to direct impacts on corals and other sessile epifauna, the spill also affected macroinfauna associated with these hard bottom communities (Fisher et al., 2014a).

C.2.3 Designated Topographic Features

The lease area is not within or near a designated topographic feature or a no-activity zone as identified in NTL 2009-G39. The nearest designated Topographic Feature Stipulation Block is located approximately 96 miles (154 km) west-southwest of the lease area. There are no IPFs associated with routine operations that could cause impacts to designated topographic features.

Due to the distance from the lease area, it is unlikely that designated topographic features would be affected by accidental spills. A small diesel fuel spill would float and dissipate on the surface and would not reach these seafloor features. In the event of an oil spill from a well blowout, a surface slick would not contact these seafloor features. If a subsurface plume were to occur, impacts on these features would be unlikely due to the distance and the difference in water depth. Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and typically would not be expected to carry a plume up onto the continental shelf edge. This assumption is consistent with the deposition patterns inferred by Valentine et al. (2014) for the subsurface plume from the Macondo spill. Felder et al. (2014) hypothesized that the Macondo spill may have affected two topographic features located 96 miles (155 km) and 168 miles (270 km) west of the Macondo site (Sackett Bank and Ewing Bank, respectively), but there was no definitive evidence of Macondo oil from either bank. Although a large oil spill could theoretically result in oil contacting topographic features, it is expected that most of the oil would rise to the surface and that the most heavily oiled sediments would likely be deposited before reaching these features (BOEM, 2012a). In the unlikely event that oil does contact topographic features, any contact with spilled oil would likely cause sublethal effects to benthic organisms because the distance between the spill source and topographic features would prevent concentrated oil from contacting any designated feature.

C.2.4 Pinnacle Trend Area Live Bottoms

The lease area is not covered by the Live Bottom (Pinnacle Trend) Stipulation. As defined by NTL 2009-G39, the nearest Pinnacle Stipulation Block is located approximately 12 miles (19 km) north of the lease area. There are no IPFs associated with routine operations that could cause impacts to pinnacle trend area live bottoms due to the distance from the lease area.

Due to their distance from the lease area, it is unlikely that pinnacle trend live bottom areas would be affected by an accidental spill. A small diesel fuel spill would float on the surface and would not reach these seafloor features. In the event of an oil spill from a well blowout, a surface slick would be unlikely to contact these seafloor features. If a subsurface plume were to occur, impacts on these features would be unlikely due to the difference in water depth. Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and would not be expected to carry a plume up onto the continental shelf edge. This assumption is consistent with the deposition patterns inferred by Valentine et al. (2014) for the subsurface plume from the Macondo spill. Although there are mechanisms that could result in oil contacting these features, it is expected that most of the oil would rise to the surface and thereby reducing potential impacts to these features.

C.2.5 Eastern Gulf Live Bottoms

The lease area is not covered by the Live Bottom (Low-Relief) Stipulation, which pertains to seagrass communities and low-relief hard bottom reefs within the Eastern Gulf of Mexico Planning Area blocks in water depths of 328 ft (100 m) or less and portions of Pensacola and Destin Dome Area blocks in the Central Gulf of Mexico Planning Area. The nearest block covered by the Live Bottom Stipulation, as defined by NTL 2009-G39, is located approximately 20 miles (32 km) north-northeast of the lease area. There are no IPFs associated with routine operations that could cause impacts to eastern Gulf live bottom areas due to the distance from the lease area.

Because of their distance from the lease area, it is unlikely that Eastern Gulf live bottom areas would be affected by an accidental spill. A small diesel fuel spill would float and dissipate on the surface and would not reach these seafloor features. In the event of an oil spill from a well blowout, a surface slick would not likely contact these seafloor features. If a subsurface plume were to occur, impacts on these features would be unlikely due the difference in water depth. Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and typically would not be expected to carry a plume up onto the continental shelf. This assumption is consistent with the deposition patterns inferred by Valentine et al. (2014) for the subsurface plume from the Macondo spill. Although there are mechanisms that could result in oil contacting these features, it is expected that most of the oil would rise to the surface thereby reducing potential impacts to benthic communities.

C.3 Threatened, Endangered, and Protected Species and Critical Habitat

This section discusses species listed as endangered or threatened under the Endangered Species Act (ESA). In addition, it includes all marine mammal species in the region, which are protected under the Marine Mammal Protection Act (MMPA).

Endangered or threatened species that may occur in the project area and along the northern Gulf Coast are listed in **Table 6**. The table also indicates the location of critical habitat (if designated in the Gulf of Mexico). Critical habitat is defined as (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation. The National Marine Fisheries Service (NMFS) has jurisdiction for ESA-listed marine mamamls (cetaceans), sea turtles in the marine environment, and fishes in the Gulf of Mexico. The USFWS has jurisdiction for ESA-listed birds, the West Indian manatee, and sea turtles on their nesting beaches.

Table 6. Federally listed endangered and threatened species that could potentially occur in the lease area and along the northern Gulf Coast.

Species	Scientific Name	Status	Potential Presence		Critical Habitat Designated in Gulf of Mexico
			Lease Area	Coastal	
Marine Mammals					
Sperm whale	*Physeter macrocephalus*	E	X	--	None
Bryde's whale	*Balaenoptera edeni*[a]	P	X	--	None
West Indian manatee	*Trichechus manatus*[b]	T	--	X	Florida (Peninsular)
Sea Turtles					
Loggerhead turtle	*Caretta caretta*	T,E[c]	X	X	Nesting beaches and nearshore reproductive habitat in Mississippi, Alabama, and Florida (Panhandle); *Sargassum* habitat including most of the central and western Gulf of Mexico
Green turtle	*Chelonia mydas*	T	X	X	None
Leatherback turtle	*Dermochelys coriacea*	E	X	X	None
Hawksbill turtle	*Eretmochelys imbricata*	E	X	X	None
Kemp's ridley turtle	*Lepidochelys kempii*	E	X	X	None
Birds					
Piping Plover	*Charadrius melodus*	T	--	X	Coastal Texas, Louisiana, Mississippi, Alabama, and Florida (Panhandle)
Whooping Crane	*Grus americana*	E	--	X	Coastal Texas (Aransas National Wildlife Refuge)
Fishes					
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	--	X	Coastal Louisiana, Mississippi, Alabama, and Florida (Panhandle)
Invertebrates					
Elkhorn coral	*Acropora palmata*	T	--	X	The Florida Keys and the Dry Tortugas
Lobed star coral	*Orbicella annularis*	T	--	X	None
Mountainous star coral	*Orbicella faveolata*	T	--	X	None
Boulder star coral	*Orbicella franksi*	T	--	X	None
Terrestrial Mammals					
Beach mice (subspecies: Alabama, Choctawhatchee, Perdido Key, St. Andrew)	*Peromyscus polionotus*	E	--	X	Alabama and Florida (Panhandle) beaches

E = endangered; P = proposed; T = threatened; X = potentially present; -- = not present.

[a] Gulf of Mexico Bryde's whales are protected by the Marine Mammal Protection Act. There is currently a proposed rule to list this stock as 'endangered' under the Endangered Species Act.

[b] There are two subspecies of West Indian manatee: the Florida manatee (*T. m. latirostris*), which ranges from the northern Gulf of Mexico to Virginia, and the Antillean manatee (*T. m. manatus*), which ranges from northern Mexico to eastern Brazil. Only the Florida manatee subspecies is likely to be found in the northern Gulf of Mexico.

[c] The loggerhead turtle is composed of nine distinct population segments (DPSs). The only DPS that may occur in the project area (Northwest Atlantic DPS) is listed as threatened (76 *FR* 58868; 22 September 2011).

In 2007, NMFS and the USFWS issued a Biological Opinion in response to ESA consultations with MMS for previous EISs (NMFS, 2007). Following the Macondo spill, on 30 July 2010, BOEM reinitiated ESA consultation with NMFS and the USFWS. Currently, BOEM, NMFS, and USFWS are in the process of collecting and awaiting additional information, which is being gathered as part of the Natural Resource Damage Assessment process in order to update the environmental baseline information as needed for this reinitiated Section 7 consultation. Consultation is ongoing at this time, and BOEM is acting as lead agency in the reinitiated consultation with BSEE involvement (BOEM, 2016b). BOEM and BSEE have developed an interim coordination and review process with NMFS and the USFWS for specific activities leading up to or resulting from upcoming lease sales. The purpose of this coordination is to ensure that NMFS and the USFWS have the opportunity to review post-lease exploration, development, and production activities prior to BOEM's approval to ensure that all approved plans and permits contain any necessary measures to avoid jeopardizing the existence of any ESA-listed species or precluding the implementation of any reasonable and prudent alternative measures. This interim coordination program remains in place while formal consultation and the development of a Biological Opinion are ongoing (BOEM, 2016b).

Coastal endangered or threatened species that may occur along the northern Gulf Coast include the West Indian manatee, Piping Plover, Whooping Crane, Gulf sturgeon, and four subspecies of beach mouse. Critical habitat has been designated for all of these species as indicated in **Table 6**, and is discussed for each species in individual sections. The Bald Eagle and Brown Pelican, which are no longer federally listed as endangered or threatened, are discussed in **Section C.4.2**.

The sperm whale and five species of sea turtles are the only endangered or threatened species likely to occur in or near the lease area. The listed sea turtles include the leatherback turtle, Kemp's ridley turtle, hawksbill turtle, loggerhead turtle, and green turtle (Pritchard, 1997). Effective 11 August 2014, NMFS has designated certain marine areas as critical habitat for the northwest Atlantic distinct population segment (DPS) of the loggerhead sea turtle (**Section C.3.4**). No critical habitat has been designated in the Gulf of Mexico for the leatherback turtle, Kemp's ridley turtle, hawksbill turtle, green turtle, or the sperm whale. Five endangered mysticetes (blue whale, fin whale, humpback whale, North Atlantic right whale, and sei whale) have been reported in the Gulf of Mexico, but are considered rare or extralimital (Würsig et al., 2000). These species are not included in the most recent NMFS stock assessment reports (Waring et al., 2016, Hayes et al., 2017) nor in the most recent BOEM multisale EIS (BOEM, 2017a); therefore, they are not considered further in the EIA.

Four threatened coral species are known from the northern Gulf of Mexico: elkhorn coral, lobed star coral, mountainous star coral, and boulder star coral. None of these species are expected to be present in the lease area (**Section C.3.9**).

There are no other endangered animals or plants in the Gulf of Mexico that are reasonably likely to be affected by either routine or accidental events. Other species occurring at certain locations in the Gulf of Mexico such as the smalltooth sawfish (*Pristis pectinata*) and Florida salt marsh vole (*Microtus pennsylvanicus dukecampbelli*) are remote from the lease area and highly unlikely to be affected.

C.3.1 Sperm Whale (Endangered)

The only endangered marine mammal likely to be present in or near the project area is the sperm whale (*Physeter macrocephalus*). Resident populations of sperm whales occur within the

Gulf of Mexico. A species description is presented in the recovery plan for this species (NMFS, 2010a). Gulf of Mexico sperm whales are classified as an endangered species and a "strategic stock" by NMFS (Waring et al., 2016). A "strategic stock" is defined by the MMPA as a marine mammal stock that meets the following criteria:

- The level of direct human-caused mortality exceeds the potential biological removal level;
- based on the best available scientific information, is in decline and is likely to be listed as a threatened species under the ESA within the foreseeable future; or
- is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA.

Current threats to sperm whale populations worldwide are discussed in a final recovery plan for the sperm whale (NMFS, 2010a). Threats are defined as "any factor that could represent an impediment to recovery," and include fisheries interactions, anthropogenic noise, vessel interactions, contaminants and pollutants, disease, injury from marine debris, research, predation and natural mortality, direct harvest, competition for resources, loss of prey base due to climate change and ecosystem change, and cable laying. In the Gulf of Mexico, impacts from many of these threats are identified as either low or unknown (BOEM, 2012a).

In 2013, NMFS conducted a status review to consider designating the Gulf of Mexico population of the sperm whale as a DPS under the ESA. The designation would list the Gulf of Mexico population as a separate endangered or threatened population that is "significant to the species and faces additional unique threats to its survival." On 13 November 2013, NMFS concluded that the designation of a Gulf of Mexico DPS for sperm whales was not warranted (78 *FR* 68032).

The distribution of sperm whales in the Gulf of Mexico is correlated with mesoscale physical features such as eddies associated with the Loop Current (Jochens et al., 2008). Sperm whale populations in the north-central Gulf of Mexico are present throughout the year (Davis et al., 2000a). Results of a multi-year tracking study show female sperm whales are typically concentrated along the upper continental slope between the 656- and 3,280-ft (200- and 1,000m) depth contours (Jochens et al., 2008). Male sperm whales were more variable in their movements and were documented in water depths greater than 9,843 ft (3,000 m). Generally, groups of sperm whales sighted in the Gulf of Mexico during the MMS-funded Sperm Whale Seismic Study consisted of mixed-sex groups comprising adult females with juveniles, and groups of bachelor males. Typical group size for mixed groups was 10 individuals (Jochens et al., 2008). A review of sighting reports from seismic mitigation surveys in the Gulf of Mexico conducted over a 6-year period found a mean group size for sperm whales of 2.5 individuals (Barkaszi et al., 2012). In these mitigation surveys, sperm whales were the most common cetacean encountered. The Sperm Whale Seismic Study results also showed that sperm whales transit through the vicinity of the lease area. Movements of satellite-tracked individuals suggest that this area of the continental slope is within the home range of the Gulf of Mexico population (within the 95% utilization distribution) (Jochens et al., 2008).

IPFs potentially affecting sperm whales include construction vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small diesel fuel spill and a large oil spill). Effluent discharges are likely to have negligible impacts on sperm whales due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of these marine mammals. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the potential for marine debris-related impacts on sperm whales. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Construction Vessel Presence, Noise, and Lights

Noise from routine installation activities has the potential to disturb sperm whales or mask the sounds whales would normally produce or hear. However, noise associated with subsea installation activities is relatively weak in intensity, and an individual animal's noise exposure would be transient. As discussed in **Section A.1**, sounds generated by an offshore vessel maximum broadband (10 Hz to 10 kHz) energy of about 190 dB re 1 µPa m (Hildebrand, 2005).

Southall et al. (2007) lists sperm whales in the same hearing group (i.e., mid-frequency cetaceans) as dolphins, toothed whales, beaked whales, and bottlenose whales (estimated hearing range from 150 Hz to 160 kHz). Therefore, vessel-related noise is likely to be heard by sperm whales. Generally, most of the acoustic energy produced by sperm whales is present at frequencies below 10 kHz, although diffuse energy up to and past 20 kHz is common, with source levels up to 236 dB re 1 µPa m (Møhl et al., 2003). Other studies indicate sperm whales' wideband clicks contain energy between 0.1 and 20 kHz (Weilgart and Whitehead, 1993, Goold and Jones, 1995). Most observations of behavioral responses of marine mammals to anthropogenic sounds, in general, have been limited to short-term behavioral responses, which included the cessation of feeding, resting, or social interactions (NMFS, 2009a).

Animals can determine the direction from which a sound arrives based on cues, such as differences in arrival times, sound levels, and phases at the two ears. Thus, an animal's directional hearing capabilities have a bearing on its vulnerability to masking (National Research Council, 2003b). Behavioral changes for marine mammals such as the sperm whale to auditory masking sounds may include producing more calls, longer calls, or shifting the frequency of the calls (Holt et al., 2009, NMFS, 2009a).

It is expected that, due to the relatively stationary nature of the proposed activities, sperm whales would move away from the proposed operations area, and noise levels that could cause auditory injury would be avoided. However, observations of sperm whales near offshore oil and gas operations suggest an inconsistent response to anthropogenic marine sound (Jochens et al., 2008). Measurements of non-impulsive sources with DP thrusters in use during installation, anchor handling, and construction operations have shown that received levels of 160 dB re 1 µPa are not exceeded beyond 20 m from the operation (NOAA, 2016b).

There are other OCS facilities and activities near the lease area, and the region as a whole has a large number of similar noise sources. Noise associated with this project will contribute to an increase in the ambient noise environment of the Gulf of Mexico, but it is not expected in amplitudes sufficient to cause auditory injuries to sperm whales. The proposed activity may cause disturbance effects; primarily avoidance or temporary displacement from the project area. Vessel lighting and presence are not identified as IPFs for sperm whales (NMFS, 2007, BOEM, 2012a, 2016b, 2017a).

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb sperm whales, and there is a risk of vessel strikes, which are identified as a threat in the recovery plan for this species (NMFS, 2010a). To reduce the potential for vessel strikes, BOEM issued BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. When whales are sighted, vessel operators and crews are required to attempt to maintain a distance of 300 ft (91 m) or greater whenever possible. Vessel operators are required to reduce vessel speed to 10 knots or less, when safety permits, when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel. Compliance with this NTL will minimize the likelihood of vessel strikes as well as reduce the chance of disturbing sperm whales.

NMFS (2007) analyzed the potential for vessel strikes and harassment of sperm whales. With implementation of the mitigation measures in NTL BOEM-2016-G01, NMFS concluded that the likelihood of collisions between vessels and sperm whales would be reduced to insignificant levels. NMFS concluded that the observed avoidance of passing vessels by sperm whales is an advantageous response to avoid a potential threat and is not expected to result in any significant effect on migration, breathing, nursing, breeding, feeding, or sheltering to individuals, or have any consequences at the population level. With implementation of the vessel strike avoidance measures requirement to maintain a distance of 300 ft (91 m) from sperm whales, NMFS concluded that the potential for harassment of sperm whales would be reduced to discountable levels.

Dependent on flight altitude, helicopter traffic also has the potential to disturb sperm whales. Smultea et al. (2008) documented responses of sperm whales offshore Hawaii to a fixed-wing aircraft flying at an altitude of 800 ft (245 m). A reaction to the initial pass of the aircraft was observed during 3 of 24 sightings (12%). All three reactions consisted of a hasty dive and occurred at less than 1,180 ft (360 m) lateral distance from the aircraft. Additional reactions were seen when the aircraft circled certain whales to make further observations. Based on other studies of cetacean responses to sound, the authors concluded that the observed reactions to brief overflights by the aircraft were short-term and limited to behavioral disturbances.

Helicopters used in support operations maintain a minimum altitude of 700 ft (213 m) while in transit offshore, 1,000 ft (305 m) over unpopulated areas or across coastlines, and 2,000 ft (610 m) over populated areas and sensitive habitats such as wildlife refuges and park properties. In addition, guidelines and regulations issued by NMFS under the authority of the MMPA specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals. In the event that a whale is seen during transit, the helicopter will not approach or circle the animal. Although responses are possible, Smultea et al. (2008) and NMFS (2007) concluded that this altitude would minimize the potential for disturbing sperm whales. Therefore, no significant impacts are expected.

Impacts of a Small Diesel Fuel Spill

Potential spill impacts on marine mammals, including sperm whales, are discussed by NMFS (2007) and BOEM (2017 a,b). Oil impacts on marine mammals are discussed by (Geraci and St. Aubin, 1990) and by the Marine Mammal Commission (MMC) (2011). For proposed activities in this DOCD, there are no unique site-specific issues with respect to spill impacts on sperm whales that were not analyzed in the previous documents.

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Anadarko's OSRP could mitigate and lessen the potential for impacts on sperm whales. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small diesel fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small diesel fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. Results of an ADIOS2 model run (**Section A.9.1**) indicate that the area of the sea surface with diesel fuel on it would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions.

Direct physical and physiological effects to sperm whale due to exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (MMC, 2011). However, due to the limited areal extent and short duration of water quality impacts from a small diesel fuel spill, as well as the mobility of sperm whales, no significant impacts are expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine mammals, including sperm whales, are discussed by NMFS (2007) and BOEM (2017 a,b). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990) and by the MMC (2011). For this DOCD, there are no unique site-specific issues with respect to spill impacts on sperm whales.

Impacts of oil spills on sperm whales can include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants) (MMC, 2011). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil (and dispersants) directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft. The level of impact of oil exposure depends on the amount, frequency, and duration of exposure; route of exposure; and type or condition of petroleum compounds or chemical dispersants (Hayes et al., 2017). Complications from the previously listed exposures may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat, disruption of social structure, changing prey availability and foraging distribution or patterns, changing reproductive behavior/productivity, and changing movement patterns or migration (MMC, 2011). Ackleh et al. (2012) hypothesized that sperm whales may have temporarily relocated away from areas near the Macondo spill in 2010.

In the event of a large spill, the increased level of vessel and aircraft activity associated with spill response operations could disturb sperm whales and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL BOEM-2016-G01 (**Table 1**) to reduce the potential for striking or disturbing these animals.

C.3.2 West Indian Manatee (Threatened)

Most of the Gulf of Mexico West Indian manatee (*Trichechus manatus*) population is located in peninsular Florida (USFWS, 2001). Critical habitat has been designated in southwest Florida in Manatee, Sarasota, Charlotte, Lee, Collier, and Monroe Counties. Manatee sightings in Louisiana have increased as the species extends its presence farther west of Florida in the warmer months (Wilson, 2003). A species description is presented in the recovery plan for this species (U.S. Fish and Wildlife Service, 2001).

IPFs that could affect manatees include support vessel and helicopter traffic and a large oil spill. A small diesel fuel spill in the lease area would be unlikely to affect manatees due to the distance from the nearest shoreline. As explained in **Section A.9.1**, a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the potential for marine debris-related impacts on manatees. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb manatees, and there is a risk of vessel strikes, which are identified as a threat in the recovery plan for this species (USFWS, 2001). Manatees are expected to be limited to inner shelf and coastal waters, and impacts are expected to be limited to transits of vessels and helicopters through these waters. To reduce the potential for vessel strikes, BOEM issued NTL BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. Compliance with this NTL will minimize the likelihood of vessel strikes, and no significant impacts on manatees are expected.

Dependent on flight altitude, helicopter traffic also has the potential to disturb manatees. Rathbun (1988) reported that manatees were disturbed more by helicopters than by fixed-wing aircraft; however, the helicopter was flown at relatively low altitudes of 66 to 525 ft (20 to 160 m). Helicopters used in support operations maintain a minimum altitude of 700 ft (213 m) while in transit offshore, 1,000 ft (305 m) over unpopulated areas or across coastlines, and 2,000 ft (610 m) over populated areas and sensitive habitats such as wildlife refuges and park properties. In addition, guidelines and regulations issued by NMFS under the authority of the MMPA specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals. This mitigation measure will minimize the potential for disturbing manatees, and no significant impacts are expected.

Impacts of a Large Oil Spill

The OSRA results summarized in **Table 3** predict that Plaquemines Parish in Louisiana is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Mississippi, and Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. There is no manatee critical habitat designated in these areas, and the number of manatees potentially present is a small fraction of the population residing in peninsular Florida. The 60-day OSRA modeling (**Table 4**) predicts that shorelines between Matagorda County, Texas, and Levy County, Florida, may be contacted within 60 days of a spill. This range does not include any areas of manatee critical habitat.

In the event that manatees are exposed to oil, effects could include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants) (MMC, 2011). Direct physical and physiological effects can include asphyxiation, acute poisoning, lowering of tolerance to other stress, nutritional stress, and inflammation of infection (BOEM, 2017a). Indirect impacts include stress from the activities and noise of response vessels and aircraft. Complications from oil exposure may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat, disruption of social structure, change in prey availability and foraging distribution or patterns, change in reproductive behavior/productivity, and change in movement patterns or migration (MMC, 2011).

In the event that a large spill reaches coastal waters where manatees are present, the increased level of vessel and aircraft activity associated with spill response could disturb manatees and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL BOEM-2016-G01 (**Table 1**) to reduce the potential for striking or disturbing these animals, and therefore no significant impacts are expected.

C.3.3 Non-Endangered Marine Mammals (Protected)

Excluding the two endangered marine mammal species that were discussed in **Sections C.3.1** and **C.3.2**, there are 21 additional species of marine mammals that may be found in the Gulf of Mexico including one species of mysticete whale, the dwarf and pygmy sperm whales, four species of beaked whales, and 14 species of delphinid whales and dolphins. All marine mammals are protected species under the MMPA. The most common non-endangered cetaceans in the deepwater environment are odontocetes such as the pantropical spotted dolphin, spinner dolphin, and rough-toothed dolphin. A brief summary is presented in the following subsections; additional information on these groups is presented by BOEM (2017a).

Bryde's Whale. The Bryde's whale (*Balaenoptera edeni*) is the only year-round resident baleen whale in the northern Gulf of Mexico. In 2014, a petition was submitted to designate the northern Gulf of Mexico population as a DPS and list it as endangered under the ESA (Natural Resources Defense Council, 2014). This petition received a 90-day positive finding by NMFS in 2015 and is currently under consideration for listing. The Bryde's whale is most frequently sighted along the 328-ft (100-m) isobath (Davis and Fargion, 1996, Davis et al., 2000a). Most sightings have been made in the DeSoto Canyon region and off western Florida, although there have been some in the west-central portion of the northeastern Gulf. Based on the available data, it is possible that Bryde's whales could occur in the lease area.

Dwarf and Pygmy Sperm Whales. At sea, it is difficult to differentiate dwarf sperm whales (*Kogia sima*) from pygmy sperm whales (*Kogia breviceps*), and sightings are often grouped together as *Kogia* spp. Both species have a worldwide distribution in temperate to tropical waters. In the Gulf of Mexico, both species occur primarily along the continental shelf edge and in deeper waters off the continental shelf (Mullin et al., 1991, Mullin, 2007, Waring et al., 2016). Either species could occur in the lease area.

Beaked Whales. Four species of beaked whales are known to occur in the Gulf of Mexico: Blainville's beaked whale (*Mesoplodon densirostris*), Sowerby's beaked whale (*Mesoplodon bidens*), Gervais' beaked whale (*Mesoplodon europaeus*), and Cuvier's beaked whale (*Ziphius cavirostris*). Stranding records (Würsig et al., 2000) as well as passive acoustic monitoring in the Gulf of Mexico (Hildebrand et al., 2015) suggest that Gervais' beaked whale and Cuvier's beaked whale are the most common. Sowerby's beaked whale is considered extralimital, with only one documented stranding in the Gulf of Mexico (Bonde and O'Shea, 1989). Blainville's beaked whales are rare, with only four documented strandings in the northern Gulf of Mexico (Würsig et al., 2000).

Due to the difficulties of at-sea identification, beaked whales in the Gulf of Mexico are identified either as Cuvier's beaked whales or are grouped into an undifferentiated species complex (*Mesoplodon* spp.). In the northern Gulf of Mexico, they are broadly distributed in water depths greater than 3,281 ft (1,000 m) over lower slope and abyssal landscapes (Davis et al., 2000a). Any of these species could occur in the lease area (Waring et al., 2016).

Delphinids. Fourteen species of delphinids are known to occur in the Gulf of Mexico: Atlantic spotted dolphin (*Stenella frontalis*), Clymene dolphin (*Stenella clymene*), pantropical spotted dolphin (*Stenella attenuata*), spinner dolphin (*Stenella longirostris*), striped dolphin (*Stenella coeruleoalba*), bottlenose dolphin (*Tursiops truncatus*), false killer whale (*Pseudorca crassidens*), killer whale (*Orcinus orca*), pygmy killer whale (*Feresa attenuata*), melon-headed whale (*Peponocephala electra*), short-finned pilot whale (*Globicephala macrorhynchus*), Risso's dolphin (*Grampus griseus*), Fraser's dolphin (*Lagenodelphis hosei*), and rough-toothed dolphin (*Steno bredanensis*). Any of these species could occur in the lease area (Waring et al., 2016). The most common non-endangered cetaceans in the deepwater environment of the northern Gulf of Mexico are the pantropical spotted dolphin, spinner dolphin, and rough toothed dolphin (Waring et al., 2016).

The bottlenose dolphin (*Tursiops truncatus*) is a common inhabitant of the northern Gulf of Mexico, particularly within continental shelf waters. There are two ecotypes of bottlenose dolphins, a coastal form and an offshore form, which are genetically isolated from each other (Waring et al., 2016). The offshore form of the bottlenose dolphin may occur within the lease area. Inshore populations of coastal bottlenose dolphins in the northern Gulf of Mexico are separated into 31 geographically distinct population units, or stocks, for management purposes by NMFS (Hayes et al., 2017).

IPFs that could affect non-endangered marine mammals include construction vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small diesel fuel spill and a large oil spill). Effluent discharges are likely to have negligible impacts due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of these marine mammals. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the potential for marine debris-related impacts. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Construction Vessel Presence, Noise, and Lights

The presence of the DP construction vessel presents an attraction to pelagic food sources that may attract cetaceans. Some odontocetes have shown increased feeding activity around lighted platforms at night (Todd et al., 2009). Therefore, prey congregation could pose an attraction to protected species that exposes them to higher levels or longer durations of noise that might otherwise be avoided. Installation and support vessel presence and lighting are not considered as IPFs for marine mammals (BOEM, 2017b)

Noise from installation operations has the potential to disturb marine mammals. As discussed in **Section A.1**, noise impacts would be expected at greater distances when DP thrusters are in use than with vessel noise alone and are dependent on variables relating to sea state conditions, thruster type and usage. Three functional hearing groups are represented in the 21 non-endangered cetceans found in the Gulf of Mexico (NMFS, 2016). Eighteen of the 20 odonotocete species are considered to be in the mid-frequency functional hearing group, two species (*Kogia*) are in the high frequency functional hearing group, and one species (Bryde's whale) is in the low frequency functional hearing group (NMFS, 2016). Thruster noise will affect each group differently depending on the frequency bandwiths produced by operations.

For mid-frequency cetaceans exposed to a non-impulsive source (such as installation operations), permanent threshold shifts are estimated to occur when the mammal has received a cumulative exposure level of 198 dB re 1 $\mu Pa^2 \cdot s$ over a 24-hour period. Similarly, temporary threshold shifts are estimated to occur when a mammal has received a cummulative noise exposure level of 178 dB re 1 $\mu Pa^2 \cdot s$ over a 24-hour period. For low frequency cetaceans, specifically the Brydes whale, permanent and temporary threshold shift onset is estimated to occur at 199 dB re 1 $\mu Pa^2 \cdot s$ and 179 dB re 1 $\mu Pa^2 \cdot s$, repectively. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters in use during offshore operations are not expected to produce received levels greater than 160 dB re 1 µPa beyond 25 m from the source. Due to the short propagation distance of high sound pressure levels, the transient nature of marine mammals, and the stationary nature of the proposed activites, it is not expected that any marine mammals will receive exposure levels necessary for the onset of auditory threshold shifts.

Behaviorial criteria are currently being updated; therefore, the NOAA (2005) criteria are used in the interim to determine behavioral disturbance thresholds for marine mammals and are applied equally across all functional hearing groups. Received sound pressure levels of 120 dB re 1 µPa from a non-impulsive source are considered high enough to illicit a behaviorial reaction in some marine mammal species (NOAA, 2005). The 120 dB isolpleth may extend tens to hundreds of kilometers from the source depending on the propagation environment. There are other OCS facilities and activities near the lease area, and the region as a whole has a large number of similar sources. Marine mammal species in the northern Gulf of Mexico have been exposed to noise from anthropogenic sources for a long period of time and over large geographic areas and likely do not represent a naïve population with regard to sound (National Research Council, 2003b). Due to the limited scope, timing, and geographic extent of proposed activities, this project would represent a small, temporary contribution to the overall noise regime, and any short-term behaviorial impacts are not expected to be biologically significant to marine mammal populations.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb marine mammals, and there is a risk of vessel strikes. Data concerning the frequency of vessel strikes are presented by BSEE (2016). To reduce the potential for vessel strikes, BOEM issued NTL BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. Vessel operators and crews are required to attempt to maintain a distance of 300 ft (91 m) or greater when whales are sighted and 150 ft (45 m) when small (non-whale) cetaceans are sighted. When cetaceans are sighted while a vessel is underway, vessels must attempt to remain parallel to the animal's course and avoid excessive speed or abrupt changes in direction until the cetacean has left the area. Vessel operators are required to reduce vessel speed to 10 knots or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel, when safety permits. These mitigation measures are only effective during daylight hours, or in sea and weather conditions where cetaceans are sighted. Compliance with NTL BOEM-2016-G01 (**Table 1**) will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing marine mammals during these periods. If collisions occur during periods of poor visibility or at night, it is likely that it may result in the death of the cetacean. Impacts to non-listed cetaceans are not significant at the population (stock) level.

Aircraft traffic also has the potential to disturb marine mammals (Würsig et al., 1998). However, while flying offshore, helicopters maintain altitudes above 700 ft (213 m) during transit to and from the working area. In addition, guidelines and regulations issued by NMFS under the authority of the MMPA specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals. Maintaining this altitude will minimize the potential for disturbing marine mammals, and no significant impacts are expected (BOEM, 2017a).

Impacts of a Small Diesel Fuel Spill

Potential spill impacts on marine mammals are discussed by BOEM (2017 a,b). Oil impacts on marine mammals, in general, are discussed by Geraci and St. Aubin (1990). For this DOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Anadarko's OSRP is expected to lessen the potential for impacts on marine mammals. **DOCD Section I** provides detail on spill response measures. Given the open ocean location of the lease area, the limited duration of a small spill and response efforts, it is expected that any impacts on marine mammals would be brief and minimal.

A small diesel fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. Direct physical and physiological effects of exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (MMC, 2011). The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. As **Section A.9.1** discusses, a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up. Therefore, due to the limited areal extent and short duration of water quality impacts from a small diesel fuel spill as well as the mobility of marine mammals, no significant impacts are expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine mammals are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues.

Impacts of oil spills on marine mammals can include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants) (MMC, 2011, Takeshita et al., 2017). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil (and dispersants) directly or via contaminated prey. Complications of the above may lead to dysfunction of immune (DeGuise et al., 2017) and reproductive systems (Kellar et al., 2017), physiological stress, declining physical condition, and death (MMC, 2011). Indirect impacts can include stress from the activities and noise of response vessels and aircraft. Behavioral responses can include displacement of animals from prime habitat (McDonald et al., 2017), disruption of social structure, change in prey availability and foraging distribution or patterns, change in reproductive behavior/productivity, and change in movement patterns or migration (MMC, 2011).

Data from the Macondo spill, as analyzed and summarized by NOAA (2016b) indicate the scope of potential impacts from a large spill. Tens of thousands of marine mammals were exposed to oil, where they likely inhaled, aspirated, ingested, physically contacted, and absorbed oil components (NOAA, 2016b). Nearly all of the marine mammal stocks in the northern Gulf of Mexico were affected. The oil's physical, chemical, and toxic effects damaged tissues and organs, leading to a constellation of adverse health effects, including reproductive failure, adrenal disease, lung disease, and poor body condition (NOAA, 2016b). According to the National Wildlife Federation (2016a), nearly all of the 21 species of dolphins and whales that live in the northern Gulf of Mexico had demonstrable, quantifiable injuries. NMFS (2014a) documented 13 dolphins and whales stranded alive, and over 150 dolphins and whales were found dead during the oil spill response. Other affected species included dwarf and pygmy sperm whales, melon-headed whales, and spinner dolphins. Because of known low detection rates of carcasses (Williams et al., 2011), it is possible that the number of marine mammal deaths was significantly underestimated. Also, necropsies to confirm the cause of death could not be conducted for many of these marine mammals. Schwacke et al. (2014) reported that one year after the spill, many dolphins in Barataria Bay, Louisiana, had evidence of disease conditions associated with petroleum exposure and toxicity, including a decline in pregnancy success rate (Lane et al., 2015).

In the aftermath of the Macondo spill, an occurrence of an "unusual mortality event" (UME) of unprecedented size and duration that affectedmarine mammal stock areas in the Gulf of Mexico. The UME began in April 2010 and ended in July 2014 (NOAA, 2016c). Carmichael et al. (2012) hypothesized that the unusual number of bottlenose dolphin strandings in the northern Gulf of Mexico in 2010 and 2011 may have been associated with environmental perturbations including sustained cold weather and the Macondo spill in 2010 as well as large volumes of cold freshwater discharge in the early months of 2011. Venn-Watson et al. (2015) performed histological studies to examine contributing factors and causes of deaths for stranded common bottlenose dolphins from Louisiana, Mississippi, and Alabama and found that the dead dolphins from the UME were more likely than those from other areas to have primary bacterial pneumonia and thin adrenal cortices. The adrenal gland and lung diseases were consistent with exposure to petroleum compounds, and the exposure to petroleum compounds during and after the Macondo spill are proposed as a cause.

In the event of a large spill, response activities that may impact marine mammals include increased vessel traffic, use of dispersants, and remediation activities (e.g., controlled burns, skimmers, boom) (BOEM, 2017 a,b). The increased level of vessel and aircraft activity associated with spill response could disturb marine mammals, potentially resulting in behavioral changes. The large number of response vessels could result in vessel strikes, entanglement, injury, or stress. Response vessels would operate in accordance with NTL BOEM-2016-G01 to reduce the potential for striking or disturbing these animals, and therefore no significant impacts are expected. The application of dispersants is likely to reduce the chances of harmful impacts as the dispersants would remove oil from the surface, thereby reducing the risk of contact and rendering it less likely to adhere to skin, baleen plates, or other body surfaces (BOEM, 2017a). The use of trained observers during remediation activities will reduce the likelihood of capture and/or entrainment (BOEM, 2017 a,b). It is expected that impacts to non-listed marine mammals from a oil spill response activities resulting in the death of individuals would be adverse but not significant at a population level.

C.3.4 Sea Turtles (Endangered/Threatened)

Five species of endangered or threatened sea turtles may be found near the lease area. Endangered species include the leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempii*), and hawksbill (*Eretmochelys imbricata*) turtles, while the North Atlantic DPS of the green turtle (*Chelonia mydas*) is listed as threatened (81 *FR* 20057). The DPS of loggerhead turtles (*Caretta caretta*) that occurs in the Gulf of Mexico is listed as threatened, although other DPSs are endangered.

Critical habitat has been designated for the loggerhead turtle in the Gulf of Mexico as shown in **Figure 3**. Critical habitat in the northern Gulf of Mexico includes nesting beaches in Mississippi, Alabama, and the Florida Panhandle; nearshore reproductive habitat within 1 mile (1.6 km) seaward from these beaches; and a large area of *Sargassum* habitat that includes most of the Western and Central Planning Areas of and parts of the southern portion of the Eastern Planning Area (NMFS, 2014b).

Loggerhead turtles in the Gulf of Mexico are part of the Northwest Atlantic Ocean DPS (76 *FR* 58868). In July 2014, NMFS and the USFWS designated critical habitat for this DPS. The USFWS designation (79 *FR* 39756) includes nesting beaches in Jackson County, Mississippi; Baldwin County, Alabama; and Bay, Gulf, and Franklin Counties in the Florida Panhandle as well as several counties in southwest Florida and the Florida Keys (and other areas along the Atlantic coast). The NMFS designation (79 *FR* 39856) includes nearshore reproductive habitat within 1 mile (1.6 km) seaward of the mean high water line along these same nesting beaches. NMFS also designated a large area of shelf and oceanic waters, termed *Sargassum* habitat, in the Gulf of Mexico (and Atlantic Ocean) as critical habitat. *Sargassum* is a brown alga (Class Phaeophyceae) and species in the Gulf of Mexico (*S. natans and S. fluitans*) have a fully pelagic lifecycle. Rafts of *Sargassum* serve as important foraging and developmental habitat for numerous fishes, and young sea turtles, including loggerhead turtles. NMFS designated three other categories of critical habitat as well; of these, two (migratory habitat and overwintering habitat) are along the Atlantic coast and the third (breeding habitat) is found in the Florida Keys and along the Florida east coast (NMFS, 2014b). The closest designated nearshore reproductive critical habitat for loggerhead sea turtles is approximately 76 miles (122 km) from the lease area. The lease area is located 54 miles (87 km) from the designated *Sargassum* critical habitat for loggerhead sea turtles (**Figure 3**).

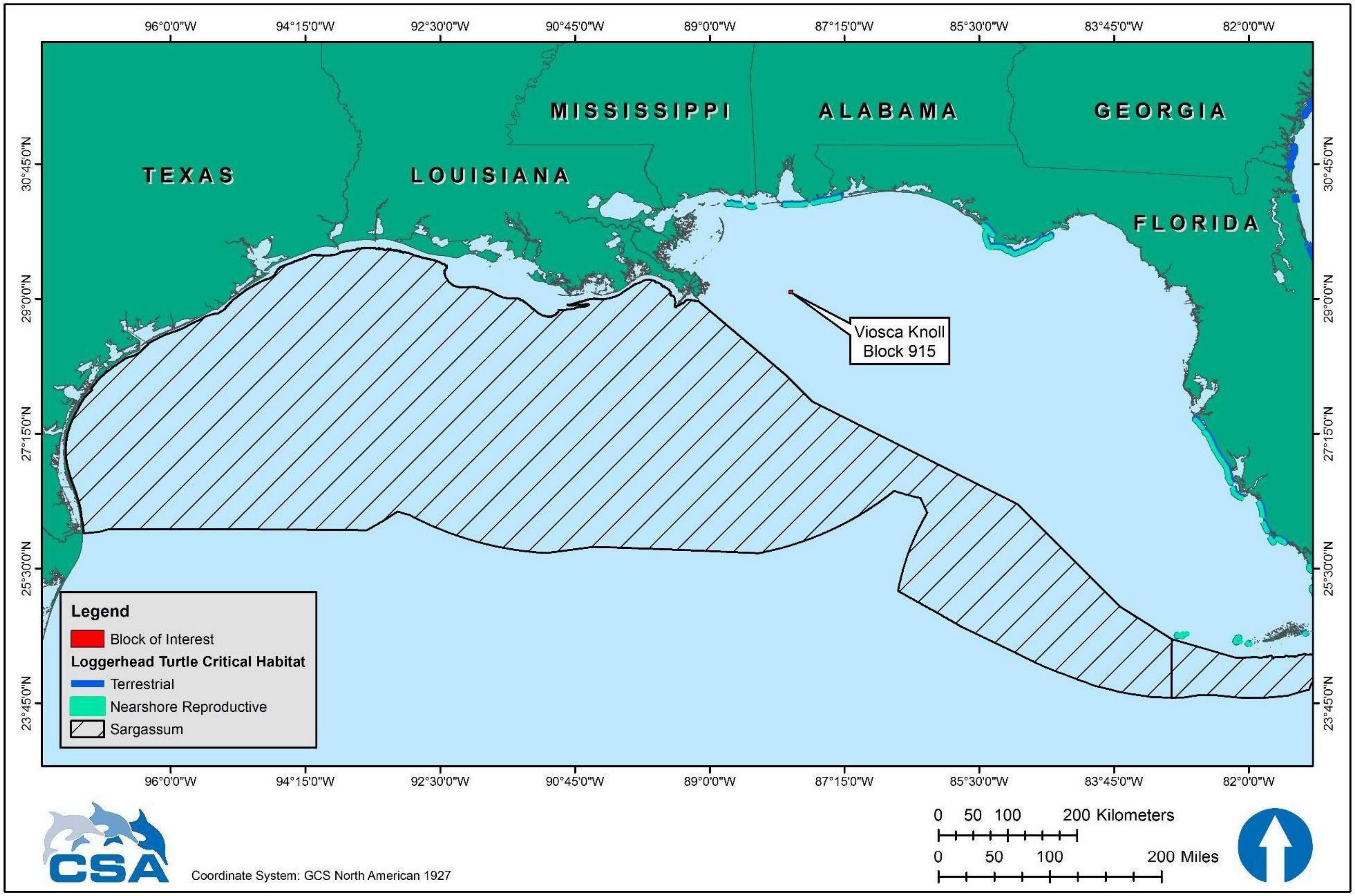

Figure 3. Location of loggerhead turtle designated critical habitat in relation to the lease area.

Leatherback and loggerhead turtles are the most likely species to be present near the lease area as adults. Green, hawksbill, and Kemp's ridley turtles are typically inner shelf and nearshore species, unlikely to occur near the lease area as adults. Hatchlings or juveniles of any of the sea turtle species may be present in deepwater areas, including the lease area, where they may be associated with *Sargassum* and other flotsam.

All five sea turtle species in the Gulf of Mexico are migratory and use different marine habitats according to their life stage. These habitats include high-energy beaches for nesting females and emerging hatchlings and pelagic convergence zones for hatchling and juvenile turtles. As adults, green, hawksbill, and loggerhead turtles forage primarily in shallow, benthic habitats. Leatherback turtles are the most pelagic of the sea turtles, feeding primarily on jellyfish.

Sea turtle nesting on the northern Gulf of Mexico coast can be summarized by species as follows:

- Loggerhead turtles – Nest in significant numbers along the Florida Panhandle (Florida Fish and Wildlife Conservation Commission, 2017a) and, to a lesser extent, from Texas through Alabama (NMFS and USFWS, 2008).
- Green and leatherback turtles – Infrequently nest on Florida Panhandle beaches (Florida Fish and Wildlife Conservation Commission, 2017b, c).
- Kemp's ridley turtles – The main nesting site is on a 16 mile (26 km) stretch of coastline near Rancho Nuevo in the Mexican state of Tamaulipas (NMFS et al., 2011). A much smaller, but growing, population nests in Padre Island National Seashore, Texas, mostly as a result of reintroduction efforts (NMFS et al., 2011). A total of 353 Kemp's ridley turtle nests were counted on Texas beaches in 2017, an increase from the 185 counted in 2016, 159 counted in 2015, and 118 counted in 2014 (Turtle Island Restoration Network, 2017). Padre Island National Seashore along the coast of Willacy, Kenedy, and Kleberg Counties in southern Texas, is the most important nesting location for this species in the United States, although there have been occasional reports of Kemp's ridleys nesting in Alabama (Share the Beach, 2016).
- Hawksbill turtles – Typically, do not nest anywhere near the project area, with most nesting in the region located in the Caribbean Sea and on the beaches of the Yucatán Peninsula (USFWS, 2016a).

IPFs that could affect sea turtles include construction vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small diesel fuel spill and a large oil spill). Effluent discharges are likely to have negligible impacts on sea turtles due to rapid dispersion, the small area of ocean affected, and the intermittent nature of the discharges. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the potential for marine debris-related impacts on sea turtles. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Construction Vessel Presence, Noise, and Lights

Subsea installation activities produce a broad array of sounds at frequencies and intensities that may be detected by sea turtles (Samuel et al., 2005, Popper et al., 2014). Potential impacts may include behavioral disruption and temporary or permanent displacement from the area near the sound source. There is scarce information regarding hearing and acoustic thresholds for marine turtles. The currently accepted hearing and response estimates are derived from fish hearing data rather than from marine mammal hearing data in combination with the limited experimental data available (Popper et al., 2014). A NMFS Biological Opinion (NMFS, 2015) lists sea turtle underwater acoustic injury and behavioral thresholds at 207 dB re 1 µPa and 166 dB re 1 µPa, respectively. No distinction is made between impulsive and continuous sources for these thresholds. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters are not expected to produce received levels greater than 160 dB re 1 µPa beyond 82 ft (25 m) from the source. Certain sea turtles, especially loggerheads, may be attracted to offshore structures (Lohoefener et al., 1990, Gitschlag et al., 1997) and, thus, may be more susceptible to impacts from sounds produced during routine operations. The most likely impacts would be short-term behavioral changes such as diving and evasive swimming, disruption of activities, or departure from the area. Due to the small impact area around the activties, limited number of sources, and short duration of activities, these short-term impacts are not expected to be biologically significant to sea turtle populations.

Artificial lighting can disrupt the nocturnal orientation of sea turtle hatchlings (Witherington, 1997, Tuxbury and Salmon, 2005). However, hatchlings may rely less on light cues when they are offshore than when they are emerging on the beach (Salmon and Wyneken, 1990). NMFS (2007) concluded that the effects of lighting from offshore structures on sea turtles are insignificant.

Impacts of Support Vessel and Helicopter Traffic

Noise generated from support vessel traffic has the potential to disturb sea turtles, and there is a risk of vessel strikes. Data show that vessel strike is one cause of sea turtle mortality in the Gulf of Mexico (Lutcavage et al., 1997). While adult sea turtles are visible at the surface during the day and in clear weather, they can be difficult to spot from a moving vessel when resting below the water surface, during nighttime, or during periods of inclement weather. To reduce the potential for vessel strikes, BOEM issued NTL BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for sea turtles and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. When sea turtles are sighted, vessel operators and crews are required to attempt to maintain a distance of 150 ft (45 m) or greater whenever possible. Compliance with this NTL (**Table 1**) will minimize the likelihood of vessel strikes during periods of daylight and during sea and weather conditions that permit sighting of turtles on the sea surface. If a project-related vessel strikes a sea turtle, it is likely that it will result in the death of the individual turtle. Lethal ship strike to these listed species is not likely but, if it occurs, is significant to the population (NMFS, 2007).

Noise generated from support helicopter traffic also has the potential to disturb sea turtles. However, while flying offshore, helicopters maintain altitudes above 700 ft (213 m) during transit to and from the working area. This altitude will minimize the potential for disturbing sea turtles, and no significant impacts are expected (NMFS, 2007, BOEM, 2012a).

Impacts of a Small Diesel Fuel Spill

Potential spill impacts on sea turtles are discussed by NMFS (2007) and BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to spill impacts on sea turtles.

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Anadarko's OSRP is expected to minimize potential impacts on sea turtles. **DOCD Section I** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts on turtles to occur would be brief.

A small diesel fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. Direct physical and physiological effects of exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (NMFS, 2014a). The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time of the spill as well as the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small diesel fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The sea surface area covered with diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions. Therefore, due to the limited areal extent and short duration of water quality impacts from a small diesel fuel spill, no significant impacts to sea turtles from direct or indirect exposure are expected.

Loggerhead Critical Habitat – Nesting Beaches. A small diesel fuel spill in the lease area would be unlikely to affect sea turtle nesting beaches due to the distance from the nearest shoreline. Loggerhead turtle nesting beaches and nearshore reproductive habitat designated as critical habitat are located in Mississippi, Alabama, and the Florida panhandle, at least 76 miles (122 km) from the lease area. As explained in **Section A.9.1**, a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion.

Loggerhead Critical Habitat – *Sargassum*. The lease area is approximately 54 miles (87 km) from the *Sargassum* habitat portion of the loggerhead turtle critical habitat (**Figure 3**). A small diesel fuel spill is unlikely to affect *Sargassum* and juvenile turtles in this habitat due to the distance from the lease area. If this habitat were contaminated, juvenile sea turtles could come into contact with or ingest oil, resulting in death, injury, or other sublethal effects. Effects of a small spill on *Sargassum* critical habitat for loggerhead turtles would be limited to the small area (0.5 to 5 ha [1.2 to 12 ac]) likely to be impacted by a small spill. An impact area of 5 ha (12 ac) would represent a negligible portion of the approximately 40,662,810 ha (100,480,000 ac) designated *Sargassum* critical habitat for loggerhead turtles in the northern Gulf of Mexico.

Impacts of a Large Oil Spill

Impacts of oil spills on sea turtles can include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes and smoke (e.g., from *in situ* burning of oil); ingestion of oil (and dispersants) directly or via contaminated food; and stress from the activities and noise of response vessels and aircraft. Complications of the above may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat, disruption of social structure, change in food availability and foraging distribution or patterns, change in reproductive behavior/productivity, and change in movement patterns or migration (NOAA, 2010, NMFS, 2014a). In the unlikely event of a spill, implementation of Anadarko's OSRP is expected to minimize the potential for these types of impacts on sea turtles. **DOCD Section I** provides detail on spill response measures.

Studies of oil effects on loggerhead turtles in a controlled setting (NOAA, 2010, Lutcavage et al., 1995) suggest that sea turtles show no avoidance behavior when they encounter an oil slick, and any sea turtle in an affected area would be expected to be exposed. Sea turtles' diving behaviors also put them at risk. Sea turtles rapidly inhale a large volume of air before diving and continually resurface over time, which may result in repeated exposure to volatile vapors and oiling (NMFS, 2007).

Results of the Macondo spill provide an indication of potential effects of a large oil spill on sea turtles. NOAA (2016b) estimates that between 4,900 and up to 7,600 large juvenile and adult sea turtles (Kemp's ridleys, loggerheads, and hardshelled sea turtles not identified to species), and between 56,000 and 166,000 small juvenile sea turtles (Kemp's ridleys, green turtles, loggerheads, hawksbills, and hardshelled sea turtles not identified to species) were killed by the Macondo spill. Impacts from a large oil spill resulting in the death of individual listed sea turtles would be significant to local populations.

Spill response activities could also kill sea turtles and interfere with nesting. NOAA (2016b) concluded that after the Macondo spill hundreds of sea turtles were likely killed by response activities such as increased boat traffic, dredging for berm construction, increased lighting at night near nesting beaches, and oil cleanup operations on nesting beaches. Nearly 35,000 hatchling sea turtles (loggerheads, Kemp's ridleys, and green turtles) were also injured by response activities (NOAA, 2016b). In addition, it is estimated that oil cleanup operations on Florida Panhandle beaches following the spill deterred adult female loggerheads from coming ashore and laying their eggs, resulting in a decrease of approximately 250 loggerhead nests in 2010 (NOAA, 2016b). Impacts from oil spill response activities resulting in the death of individual listed sea turtles would be significant to local populations.

<u>Loggerhead Critical Habitat – Nesting Beaches</u>. If spilled oil reaches sea turtle nesting beaches, nesting sea turtles and egg development could be affected (NMFS, 2007). An oiled beach could affect nest site selection or result in no nesting at all (e.g., false crawls). Upon hatching and successfully reaching the water, hatchlings are subject to the same types of oil spill exposure hazards as adults. Hatchlings that contact oil residues while crossing a beach can exhibit a range of effects, from acute toxicity to impaired movement and abnormal bodily functions (NMFS, 2007).

The 30-day OSRA results summarized in **Table 3** estimate that Louisiana, Mississippi, Alabama, and Florida shorelines that support limited sea turtle nesting could be contacted within 30 days (1 to 17% conditional probability). Plaquemines Parish in Louisiana is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). The 60-day OSRA modeling (**Table 4**) predicts the conditional probability of contacting Mississippi, Alabama, and Florida Panhandle shorelines that support significant loggerhead sea turtle nesting is 24% or less. The nearest nearshore reproductive critical habitat for the loggerhead turtle is 76 miles (122 km) from the lease area and is predicted by the 60-day OSRA model to have a 18% or less conditional probability of contact within 60 days of a spill.

<u>Loggerhead Critical Habitat – *Sargassum*</u>. The lease area is approximately 54 miles (87 km) from the loggerhead turtle critical habitat designated as *Sargassum* habitat, which includes most of the Western and Central Planning Areas in the Gulf of Mexico and parts of the southern portion of the Eastern Planning Area (**Figure 3**) (NMFS, 2014b). Because of the large area covered by the designated *Sargassum* habitat for loggerhead turtles, a large spill could result in a substantial part of the *Sargassum* habitat in the northern Gulf of Mexico being oiled. However, the catastrophic 2010 Macondo spill affected approximately one-third of the *Sargassum* habitat in the northern Gulf of Mexico (BOEM, 2014a). It is extremely unlikely that the entire *Sargassum* critical habitat would be affected by a large spill. Because *Sargassum* is a floating, pelagic species, it would only be affected by impacts that occur near the surface.

The effects of oiling on *Sargassum* vary with spill severity, but moderate to heavy oiling that could occur during a large spill could cause complete mortality to *Sargassum* and its associated communities (BOEM, 2017a). *Sargassum* also has the potential to sink during a large spill, thus temporarily removing the habitat and possibly being an additional pathway of exposure to the benthic environment (Powers et al., 2013). Lower levels of oiling may cause sub-lethal affects, including a reduction in growth, productivity, and recruitment of organisms associated with *Sargassum*. The *Sargassum* algae itself could be less impacted by light to moderate oiling than associated organisms because of a waxy outer layer that might help protect it from oiling (BOEM, 2016b). *Sargassum* has a yearly seasonal cycle of growth and a yearly cycle of migration from the Gulf of Mexico to the western Atlantic. A large spill could affect a large portion of the annual crop of the algae; however, because of its ubiquitous distribution and seasonal cycle, recovery of the *Sargassum* community would be expected to occur within a short time period (BOEM, 2017a).

In the event of a large spill, the level of vessel and aircraft activity associated with spill response could disturb sea turtles and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL BOEM-2016-G01 (**Table 1**) to reduce the potential for striking or disturbing these animals; however, events leading to the death of individual sea turtles from spill response activities are expected to be significant to local populations.

C.3.5 Piping Plover (Threatened)

The Piping Plover (*Charadrius melodus*) is a migratory shorebird that overwinters along the southeastern U.S. and Gulf of Mexico coasts. This threatened species is in decline as a result of hunting, habitat loss and modification, predation, and disease (USFWS, 2003). Critical overwintering habitat has been designated, including beaches in Texas, Louisiana, Mississippi, Alabama, and Florida (**Figure 4**). Piping Plovers inhabit coastal sandy beaches and mudflats, feeding by probing for invertebrates at or just below the surface. They use beaches adjacent to foraging areas for roosting and preening (USFWS, nd).

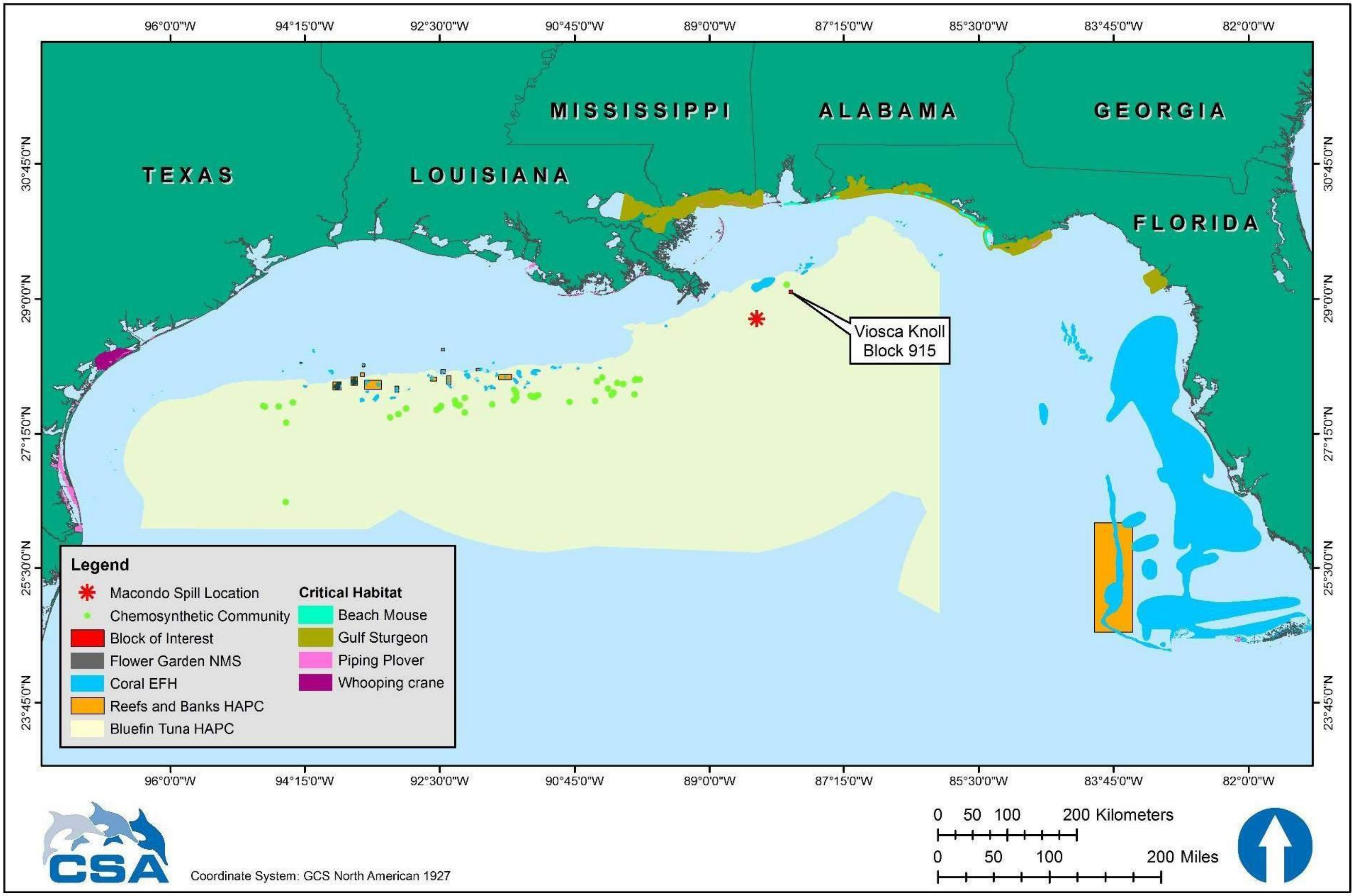

Figure 4. Location of selected environmental features in relation to the lease area. EFH = Essential Fish Habitat; HAPC = Habitat Area of Particular Concern; NMS= National Marine Sanctuary.

IPFs potentially affecting Piping Plovers include helicopter traffic crossing over selected coastal habitats and a large oil spill. These IPFs with potential impacts listed in **Table 2** are discussed below. It is asumed that helicopters will maintain an altitude of 1,000 ft (305 m) over unpopulated areas or across coastlines. Therefore, it is not likely that the crossing of helicopters over coastlines will significantly impact overwintering Piping Plovers.

A small diesel fuel spill in the lease area would be unlikely to affect Piping Plovers because a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion (**Section A.9.1**).

Impacts of a Large Oil Spill

The lease area is approximately 70 miles (113 km) to the nearest shoreline that is designed as critical habitat for Piping Plovers in Plaquemines Parish, Louisiana (**Figure 4**). The 30-day OSRA modeling (**Table 3**) predicts that Piping Plover critical habitat in Plaquemines Parish, Louisiana, could be contacted within 10 days of a spill (7% conditional probability). The 60-day OSRA modeling (**Table 4**) predicts that during the spring, there is a 24% conditional probability that an oil spill from the lease area would reach a shoreline designated as critical habitat for the Piping Plover within 60 days of a spill. Piping Plovers could become physically oiled while foraging on oiled shores or secondarily contaminated through ingestion of oiled intertidal sediments and prey (BOEM, 2017a). Piping Plovers congregate and feed along tidally exposed banks and shorelines, following the tide out to allow foraging at the water's edge. It is possible that some deaths of Piping Plovers could occur, especially if spills occur during winter months when plovers are most common along the coastal Gulf or if spills contacted critical habitat. Impacts also could occur from vehicular traffic on beaches and other activities associated with spill cleanup. Anadarko has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in their Regional OSRP. Impacts resulting in the deaths of individual Piping Plovers may be significant to the local population, based on the number of individuals lost.

C.3.6 Whooping Crane (Endangered)

The Whooping Crane (*Grus americana*) is a large omnivorous wading bird listed as an endangered species. Three wild populations live in North America (National Wildlife Federation, 2016b). One population winters along the Texas coast at Aransas NWR and summers at Wood Buffalo National Park in Canada. This population represents the majority of the world's population of free-ranging Whooping Cranes, reaching a record estimated population of 431 during the 2016 to 2017 winter (USFWS, 2017). A non-migratory population was reintroduced in central Florida, and another reintroduced population summers in Wisconsin and migrates to the southeastern U.S. for the winter. Whooping Cranes breed, migrate, winter, and forage in a variety of habitats, including coastal marshes and estuaries, inland marshes, lakes, ponds, wet meadows and rivers, and agricultural fields (USFWS, 2007). Approximately 9,000 ha (22,240 ac) of salt flats on Aransas NWR and adjacent islands make up the principal wintering grounds of the Whooping Crane (**Figure 4**). Aransas NWR is designated as critical habitat for the species. A species description is presented by BOEM (2012a).

A large oil spill is the only IPF potentially affecting Whooping Cranes. A small diesel fuel spill in the lease area would be unlikely to affect Whooping Cranes due to the distance from Aransas

NWR. As explained in **Section A.9.1**, a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion.

Impacts of a Large Oil Spill

The lease area is 517 miles (832 km) from the Aransas NWR in Aransas and Calhoun Counties, Texas, the nearest shoreline that is designed as critical habitat for Whooping Cranes. The 60-day OSRA modeling (**Table 4**) predicts that there is a <0.5% conditional probability that an oil spill from the lease area would reach a shoreline designated as critical habitat for the Whooping Crane within 60 days of a spill. Whooping Cranes could physically oil themselves while foraging in oiled areas or secondarily contaminate themselves through ingestion of contaminated shellfish, frogs, and fishes. It is possible that some deaths of Whooping Cranes could occur, especially if spills occur during winter months when Whooping Cranes are most common along the Texas coast or if the spill contacts their critical habitat in Aransas NWR. Impacts could also occur from vehicular traffic on beaches and other activities associated with spill cleanup. Anadarko has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in their OSRP. Impacts leading to the death of individual Whooping Cranes would be significant at a species level.

C.3.7 Gulf Sturgeon (Threatened)

The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) is a threatened fish species that inhabits major rivers and inner shelf waters from the Mississippi River to the Suwannee River, Florida (Barkuloo, 1988, Wakeford, 2001). The Gulf sturgeon is anadromous and migrates from the sea upstream into coastal rivers to spawn in freshwater. The historic range of the species extended from the Mississippi River to Charlotte Harbor, Florida (Wakeford, 2001). This range has contracted to encompass major rivers and inner shelf waters from the Mississippi River to the Suwannee River, Florida. Populations have been depleted or even extirpated throughout this range by fishing, shoreline development, dam construction, water quality changes, and other factors (Barkuloo, 1988, Wakeford, 2001). These declines prompted the listing of the Gulf sturgeon as a threatened species in 1991. The best-known populations occur in the Apalachicola and Suwannee Rivers in Florida (Carr, 1996, Sulak and Clugston, 1998), the Choctawhatchee River in Alabama (Fox et al., 2000), and the Pearl River in Mississippi/Louisiana (Morrow et al., 1998). Rudd et al. (2014) reconfirmed the spatial distribution and movement patterns of Gulf Sturgeon by surgically implanting acoustic telemetry tags. Critical habitat in the Gulf extends from Lake Borgne, Louisiana (St. Bernard Parish), to Suwannee Sound, Florida (Levy County) (NMFS, 2014c) (**Figure 4**). A species description is presented by BOEM (2012a) and in the recovery plan for this species (USFWS, 1995).

A large oil spill is the only IPF that could affect Gulf sturgeon. There are no IPFs associated with routine project activities that could affect these fish. A small diesel fuel spill in the lease area would be unlikely to affect Gulf sturgeon because a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion (see explanation in **Section A.9.1**).

Impacts of a Large Oil Spill

Potential spill impacts on Gulf sturgeon are discussed by NMFS (2007) and BOEM (2012a). For this DOCD, there are no unique site-specific issues with respect to this species.

The lease area is approximately 79 miles (127 km) from the nearest Gulf sturgeon critical habitat in St Bernard Parish, Louisiana, and Harrison County, Mississippi. The 30-day OSRA modeling (**Table 3**) predicts that a spill in the lease area has 2% or less conditional probability of contacting any coastal areas containing Gulf sturgeon critical habitat within 10 days of a spill and 7% or less conditional probability within 30 days. The 60-day OSRA modeling (**Table 4**) predicts that a spill in the lease areas has a 14% or less conditional probability of contacting any coastal areas containing Gulf sturgeon critical habitat within 60 days of a spill.

In the event of oil reaching Gulf sturgeon habitat, the fish could be affected by direct ingestion, ingestion of oiled prey, or the absorption of dissolved petroleum products through the gills. Based on the life history of this species, sub-adult and adult Gulf sturgeon would be most vulnerable to an estuarine or marine oil spill, and likely would be vulnerable only from 1 September through 30 April when the species is typically foraging in estuarine and shallow marine habitats (NMFS, 2007).

NOAA (2016b) estimated that 1,100 to 3,600 Gulf sturgeon were exposed to oil from the Macondo spill. Overall, 63% of the Gulf sturgeon from six river populations were potentially exposed to the spill. Although the number of dead or injured Gulf sturgeon was not estimated, laboratory and field tests indicated that Gulf sturgeon exposed to oil displayed both genotoxicity and immunosuppression, which can lead to malignancies, cell death, susceptibility to disease, infections, and a decreased ability to heal (NOAA, 2016b). Impacts resulting in the deaths of individual Gulf sturgeons may be significant to the local population, based on the number of individuals lost.

C.3.8 Beach Mice (Endangered)

Four subspecies of endangered beach mice (*Peromyscus polionotus*) occur on the barrier islands of Alabama and the Florida Panhandle: Alabama, Choctawhatchee, Perdido Key, and St. Andrew beach mice. Critical habitat has been designated for all four subspecies. **Figure 4** shows the combined critical habitat for all four subspecies. Species descriptions are provided by BOEM (2012a).

A large oil spill is the only IPF that could affect beach mice. There are no IPFs associated with routine project activities that could affect these animals due to the distance from shore and the lack of any onshore support activities near their habitat. A small diesel fuel spill in the lease area would not affect beach mice because a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion (**Section A.9.1**).

Impacts of a Large Oil Spill

Potential spill impacts on beach mice are discussed by BOEM (2017a). For this DOCD, there are no unique site-specific issues with respect to these species that were not analyzed in these documents.

Beach mouse critical habitat in Baldwin County, Alabama, is approximately 77 miles (124 km) from the lease area. The 30-day OSRA results (**Table 3**) predicts a 1% or less conditional probability of oil contact with beach mouse critical habitat within 10 days of a spill and 3% or less conditional probability of oil contact within 30 days of a spill. The 60-day OSRA modeling (**Table 4**) predicts that a spill in the lease area has a 18% or less conditional probability of reaching either the Alabama or Florida shorelines inhabited by beach mice within 60 days of a spill.

In the event of oil contacting these beaches, beach mice could experience several types of direct and indirect impacts. Contact with spilled oil could cause skin and eye irritation and subsequent infection; matting of fur; irritation of sweat glands, ear tissues, and throat tissues; disruption of sight and hearing; asphyxiation from inhalation of fumes; and toxicity from ingestion of oil and contaminated food. Indirect impacts could include reduction of food supply, destruction of habitat, and fouling of nests. Impacts could also occur from vehicular traffic and other activities associated with spill cleanup (BOEM, 2017 a,b). However, any such impacts are unlikely due to the distance from shore and response actions that would occur in the event of a spill. Impacts leading to the death of individual beach mice would be significant at a species level.

C.3.9 Threatened Coral Species

Four threatened coral species are known from the northern Gulf of Mexico: elkhorn coral (*Acropora palmata*), lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), and boulder star coral (*Orbicella franksi*). These species have been reported from the coral cap region of the Flower Garden Banks (NOAA, 2014) but are unlikely to be present as regular residents anywhere else in the northern Gulf of Mexico because they typically inhabit coral reefs in shallow, clear tropical, or subtropical waters. Other Caribbean coral species evaluated by NMFS in 2014 (79 *FR* 53852) either do not meet the criteria for ESA listing or are not known from the Flower Garden Banks. Critical habitat has been designated for elkhorn corals in the Florida Keys, but none has been designated for the other threatened coral species included above.

There are no IPFs associated with routine project activities that could affect threatened corals in the northern Gulf of Mexico. A small diesel fuel spill would not affect threatened coral species because the oil would float and dissipate on the sea surface. A large oil spill is the only relevant IPF.

Impacts of a Large Oil Spill

A large oil spill would be unlikely to reach coral reefs at the Flower Garden Banks or elkhorn coral critical habitat in the Florida Keys (Monroe County, Florida). The 60-day OSRA modeling (**Table 4**) predicts the conditional probability of oil contacting the Florida Keys is 0.5% or less. A surface slick would not contact corals on the seafloor. If a subsurface plume were to occur, impacts on the Flower Garden Banks would be unlikely due to the distance and the difference in water depth. Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and typically would not carry a plume up onto the continental shelf edge. Valentine et al. (2014) observed the spatial distribution of excess hopane, a crude oil tracer from Macondo spill sediment core samples, to be in the deeper waters and not transported up the shelf, thus confirming that near-bottom currents flow along the isobaths.

In the unlikely event that an oil slick reached reefs at the Flower Garden Banks or other Gulf of Mexico reefs, oil droplets or oiled sediment particles could come into contact with reef organisms or corals. As discussed by BOEM (2017a), impacts could include loss of habitat, biodiversity, and live coral coverage; destruction of hard substrate; change in sediment characteristics; and reduction or loss of one or more commercial and recreational fishery habitats. Sublethal effects could be long-lasting and affect the resilience of coral colonies to natural disturbances (e.g., elevated water temperature and diseases) (BOEM, 2017a).

Due to the distance between the lease area and coral habitats, there is a low chance of oil contacting threatened coral habitat in the event of a spill, and no significant impacts on threatened coral species are expected.

C.4 Coastal and Marine Birds

C.4.1 Marine Birds

Marine birds include seabirds and other species that may occur in the pelagic environment of the project area (Clapp et al., 1982a, Clapp et al., 1982b, 1983, Peake, 1996, Hess and Ribic, 2000). Seabirds spend much of their lives offshore over the open ocean, except during breeding season when they nest on islands along the coast. Other waterbirds, such as waterfowl, marsh birds, and shorebirds may occasionally be present over open ocean areas. No endangered or threatened bird species are likely to occur at the project area. For a discussion of shorebirds and coastal nesting birds, **Section C.4.2**.

Seabirds of the northern Gulf of Mexico were surveyed from ships during the GulfCet II program (Davis et al., 2000b). Hess and Ribic (2000) reported that terns, storm-petrels, shearwaters, and jaegers were the most frequently sighted seabirds in the deepwater area. From these surveys, four ecological categories of seabirds were documented in the deepwater areas of the Gulf: summer migrants (shearwaters, storm-petrels, boobies); summer residents that breed along the Gulf coast (Sooty Tern, Least Tern, Sandwich Tern, Magnificent Frigatebird); winter residents (gannets, gulls, jaegers); and permanent resident species (Laughing Gulls, Royal Terns, Bridled Terns) (Hess and Ribic, 2000). The GulfCet II study did not estimate bird densities; however, Powers (1987) indicated that seabird densities over the open ocean typically are less than 10 birds km^{-2}.

The distributions and relative densities of seabirds within the deepwater areas of the Gulf of Mexico, including the project area, vary temporally (i.e., seasonally) and spatially. In GulfCet II studies (Davis et al., 2000b), species diversity and density varied by hydrographic environment and by the presence and relative location of mesoscale features such as Loop Current eddies that may enhance nutrient levels and productivity of surface waters where these seabird species forage (Hess and Ribic, 2000).

Trans-Gulf migratory birds including shorebirds, wading birds, and terrestrial birds may also be present in the lease area. Migrant birds may use offshore structures and vessels for resting, feeding, or as temporary shelter from inclement weather. Some birds may be attracted to offshore structures and vessels because of the lights and the fish populations that aggregate around these structures (Russell, 2005).

IPFs that could affect marine and pelagic birds include construction vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small diesel fuel spill and a large oil spill). Effluent discharges are likely to have negligible impacts on the birds due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of these animals. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the potential for marine debris-related impacts on birds. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Construction Vessel Presence, Noise, and Lights

Birds migrating over water have been known to strike offshore structures, resulting in death or injury (Wiese et al., 2001, Russell, 2005). Mortality of migrant birds at tall towers and other land-based structures has been reviewed extensively, and the mechanisms involved in offshore vessels appear to be similar. In some cases, migrants simply do not see a part of the rig until it is too late to avoid it. In other cases, navigation may be disrupted by noise or lighting (Russell, 2005). However, offshore structures may in some cases serve as suitable stopover habitats for trans-Gulf migrant species, particularly in spring (Russell, 2005).

Due to the limited scope and duration of construction vessel activities, any impacts on populations of either seabirds or trans-Gulf migrant birds from activities described in this DOCD are not expected to be significant.

Impacts of Support Vessel and Helicopter Traffic

Support vessels and helicopters are unlikely to significantly disturb pelagic birds in areas of open offshore waters. It is likely that individual birds would experience, at most, only short-term behavioral disruption resulting from support vessel and helicopter traffic, and the impact would not be significant.

Impacts of a Small Diesel Fuel Spill

Potential spill impacts on marine birds are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfers. In the unlikely event of a spill, implementation of Anadarko's OSRP could reduce the potential for impacts on marine and pelagic birds. **DOCD Section I** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small diesel fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small diesel fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The sea surface area covered with diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions.

Birds exposed to oil on the sea surface could experience direct physical and physiological effects including skin irritation; chemical burns of skin, eyes, and mucous membranes; and inhalation of toxic fumes. Due to the limited areal extent and short duration of water quality impacts from a small diesel fuel spill, secondary impacts due to ingestion of oil via contaminated prey or reductions in prey abundance are unlikely. Due to the low densities of birds in open ocean areas, the small area affected, and the brief duration of the surface slick, no significant impacts on pelagic birds are expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine and pelagic birds are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to spill impacts on marine birds.

Pelagic seabirds could be exposed to oil from a spill at the project area. Hess and Ribic (2000) reported that terns, storm-petrels, shearwaters, and jaegers were the most frequently sighted seabirds in the deepwater Gulf of Mexico (>656 ft [>200 m]). Powers (1987) indicated that seabird densities over the open ocean typically are less than 10 birds km^{-2}. The number of pelagic birds that could be affected in open offshore waters would depend on the extent and persistence of the oil slick.

Data following the Macondo spill provide relevant information about the species of pelagic birds that may be affected in the event of a large oil spill. Birds that have been treated for oiling include several pelagic species such as the Northern Gannet, Magnificent Frigatebird, and Masked Booby (USFWS, 2011). The Northern Gannet was among the species with the largest numbers of birds affected by the spill. NOAA reported that at least 93 resident and migratory bird species across all five Gulf Coast states were exposed to oil from the Macondo spill in multiple habitats, including offshore/open waters, island waterbird colonies, barrier islands, beaches, bays, and marshes (NOAA, 2016b). Exposure of marine birds to oil can result in adverse health with severity, depending on the level of oiling. Effects can range from plumage damage and loss of buoyancy from external oiling to more severe effects, such as organ damage, immune suppression, endocrine imbalance, reduced aerobic capacity, and death as a result of oil inhalation or ingestion (NOAA, 2016b). It is expected that impacts to marine birds from a large oil spill resulting in the death of individual birds would be adverse but not significant at population levels.

C.4.2 Coastal Birds

Threatened and endangered bird species (Piping Plover and Whooping Crane) were discussed in **Sections C.3.6** and **C.3.7**. The Brown Pelican (*Pelecanus occidentalis*) was delisted from federal endangered status in 2009 (USFWS, 2016b). However, this species remains listed as endangered by both Louisiana (State of Louisiana Department of Wildlife and Fisheries, 2005) and Mississippi (Mississippi Natural Heritage Program, 2015). The Brown Pelican was delisted as a species of special concern by the State of Florida in 2017 (Florida Fish and Wildlife Conservation Commission, 2017d). Brown Pelicans inhabit coastal habitats and forage within both coastal waters and waters of the inner continental shelf. Aerial and shipboard surveys, including GulfCet and GulfCet II (Davis et al., 2000b), indicate that Brown Pelicans do not occur in deep offshore waters (Fritts and Reynolds, 1981, Peake, 1996, Hess and Ribic, 2000). Nearly half the southeastern population of Brown Pelicans lives in the northern Gulf Coast, generally nesting on protected islands (USFWS, 2010a).

The Bald Eagle (*Haliaeetus leucocephalus*) was delisted from its threatened status in the lower 48 states on 28 June 2007. The Bald Eagle still receives protection under the Migratory Bird Treaty Act of 1918 and the Bald and Golden Eagle Protection Act of 1940 (USFWS, 2015). The Bald Eagle is a terrestrial raptor widely distributed across the southern U.S., including coastal habitats along the Gulf of Mexico. The Gulf Coast is inhabited by both wintering migrant and resident Bald Eagles (Johnsgard, 1990, Ehrlich et al., 1992).

Various species of non-endangered birds are also found along the northern Gulf Coast, including diving birds, shorebirds, marsh birds, wading birds, and waterfowl. Gulf Coast marshes and beaches also provide important feeding grounds and nesting habitats. Species that breed on beaches, flats, dunes, bars, barrier islands, and similar habitats include the Sandwich Tern, Wilson's Plover, Black Skimmer, Forster's Tern, Gull-Billed Tern, Laughing Gull, Least Tern, and Royal Tern (USFWS, 2010a). Additional information is presented by BOEM (2012a, 2017a).

IPFs that could affect coastal birds include support vessel and helicopter traffic and a large oil spill. A small diesel fuel spill in the lease area would be unlikely to affect shorebirds or coastal nesting birds, due to the lease area's distance from the nearest shoreline. As explained in **Section A.9.1**, a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the potential for marine debris-related impacts on shorebirds.

Impacts of Support Vessel and Helicopter Traffic

Support vessels and helicopters will transit coastal areas near Port Fourchon and Houma, Louisiana, where shorebirds and coastal nesting birds may be found. These activities could periodically disturb individuals or groups of birds within sensitive coastal habitats (e.g., wetlands that may support feeding, resting, or breeding birds).

Vessel traffic may disturb foraging and resting birds. Flushing distances vary among species and individuals (Rodgers and Schwikert, 2002). The disturbances will be limited to flushing birds away from vessel pathways; known distances are from 65 to 160 ft (20 to 49 m) for personal watercraft and 75 to 190 ft (23 to 58 m) for outboard-powered boats (Rodgers and Schwikert, 2002). Flushing distances may be similar or less for the support vessels to be used for Anadarko's project, and some species such as gulls are attracted to boats. Support vessels will not approach nesting or breeding areas on the shoreline, so disturbances to nesting birds, eggs, and chicks are not expected. Vessel operators will use designated navigation channels and comply with posted speed and wake restrictions while transiting sensitive inland waterways. Due to the limited scope and short duration of support vessel activities, any short-term impacts are not expected to be biologically significant to coastal bird populations.

Aircraft traffic can cause some disturbance to birds onshore and offshore. Responses are highly dependent on the type of aircraft, bird species, activities that animals were previously engaged in, and previous exposures to overflights (Efroymson et al., 2000). Helicopters seem to cause the most intense responses when compared with other anthropogenic disturbances for some species (Bélanger and Bédard, 1989). Federal Aviation Administration (FAA) Advisory Circular No. 91-36D recommends that pilots maintain a minimum altitude of 2,000 ft (610 m) when flying over noise sensitive areas such as wildlife refuges, parks, and areas with wilderness characteristics. This is greater than the distance (slant range) at which aircraft overflights have been reported to cause behavioral effects on most species of birds studied (Efroymson et al., 2000). With the FAA guidelines in effect, it is likely that individual birds would experience, at most, only short-term behavioral disruption.

Impacts of Large Oil Spill

The OSRA results summarized in **Table 3** estimate that shorelines of Plaquemines Parish, Louisiana, that includes habitat for shorebirds and coastal nesting birds is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other

Louisiana, Mississippi, and Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. The 60-day OSRA modeling (**Table 4**) predicts that shorelines between Matagorda County, Texas , and Levy County, Florida, have up to a 24% probability of contact within 60 days of a spill.

Coastal birds can be exposed to oil as they float on the water surface, dive during foraging, or wade in oiled coastal waters. Oiled birds can lose the ability to fly, dive for food, or float on the water, which could lead to drowning (USFWS, 2010b). Oil interferes with the water repellency of feathers and can cause hypothermia in the right conditions. As birds groom themselves, they can ingest and inhale the oil on their bodies. Scavengers such as Bald Eagles and gulls can be exposed to oil by feeding on carcasses of contaminated fish and wildlife. While ingestion can kill animals immediately, more often it results in lung, liver, and kidney damage, which can lead to death (BOEM, 2017a). Bird eggs may be damaged if an oiled adult sits on the nest.

Data from the Macondo spill provide an indication of the potential impacts of a large spill on coastal bird populations. According to NOAA (2016b), an estimated 51,600 to 84,500 birds were killed by the spill and the reproductive output lost as a result of breeding adult bird mortality was estimated to range from 4,600 to 17,900 fledglings that would have been produced in the absence of premature deaths of adult birds (NOAA, 2016b). Species with the largest numbers of estimated mortalities were American White Pelican, Black Skimmer, Black Tern, Brown Pelican, Laughing Gull, Least Tern, Northern Gannet, and Royal Tern (NOAA, 2016b).

Brown Pelicans are especially at risk from direct and indirect impacts from spilled oil within inner shelf and inshore waters, such as embayments. The range of this species is generally limited to these waters and surrounding coastal habitats. Brown Pelicans feed on mid-size fish that they capture by diving from above (i.e.,plunge diving) and then scooping the fish into their expandable gular pouch. This behavior makes them susceptible to plumage oiling if they feed in areas with surface oil or an oil sheen. They may also capture prey that has been physically contaminated with oil or has ingested oil. Issues for Brown Pelicans include direct contact with oil, disturbance from cleanup activities, and long-term habitat contamination (BOEM, 2012a).

The Bald Eagle also may be especially at risk from direct and indirect impacts from spilled oil. This species often captures fish within shallow water areas (snatching prey from the surface or wading into shallow areas to capture prey with their bill) and so may be susceptible to plumage oiling and, as with the Brown Pelican, they may also capture prey that has been physically contaminated with oil or has ingested oil (BOEM, 2012a). It is expected that impacts to coastal birds from a large oil spill resulting in the death of individual birds would be adverse but not significant at population levels.

C.5 Fisheries Resources

C.5.1 Pelagic Communities and Ichthyoplankton

Biggs and Ressler (2000) reviewed the biology of pelagic communities in the deepwater environment of the northern Gulf of Mexico. The biological oceanography of the region is dominated by the influence of the Loop Current, the surface waters of which are among the most oligotrophic in the world’s oceans. Superimposed on this low-productivity condition are productive "hot spots" associated with entrainment of nutrient-rich Mississippi River water and mesoscale oceanographic features. Anticyclonic and cyclonic hydrographic features play an important role in determining biogeographic patterns and controlling primary productivity in the northern Gulf of Mexico (Biggs and Ressler, 2000).

Most fishes inhabiting shelf or oceanic waters of the Gulf of Mexico have planktonic eggs and larvae (Ditty, 1986, Ditty et al., 1988, Richards et al., 1989, Richards et al., 1993). A study by Ross et al. (2012) on midwater fauna to characterize vertical distribution of mesopelagic fishes in selected deepwater areas in the Gulf of Mexico substantiated high species richness but general numerical domination by relatively few families and species.

IPFs potentially affecting pelagic communities and ichthyoplankton include construction vessel presence, noise, and lights; effluent discharges; water intakes; and two types of accidents (a small diesel fuel spill and a large oil spill).

Impacts of Construction Vessel Presence, Noise, and Lights

The construction vessel, as floating structure in the deepwater environment, will act as a fish aggregating device (FAD). In oceanic waters, the FAD effect would be most pronounced for epipelagic fishes such as tunas, dolphin, billfishes, and jacks, which are commonly attracted to fixed and drifting surface structures (Higashi, 1994, Relini et al., 1994, Holand, 1997). Positive fish associations with offshore rigs and platforms in the Gulf of Mexico are well documented (Gallaway and Lewbel, 1982, Wilson et al., 2003, Peabody and Wilson, 2006). The FAD effect could possibly enhance the feeding of epipelagic predators by attracting and concentrating smaller fish species. Construction vessel noise could potentially cause masking in fishes, thereby reducing their ability to hear biologically relevant sounds (Radford et al., 2014).

The only defined acoustic threshold levels for continuous noise are given by Popper et al. (2014) and apply only to species of fish with swim bladders that provide some hearing (pressure detection) function. Popper et al. (2014) estimated threshold levels of 170 dB re 1 µPa accumulated over a 48-hour period for onset of recoverable injury and 158 dB re 1 µPa accumulated over a 12-hour period for onset temporary auditory threshold shifts. However, no consistent behavioral thresholds for fish have been established (Hawkins and Popper, 2014). Noise may also influence fish behaviors, such as predator-avoidance, foraging, reproduction, intraspecific interactions, and offspring survival (Picciulin et al., 2010, Bruintjes and Radford, 2013, McLaughlin and Kunc, 2015, Simpson et al., 2016, Nedelec et al., 2017). Fish aggregating is likely to occur to some degree due to the presence of the construction vessel, but the impacts would be limited in geographic scope and no population level impacts are expected.

Few data exist regarding the impacts of noise on pelagic larvae and eggs. Generally, it is believed that larval fish will have similar hearing sensitivities as adults, but may be more susceptible to barotrauma injuries associated with impulsive noise (Popper et al., 2014). Larval fish were experimentally exposed to simulated impulsive sounds by Bolle et al. (2012). The controlled playbacks produced cumulative exposures of 206 dB re 1 $\mu Pa^2 \cdot s$ but resulted in no increased mortality between the exposure and control groups. Non-impulsive noise sources are expected to be less injurious than impulsive noise. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters, are not expected to produce received levels greater than 160 dB re 1 µPa beyond 82 ft (25 m) from the source. Because of the limited propagation distances of high sound pressure levels and the periodic and transient nature of ichthyoplankton, no impacts to these life stages are expected.

Impacts of Effluent Discharges

Treated sanitary and domestic wastes may have a slight effect on the pelagic environment in the immediate vicinity of these discharges. These wastes may have elevated levels of nutrients, organic matter, and chlorine, but should dilute rapidly to undetectable levels within tens to hundreds of meters from the source. As a result of quick dilution, minimal impacts on water quality, plankton, and nekton are anticipated.

Deck drainage may have a slight effect on the pelagic environment in the immediate vicinity of these discharges. Deck drainage from contaminated areas will be passed through an oil-and-water separator prior to release, and discharges will be monitored for visible sheen. The discharges may have slightly elevated levels of hydrocarbons but should dilute rapidly to undetectable levels within tens to hundreds of meters from the source. Minimal impacts on water quality, plankton, and nekton are anticipated.

Other discharges in accordance with the NPDES permit, such as non-pollutant completion fluids, subsea production control fluid, produced water, desalination unit brine and uncontaminated cooling water, fire water, bilge, and ballast water, are expected to dilute rapidly and have little or no impact on water column biota.

Impacts of Water Intakes

Seawater will be drawn from the ocean for once-through, non-contact cooling of machinery on the construction vessel. The construction vessel ultimately chosen for this project will be in compliance with all cooling water intake requirements of the NPDES permit to comply with Section 316(b) of the Clean Water Act.

The intake of seawater for cooling water will entrain plankton. The low intake velocity should allow most strong-swimming juvenile fishes and smaller adults to escape entrainment or impingement. However, drifting plankton would not be able to escape entrainment with the exception of a few fast-swimming larvae of certain taxonomic groups. The entrained organisms may be stressed or killed, primarily through changes in water temperature during the route from cooling intake structure to discharge structure and through mechanical damage (turbulence in pumps and condensers) (BOEM, 2017a). Due to the limited scope and duration of proposed activities, any short-term impacts of entrainment are not expected to be significant on a population level for plankton or ichthyoplankton.

Impacts of a Small Diesel Fuel Spill

Potential spill impacts on fisheries resources are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to spill impacts.

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfers between the supply vessel and project area. In the unlikely event of a spill, implementation of Anadarko's OSRP could mitigate the potential for impacts on pelagic communities, including ichthyoplankton. **DOCD Section I** provides detail on spill response measures. Given the open ocean location of the lease area and the duration of a small spill, the opportunity for impacts to occur would be very brief.

A small diesel fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small diesel fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The sea surface area covered with diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions.

A small diesel fuel spill could have localized impacts (i.e., hydrocarbon contamination) on phytoplankton, zooplankton, and nekton. Due to the limited areal extent and short duration of water quality impacts, a small diesel fuel spill would be unlikely to produce detectable impacts on pelagic communities.

Impacts of a Large Oil Spill

Potential spill impacts on pelagic communities and ichthyoplankton are discussed by BOEM (2016b, 2017 a,b). For this DOCD, there are no unique site-specific issues.

A large oil spill could directly affect water column biota including phytoplankton, zooplankton, ichthyoplankton, and nekton. A large spill that persisted for weeks or months would be more likely to affect these communities. While adult and juvenile fishes may actively avoid a large spill, planktonic eggs and larvae would be unable to avoid contact. Fish eggs and larvae are especially vulnerable to oiling because they inhabit the upper layers of the water column, and they will die if exposed to certain toxic fractions of spilled oil. Impacts could be greater if local-scale currents retained planktonic larval assemblages (and the floating oil slick) within the same water mass. Impacts to ichthyoplankton from a large spill would be greatest during spring and summer when shelf concentrations peak (BOEM, 2016b). Adult and juvenile fishes could also be impacted through the ingestion of oiled prey (USFWS, 2010b). It is expected that impacts to pelagic communites and ichthyoplankton from a large oil spill resulting in the death of individual fishes would be adverse but not significant at population levels.

C.5.2 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined as the waters and substrate necessary to fish for spawning, breeding, feeding, and growth to maturity. Under the Magnuson-Stevens Fishery Conservation and Management Act, as amended, federal agencies are required to consult on activities that may adversely affect EFH designated in Fishery Management Plans developed by the regional Fishery Management Councils.

The Gulf of Mexico Fishery Management Council (GMFMC) has prepared Fishery Management Plans for corals and coral reefs, shrimps, spiny lobster, reef fishes, coastal migratory pelagic fishes, and red drum. In 2005, the EFH for these managed species was redefined in Generic Amendment No. 3 to the various Fishery Management Plans (Gulf of Mexico Fishery Management Council, 2005). The EFH for most of these GMFMC-managed species is on the continental shelf in waters shallower than 600 ft (183 m). The shelf edge is the outer boundary for coastal migratory pelagic fishes, reef fishes, and shrimps. EFH for corals and coral reefs includes some shelf-edge topographic features located approximately 14 miles (23 km) west-northwest of the lease area.

Highly migratory pelagic fishes, which occur as transients in the lease area, are the only remaining group for which EFH has been identified in the deepwater Gulf of Mexico. Species in this group, including tunas, swordfishes, billfishes, and sharks are managed by NMFS. Highly migratory species with EFH in or near the lease area include the following species and life stages (NMFS, 2009b):

- Bigeye thresher shark (all)
- Blue marlin (juveniles, adults)
- Bluefin tuna (spawning, eggs, larvae)
- Bull shark (adults)
- Longfin mako shark (all)
- Oceanic whitetip shark (all)
- Scalloped hammerhead shark (juveniles, adults)
- Silky Shark (all)
- Skipjack tuna (spawning, adults)
- Smooth Dogfish (all)
- Swordfish (larvae, juveniles)
- Whale shark (all)
- White marlin (juveniles, adults)
- Yellowfin tuna (spawning, juveniles, adults)

Research indicates the central and western Gulf of Mexico may be important spawning habitat for Atlantic bluefin tuna (*Thunnus thynnus*), and NMFS (2009b) has designated a Habitat Area of Particular Concern (HAPC) for this species. The HAPC covers much of the deepwater Gulf of Mexico, including the lease area (**Figure 4**). The areal extent of the HAPC is approximately 115,830 miles^2 (300,000 km^2). The prevailing assumption is that Atlantic bluefin tuna follow an annual cycle of foraging in June through March off the eastern U.S. and Canadian coasts, followed by migration to the Gulf of Mexico to spawn in April, May, and June (NMFS, 2009b). The Atlantic bluefin tuna has also been designated as a species of concern (NMFS, 2011).

An amendment to the original EFH Generic Amendment was finalized in 2005 (Gulf of Mexico Fishery Management Council, 2005). One of the most significant proposed changes in this amendment reduced the extent of EFH relative to the 1998 Generic Amendment by removing the EFH description and identification from waters between 100 fathoms and the seaward limit of the Exclusive Economic Zone (EEZ). The Highly Migratory Species Fisheries Management Plan was amended in 2009 to update EFH and HAPC to include the bluefin tuna spawning area (NMFS, 2009b).

NTLs 2009-G39 and 2009-G40 provide guidance and clarification of regulations for biologically sensitive underwater features and areas and benthic communities that are considered EFH. As part of an agreement between BOEM and NMFS to complete a new programmatic EFH consultation for each new Five-Year Program, an EFH consultation was initiated between BOEM's Gulf of Mexico Region and NOAA's Southeastern Region during the preparation, distribution, and review of BOEM's 2017-2022 Multisale EIS (BOEM, 2017a). The EFH assessment was completed and there is ongoing coordination among NMFS, BOEM, and BSEE, including discussions of mitigation (BOEM, 2016c).

Other HAPCs have been identified by the Gulf of Mexico Fishery Management Council (2005). These include the Florida Middle Grounds, Madison-Swanson Marine Reserve, Dry Tortugas North and South Ecological Reserves, Pulley Ridge, and several individual reefs and banks of the northwestern Gulf of Mexico. (**Figure 4**). The nearest HAPC is Madison Swanson Marine Reserve, located approximately 126 miles (203 km) east of the lease area.

IPFs that could affect EFH include construction vessel presence, noise, and lights; effluent discharges; water intakes; and two types of accidents (a small diesel fuel spill and a large oil spill).

Impacts of Construction Vessel Presence, Noise, and Lights

The construction vessel, as a floating structure in the deepwater environment, will act as an FAD. In oceanic waters, the FAD effect would be most pronounced for epipelagic fishes such as tunas, dolphin, billfishes, and jacks, which are commonly attracted to fixed and drifting surface structures (Holland, 1990, Higashi, 1994, Relini et al., 1994). The FAD effect would possibly enhance feeding of epipelagic predators by attracting and concentrating smaller fish species. Construction vessel noise could potentially cause acoustic masking for fishes, thereby reducing their ability to hear biologically relevant sounds (Radford et al., 2014). Noise may also influence fish behaviors such as predator avoidance, foraging, reproduction, and intraspecific interactions (Picciulin et al., 2010, Bruintjes and Radford, 2013, McLaughlin and Kunc, 2015).

The only defined acoustic threshold levels for continuous noise are given by Popper et al. (2014) and apply only to species of fish with swim bladders that provide some hearing (pressure detection) function. Popper et al. (2014) estimated threshold levels of 170 dB re 1 µPa accumulated over a 48-hour period for onset of recoverable injury and 158 dB re 1 µPa accumulated over a 12-hour period for onset temporary auditory threshold shifts. No consistent behavioral thresholds for fish have been established (Hawkins and Popper, 2014). Because the construction vessel is a temporary structure, any impacts on EFH for highly migratory pelagic fishes are considered minor.

Few data exist regarding the impacts of noise on pelagic larvae and eggs. Generally, it is believed that larval fish will have similar hearing sensitivities as adults, but may be more susceptible to barotrauma injuries associated with impulsive noise (Popper et al., 2014). Larval fish were experimentally exposed to simulated impulsive sounds by Bolle et al. (2012). The controlled playbacks produced cumulative exposures of 206 dB re 1 $\mu Pa^2 \cdot s$ but resulted in no increased mortality between the exposure and control groups. Non-impulsive noise sources are expected to be less injurious than impulsive noise. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters in use during offshore operations, are not expected to produce received levels greater than 160 dB re 1 µPa beyond 82 ft (25 m) from the source. Because of the limited propagation distances of high sound pressure levels and the periodic and transient nature of ichthyoplankton, no impacts to these life stages are expected.

Impacts of Effluent Discharges

Effluent discharges affecting EFH by diminishing ambient water quality include treated sanitary and domestic wastes, deck drainage, non-pollutant completion fluids, subsea production control fluid, produced water, and miscellaneous discharges such as desalination unit brine, uncontaminated cooling water, fire water, and bilge and ballast water. Impacts on water quality have been discussed previously. No significant impacts on EFH for highly migratory pelagic fishes are expected from these discharges if discharged according to NPDES permit conditions.

Impacts of Water Intakes

As noted previously, cooling water intake will cause entrainment and impingement of plankton, including fish eggs and larvae (ichthyoplankton). Due to the limited scope and relatively short duration of installation activities, any short-term impacts on EFH for highly migratory pelagic fishes due to water intake are not expected to be biologically significant if operated in compliance with USEPA requirements.

Impacts of a Small Diesel Fuel Spill

Potential spill impacts on EFH are discussed by BOEM (2016c, 2017a). For this DOCD, there are no unique site-specific issues with respect to spill impacts.

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfer between the supply vessel and construction vessel. In the unlikely event of a spill, implementation of Anadarko's OSRP could help diminish the potential for impacts on EFH. **DOCD Section I** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small diesel fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small diesel fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The sea surface area covered with diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions.

A small diesel fuel spill could have localized impacts on EFH for highly migratory pelagic fishes, including tunas, swordfishes, billfishes, and sharks. These species occur as transients in the lease area. A spill would also produce short-term impacts on surface and near-surface water quality in the HAPC for spawning bluefin tuna, which covers much of the deepwater Gulf of Mexico. The affected area would represent a negligible portion of the HAPC, which covers approximately 115,830 miles^2 (300,000 km^2) of the Gulf of Mexico.

A small diesel fuel spill would likely not affect EFH for corals and coral reefs, the nearest of which is located approximately 14 miles (23 km) west-northwest from the project area. A small diesel fuel spill would float and dissipate on the sea surface and would not contact these features.

Impacts of a Large Oil Spill

Potential spill impacts on EFH are discussed by BOEM (2016c, 2017a). For this DOCD, there are no unique site-specific issues with respect to EFH.

An oil spill in offshore waters would temporarily increase hydrocarbon concentrations on the water surface and potentially in the subsurface as well. Given the extent of EFH designations in the Gulf of Mexico (Gulf of Mexico Fishery Management Council, 2005, NMFS, 2009b), some impact on EFH would be unavoidable.

A large spill could affect the EFH for many managed species including shrimp, spiny lobster, reef fishes, coastal migratory pelagic fishes, and red drum. It would result in adverse impacts on water quality and water column biota including phytoplankton, zooplankton, and nekton. In coastal waters, sediments could be contaminated and result in persistent degradation of the seafloor habitat for managed demersal fish and shellfish species.

The lease area is within the HAPC for spawning Atlantic bluefin tuna (NMFS, 2009b). A large spill could temporarily degrade the HAPC due to increased hydrocarbon concentrations in the water column, with the potential for lethal or sublethal impacts on spawning tuna. Potential impacts would depend in part on the timing of a spill, as the species migrates to the Gulf of Mexico to spawn in April, May, and June (NMFS, 2009b).

The nearest feature designated as EFH for corals is located approximately 14 miles (23 km) west-northwest from the lease area. An accidental spill could reach or affect this feature, although near-bottom currents in the region are expected to flow along the isobaths (Nowlin et al., 2001, Valentine et al., 2014) and typically would not carry a plume up onto the continental shelf edge.

C.6 Archaeological Resources

C.6.1 Shipwreck Sites

Based on NTL 2011-JOINT-G01, the lease area is on BOEM's list of archaeology survey blocks (BOEM, 2011). No archaeological resources were noted in the site clearance letter for the wellsite where the proposed installation activities will occur (Geoscience Earth & Marine Services Inc., 2014).

Anadarko will abide by the applicable requirements of NTL 2005-G07, which stipulate that work be stopped at the project site if any previously undetected archaeological resource is discovered after work has begun until appropriate surveys and evaluations have been completed. Because there are no known shipwreck sites in the lease area, there are no routine IPFs that are likely to affect shipwrecks. Impacts of a large oil spill are the only IPFs considered. A small diesel fuel spill would not affect shipwrecks because the oil would float and dissipate on the sea surface.

Impacts of a Large Oil Spill

BOEM (2012a) estimated that a severe subsurface blowout could resuspend and disperse sediments within a 984 ft (300 m) radius. Because there are no historic shipwrecks in the lease area, this impact would not be relevant.

Beyond this radius, there is the potential for impacts from oil, dispersants, and depleted oxygen levels. These impacts could include chemical contamination as well as alteration of the rates of microbial activity (BOEM, 2017a). During the Macondo spill, subsurface plumes were reported at a water depth of approximately 3,609 ft (1,100 m), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface plumes apparently resulted from the use of subsea dispersants at the wellhead (NOAA, 2011c). While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could have the potential to contact shipwreck sites beyond the 984 ft (300 m) radius estimated by BOEM (2012a), depending on its extent, trajectory, and persistence (Spier et al., 2013). If oil from a subsea spill should come into contact with wooden shipwrecks on the seafloor, it could adversely affect their condition or preservation. Should there be any indication that potential shipwreck sites could be affected, in accordance with NTL 2005-G07, Anadarko will immediately halt operations, take steps to ensure that the site is not disturbed in any way, and contact BOEM Regional Supervisor, Leasing and Environment, within 48 hours of its discovery. Anadarko would cease all operations within 1,000 ft (305 m) of the site until the Regional Supervisor provides instructions on steps to take to assess the site's potential historic significance and protect it.

A spill entering shallow coastal waters could conceivably contaminate an undiscovered shipwreck site. The 30-day OSRA modeling summarized in **Table 3** predicts that shorelines in

Plaquemines Parish, Louisiana, is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Mississippi, or Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. In addition, the 60-day OSRA modeling (**Table 4**) predicts that shorelines between Matagorda County, Texas, and Levy County, Florida, have up to a 24% conditional probability of oil contact within 60 days of a spill. If an oil spill contacted a coastal historic site, such as a fort or a lighthouse, the impacts may be temporary and reversible (BOEM, 2017a).

C.6.2 Prehistoric Archaeological Sites

With a water depth at the location of the proposed activities approximately 5,466 ft (1,666 m), the project area is well beyond the 197 ft (60 m) depth contour used by BOEM as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. Because of this, the only relevant IPF is a large oil spill. A small diesel fuel spill would not affect prehistoric archaeological resources because the oil would float and dissipate on the sea surface.

Impacts of a Large Oil Spill

Because of the water depth and the lack of prehistoric archaeological sites found in the lease area, they would not be impacted by the physical effects of a subsea blowout. BOEM (2012a) estimated that a severe subsurface blowout could resuspend and disperse sediments within a 984 ft (300 m) radius.

Along the northern Gulf Coast, prehistoric sites occur frequently along the barrier islands and mainland coast and along the margins of bays and bayous (BOEM, 2016a). The 30-day OSRA modeling summarized in **Table 3** estimates that shorelines in Plaquemines Parish, Louisiana, is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Mississippi, or Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. In addition, the 60-day OSRA modeling (**Table 4**) predicts that shorelines between Matagorda County, Texas, and Levy County, Florida, have up to a 24% conditional probability of oil contact within 60 days of a spill. If a spill did reach a prehistoric site along these shorelines, it could coat fragile artifacts or site features and compromise the potential for radiocarbon dating organic materials in a site. Coastal prehistoric sites also could be damaged by spill cleanup operations (e.g., by destroying fragile artifacts and disturbing the provenance of artifacts and site features). BOEM (2017c) notes that some unavoidable direct and indirect impacts on coastal historic resources could occur, resulting in the loss of information.

C.7 Coastal Habitats and Protected Areas

Coastal habitats in the northeastern Gulf of Mexico that may be affected by oil and gas activities are described by BOEM (2016a, 2017 a,b), and are tabulated in the OSRP. Coastal habitats inshore of the project area include coastal and barrier island beaches and dunes, wetlands, and submerged seagrass beds. Most of the northeastern Gulf of Mexico is fringed by coastal and barrier island beaches, with wetlands and submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries.

Due to the distance from shore, the only IPF associated with routine activities in the lease area that could affect beaches and dunes, wetlands, seagrass beds, coastal wildlife refuges, wilderness areas, or any other managed or protected coastal area is support vessel traffic. The support bases at Port Fourchon and Houma, Louisiana, are not in wildlife refuges or wilderness areas. Potential impacts of support vessel traffic are briefly addressed below.

A large oil spill is the only accidental IPF that could affect coastal habitats and protected areas. A small diesel fuel spill in the lease area would be unlikely to affect coastal habitats due to the lease area's distance from the nearest shoreline. As explained in **Section A.9.1**, a small diesel fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion.

Impacts of Support Vessel Traffic

Support operations, including crew boats and supply boats as detailed in **DOCD Section H**, may have a minor incremental impact on coastal and barrier island beaches, wetlands, and protected areas. Over time with a large number of vessel trips, vessel wakes can erode shorelines along inlets, channels, and harbors, resulting in localized land loss. Impacts to beaches, wetlands, and protected areas will be minimized by following the speed and wake restrictions in harbors and channels.

Support operations, including crew boats and supply boats are not anticipated to have a significant impact on submerged seagrass beds. While submerged seagrass beds have the potential to be uprooted, scarred, or lost due to direct contact from vessels, use of navigation channels and adherence to local requirements and implemented programs will decrease the likelihood of impacts to submerged seagrass beds (BOEM, 2017 a,b).

Impacts of a Large Oil Spill

Potential spill impacts on coastal habitats are discussed by BOEM (2017a). Coastal habitats inshore of the project area include coastal and barrier island beaches, wetlands, and submerged seagrass beds. For this DOCD, there are no unique site-specific issues with respect to coastal habitats.

The 30-day OSRA modeling (**Table 3**) indicates that shorelines in Plaquemines Parish, Louisiana, is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Mississippi, or Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. The 60-day OSRA modeling (**Table 4**) predicts that shorelines between Matagorda County, Texas, and Levy County, Florida, have up to a 24% conditional probability of oil contact within 60 days of a spill.

The shorelines within the geographic range predicted by the 60-day OSRA modeling (**Table 4**) include extensive barrier beaches and wetlands, with submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries. NWRs and other protected areas along the coast are discussed by BOEM (2017a) and Anadarko's OSRP. Based on the 30-day OSRA, coastal and near-coastal wildlife refuges, wilderness areas, and state and national parks within the geographic range of the potential shoreline contacts within 30 days are presented in **Table 7**.

Table 7. Wildlife refuges, wilderness areas, and state and national parks and preserves within the geographic range of 1% or greater conditional probability of shoreline contacts within 30 days based on the 30-day Oil Spill Risk Analysis model.

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
Terrebonne, Louisiana	Isles Dernieres Barrier Islands Refuge
	Pointe aux Chenes Wildlife Management Area
Lafourche, Louisiana	East Timbalier Island National Wildlife Refuge
	Pointe aux Chenes Wildlife Management Area
	Wisner Wildlife Management Area (Includes Picciola Tract)
Plaquemines, Louisiana	Breton National Wildlife Refuge
	Delta National Wildlife Refuge
	Pass a Loutre Wildlife Management Area
St. Bernard, Louisiana	Biloxi Wildlife Management Area
	Breton National Wildlife Refuge
	Saint Bernard State Park
Hancock and Harrison, Mississippi	Grand Bayou Preserve
	Jourdan River Preserve
	Hancock County Marshes Preserve
	Bayou Portage Preserve
	Biloxi River Marshes Preserve
	Cat Island Preserve
	Deer Island Preserve
	Gulf Islands National Seashore
	Hiller Park Recreational Area
	Sandhill Crane Refuge Preserve
	Ship Island Preserve
	Wolf River Preserve
Jackson, Mississippi	Bellefontaine Marsh Preserve
	Davis Bayou Preserve
	Escatawpa River Marsh Preserve
	Grand Bay National Estuarine Research Reserve
	Grand Bay Savanna Preserve
	Graveline Bay Preserve
	Gulf Islands National Seashore
	Gulf Islands Wilderness
	Horn Island Preserve
	Old Fort Bayou Preserve
	Pascagoula River Marsh Preserve
	Petit Bois Island Preserve
	Round Island Preserve
	Shepard State Park

Table 7. (Continued).

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
Baldwin, Alabama	Betty and Crawford Rainwater Perdido River Nature Preserve
	Bon Secour National Wildlife Refuge
	Gulf State Park
	Meaher State Park
	Mobile-Tensaw Delta CIAP Parcel State Habitat Area
	Mobile-Tensaw Delta Wildlife Management Area
	Perdido River Water Management Area
	W.L. Holland Wildlife Management Area
	Weeks Bay Harris and Worcester Tracts
	Weeks Bay National Estuarine Research Reserve
	Weeks Bay Reserve Addition - Beck Tract
Mobile, Alabama	Grand Bay National Wildlife Refuge
	Grand Bay Savanna State Nature Preserve
	Mobile-Tensaw Delta Wildlife Management Area
	Penalver Park
	The Grand Bay Savanna Tract (and Addition Tract)
	W.L. Holland Wildlife Management Area
Escambia, Florida	Bayou Marcus Wetlands
	Big Lagoon State Park
	Blue Angel Recreation Park
	Bay Bluffs Park
	Ft. Pickens Aquatic Preserve
	Gulf Islands National Seashore
	Mallory Heights Park #3
	Perdido Bay/Crown Pointe Preserve
	Perdido Key State Park
	Tarkiln Bayou Preserve State Park
	USS Massachusetts (BB-2) Underwater Archaeological Preserve
	Wayside Park
Okaloosa, Florida	Eglin Beach Park
	Fred Gannon Rocky Bayou State Park
	Gulf Islands National Seashore
	Henderson Beach State Park
	Rocky Bayou Aquatic Preserve
	Yellow River Wildlife Management Area
Walton, Florida	Choctawhatchee River Delta Preserve
	Choctawhatchee River Water Management Area
	Deer Lake State Park
	Grayton Beach State Park
	Point Washington State Forest
	Topsail Hill Preserve State Park
Bay, Florida	Camp Helen State Park
	SS Tarpon Underwater Archaeological Preserve
	St. Andrews Aquatic Preserve
	St. Andrews State Park
	Vamar Underwater Archaeological Preserve

Table 7. (Continued).

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
Gulf, Florida	Apalachicola Bay Aquatic Preserve
	Apalachicola National Estuarine Research Reserve
	Apalachicola River Wildlife and Environmental Area
	Apalachicola River Water Management Area
	Box-R Wildlife Management Area
	Constitution Convention Museum State Park
	St. Joseph Bay State Buffer Preserve
	St. Joseph Bay Aquatic Preserve
	T.H. Stone Memorial St. Joseph Peninsula State Park
Franklin, Florida	Alligator Harbor Aquatic Preserve
	Apalachicola Bay Aquatic Preserve
	Apalachicola National Estuarine Research Reserve
	Bald Point State Park
	Cape St. George State Island State Reserve
	Dr. Julian G. Bruce St. George Island State Park
	Jeff Lewis Wilderness Preserve
	John S. Phipps Preserve
	St. Marks National Wildlife Refuge
	St. Vincent National Wildlife Refuge
	Tate's Hell State Forest

The level of impacts from oil spills on coastal habitats depends on many factors, including the oil characteristics, the geographic location of the landfall, and the weather and oceanographic conditions during the time of the spill (BOEM, 2017 a,b). Oil that makes it to beaches may be either liquid weathered oil, an oil-and-water mousse, or tarballs. Oil is generally deposited on beaches in lines defined by wave action at the time of landfall. Oil that remains on the beach will thicken as its volatile components are lost. Thickened oil may form tarballs or aggregations that incorporate sand, shell, and other materials into its mass. Tar may be buried to varying depths under the sand. On warm days, both exposed and buried tarballs may liquefy and ooze. Oozing may also serve to expand the size of a mass as it incorporates beach materials. Oil on beaches may be cleaned up manually, mechanically, or both. Some oil can remain on the beach at varying depths and may persist for several years as it slowly biodegrades and volatilizes (BOEM, 2017a). Impacts associated with an extensive oiling of coastal and barrier island beaches from a large oil spill are expected to be adverse.

Coastal wetlands are highly sensitive to oiling and can be significantly affected because of the inherent toxicity of hydrocarbon and non-hydrocarbon components of the spilled substances (Beazley et al., 2012, Lin and Mendelssohn, 2012, Mendelssohn et al., 2012). Numerous variables such as oil concentration and chemical composition, vegetation type and density, season or weather, preexisting stress levels, soil types, and water levels may influence the impacts of oil exposure on wetlands. Light oiling could cause plant die-back, followed by recovery in a fairly short time. Vegetation exposed to oil that persists in wetlands could take years to recover (BOEM, 2017a). However, in a study in Barataria Bay, Louisiana, after the Macondo spill, Silliman et al. (2012) reported that vegetation in previously healthy marshes largely recovered to a pre-oiling state within 18 months. Oiled marshes that had prior accelerated rates of erosion experienced a bio-geomorphological feedback that further increased marsh loss to erosion and did not experience regrowth (Silliman et al., 2012). In addition to the direct impacts of oil, cleanup activities in marshes may accelerate rates of erosion and retard recovery rates (BOEM, 2017a, Lin et al., 2016, Turner et al., 2016, b). A recent review of the literature and new studies indicated that oil spill impacts to seagrass beds are often limited and may be limited to when oil is in direct contact with these plants (Fonseca et al., 2017). Impacts associated with an extensive oiling of coastal wetland habitat from a large oil spill are expected to be significant.

C.8 Socioeconomic and Other Resources

C.8.1 Recreational and Commercial Fishing

Potential impacts to recreational and commercial fishing are analyzed by BOEM (2017 a,b). The main commercial fishing activity in deep waters of the northern Gulf of Mexico is pelagic longlining for tunas, swordfishes, and other billfishes (Continental Shelf Associates, 2002). Pelagic longlining has occurred historically in the project area, primarily during spring and summer.

Longline gear consists of monofilament line deployed from a moving vessel and generally allowed to drift for 4 to 5 hours. As the mainline is put out, baited leaders and buoys are clipped in place at regular intervals. It takes 8 to 10 hours to deploy a longline and approximately the same time to retrieve it. Longlines are often set near oceanographic features such as fronts or downwellings, with the aid of sophisticated onboard temperature sensors, depth finders, and positioning equipment. Vessels typically are 33 to 98 ft (10 to 30 m) long, and their trips last from 1 to 3 weeks. The main Gulf of Mexico homeports for longlining vessels are in Louisiana (Dulac and Venice) and Florida (Destin, Madeira Beach, and Panama City) (Continental Shelf Associates, 2002).

It is unlikely that any commercial fishing activity other than longlining will occur in or near the project area due to the water depth at the project area. Benthic species targeted by commercial fishers occur on the upper continental slope, well inshore of the project area. Royal red shrimp (*Pleoticus robustus*) are caught by trawlers in water depths of approximately 820 to 1,804 ft (250 to 550 m). Tilefishes (primarily *Lophalotilus chamaeleonticeps*) are caught by bottom longlining in water depths from approximately 540 to 1,476 ft (165 to 450 m) (Continental Shelf Associates, 2002).

Most recreational fishing activity in the region occurs in water depths less than 656 ft (200 m) (Continental Shelf Associates, 1997, 2002). In deeper water, the main attraction to recreational fishers is petroleum rigs offshore Texas and Louisiana. Due to the project site's distance from shore, it is unlikely that recreational fishing activity is occurring in the lease area.

The only routine IPF potentially affecting fisheries and, therefore, commercial and recreational fishing, is construction vessel presence (including noise and lights). Potential accidental IPFs that could affect fisheries are include both a small diesel fuel spill and a large oil spill.

Impacts of Construction Vessel Presence, Noise, and Lights

There is a slight possibility of pelagic longlines becoming entangled in the construction vessel. For example, in January 1999 a portion of a pelagic longline snagged on the acoustic Doppler current profiler of a drillship working in the Gulf of Mexico (Continental Shelf Associates, 2002).

The line was removed without incident. Generally, longline fishers use radar and are aware of offshore structures and ships when placing their sets. Therefore, little or no impact on pelagic longlining is expected.

Because it is unlikely that any recreational fishing activity is occurring in the project area, no adverse impacts are anticipated. Other factors such as effluent discharges are likely to have negligible impacts on commercial or recreational fisheries due to rapid dispersion, the small area of ocean affected, and the intermittent nature of the discharges.

Impacts of a Small Diesel Fuel Spill

Pelagic longlining activities in the lease area, if any, could be interrupted in the event of a small diesel fuel spill. The sea surface area covered with diesel fuel would range from 0.5 to 5 ha (1.2 to 12 ac), depending on sea state and weather conditions (**Section A.9.1**). Fishing activities could be interrupted due to the activities of response vessels operating in the lease area. A small diesel fuel spill would not affect coastal water quality because the spill would not be expected to make landfall or reach coastal waters prior to natural dispersion (**Section A.9.1**).

The probability of a fuel spill will be minimized by Anadarko's preventative measures that will be implemented during routine operations, including fuel transfers. In the unlikely event of a spill, implementation of Anadarko's OSRP could potentially mitigate and reduce the potential for impacts. **DOCD Section I** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur is expected to be very brief.

Impacts of a Large Oil Spill

Potential spill impacts on fishing activities are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to this activity.

Pelagic longlining activities in the lease area and other fishing activities in the northern Gulf of Mexico could be interrupted in the event of a large oil spill. A spill may or may not result in fishery closures, depending on the duration of the spill, the oceanographic and meteorological conditions at the time, and the effectiveness of spill response measures. Data following the Macondo spill provide information about the maximum potential extent of fishery closures in the event of a large oil spill in the Gulf of Mexico (NMFS, 2010b). At its peak on 12 July 2010, closures encompassed 84,101 miles^2 (217,821 km^2), or 34.8% of the U.S. Gulf of Mexico EEZ. BOEM (2012a) notes that fisheries closures from a large spill event could have a negative effect on short-term fisheries catch and marketability.

According to BOEM (2012a, 2017 a,b), the potential impacts on commercial and recreational fishing activities from an accidental oil spill are anticipated to be minimal because the potential for oil spills is very low, the most typical events are small and of short duration, and the effects are so localized that fishes are typically able to avoid the affected area. Fish populations may be affected by an oil spill event should it occur, but they would be primarily affected if the oil reaches the productive shelf and estuarine areas where many fishes spend a portion of their life cycle. The probability of an offshore spill affecting these nearshore environments is also low. Should a large oil spill occur, economic impacts on commercial and recreational fishing activities would likely occur, but are difficult to predict because impacts would differ by fishery and season (BOEM, 2017a,b).

C.8.2 Public Health and Safety

There are no IPFs associated with routine operations that are expected to affect public health and safety. A small diesel fuel spill would not have any impacts on public health and safety because it would affect only a small area of the open ocean. The lease area is approximately 66 miles (106 km) from the nearest shoreline and nearly all of the diesel fuel would evaporate or disperse naturally within 24 hours (**Section A.9.1**). Impacts of a large oil spill are addressed below.

Impacts of a Large Oil Spill

In the event of a large spill from a blowout, the main safety and health concerns are those of the offshore personnel involved in the incident and those responding to the spill. The proposed activities will be covered by Anadarko's Regional OSRP and the construction vessel's emergency response plans.

Depending on the spill rate and duration, the physical/chemical characteristics of the oil, meteorological and oceanographic conditions at the time, and the effectiveness of spill response measures, the public could be exposed to oil on the water and along the shoreline, including skin contact or breathing VOCs. Oil is a highly flammable material, and any smoke or vapors from an oil fire can cause irritation, and in large quantities may pose a health hazard.

Studies conducted after the Macondo spill provide relevant information about the types of health issues that may occur in the event of a large oil spill. Wildlife cleaning and rehabilitation workers have reported concerns including scrapes and cuts, itchy or red skin or rash, and symptoms of headache or feeling faint, dizzy, or fatigued (King and Gibbins, 2011). Hand, shoulder, or back pain was reported by some wildlife-cleaning workers as well. Awkward postures, repetitive motions, and heavy lifting tasks were noted by investigators as contributing to musculoskeletal symptoms. Personnel working on offshore vessels or providing direct oversight to offshore vessels, including USCG personnel, civilian contractors, and other responders who were exposed to oil and dispersants, had a 7 to 12 times higher prevalence of upper respiratory symptoms and cough than those not exposed (Centers for Disease Control and Prevention, 2010). Another potential occupational hazard for spill response workers in general was heat stress from work in a hot and humid environment (King and Gibbins, 2011). Initial symptoms from cleanup workers who sought medical care in Louisiana were typical of acute exposure to hydrocarbons or H_2S (e.g., headaches, dizziness, nausea, vomiting, cough, respiratory distress, and chest pain) (Solomon and Janssen, 2010). Impacts associated with a large oil spill to public safety are expected to be adverse but not significant.

C.8.3 Employment and Infrastructure

There are no IPFs associated with routine operations that are expected to affect employment and infrastructure. The project involves support from an installation vessel contractor and associated third-party services, and existing shorebase facilities in Louisiana. No new or expanded facilities will be constructed, and no new employees are expected to move permanently into the area. The project will have a negligible impact on socioeconomic conditions such as local employment and existing offshore and coastal infrastructure. A small diesel fuel spill that is dissipated within a few days would have little or no economic impact, as the spill response would use existing facilities, resources, and personnel. Impacts of a large oil spill on employment and infrastrucre are addressed below.

Impacts of a Large Oil Spill

Potential socioeconomic impacts of an oil spill are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to employment and coastal infrastructure. A large spill could cause economic impacts in several ways: it could result in extensive fishery closures that put fishermen out of work; it could result in temporary employment as part of the response effort; it could result in adverse publicity that affects employment in coastal recreation and tourism industries; and it could result in another suspension of OCS drilling activities, including service and support operations that are an important part of local economies.

In addition to the analyses presented by BOEM (2012a), a study explored the economic impacts of the Macondo spill on oil and gas industry employment due to suspension of deepwater drilling (U.S. Department of Commerce, 2010). The study indicates that during the moratorium, the number of oil industry workers in the Gulf of Mexico fell by approximately 2,000 and may have indirectly caused a temporary loss of 8,000 to 12,000 jobs along the Gulf Coast. Total spending by drilling operators is estimated to have declined by $1.8 billion over a 6-month period; this direct reduction in spending affected employment in the industries that supply the Gulf drilling industry and in all other industries affected by declines in consumer and business spending (U.S. Department of Commerce, 2010).

As noted by BOEM (2012a), the short-term social and economic consequences for the Gulf Coast region should a large spill occur include the opportunity cost of employment and expenditures that could have gone to production or consumption rather the spill cleanup efforts. Nonmarket effects such as traffic congestion, strains on public services, shortages of commodities or services, and disruptions to the normal patterns of activities or expectations could also occur in the short term. These negative, short-term social and economic consequences of a spill are expected to be modest in terms of projected cleanup expenditures and the number of people employed in cleanup and remediation activities (BOEM, 2017 a,b). Net employment impacts from a spill would not be expected to exceed 1% of baseline employment in any given year (BOEM, 2012a).

C.8.4 Recreation and Tourism

For this DOCD, there are no unique site-specific issues with respect to this recreation and tourism. There are no known recreational uses of the lease area. Recreational resources and tourism in coastal areas would not be affected by any routine activities due to the distance from shore. Compliance with NTL BSEE-2015-G03 (**Table 1**) will minimize the chance of trash or debris being lost overboard from the construction vessel and subsequently washing up on beaches. A small diesel fuel spill in the lease area would be unlikely to affect recreation and tourism because, as explained in **Section A.9.1**, it would not be expected to make landfall or reach coastal waters prior to breaking up. Impacts of a large oil spill on recreation and tourism are discussed below.

Impacts of a Large Oil Spill

Potential impacts of an oil spill on recreation and tourism are discussed by BOEM (2017 a,b). For this DOCD, there are no unique site-specific issues with respect to these impacts.

Impacts on recreation and tourism would vary depending on the duration of the spill and its fate including the effectiveness of response measures. A large spill that reached coastal waters and shorelines could adversely affect recreation and tourism by contaminating beaches and wetlands, resulting in negative publicity that encourages people to stay away. The 30-day OSRA modeling (**Table 3**) indicates that Plaquemines Parish in Louisiana is the coastal area most likely to be affected (7% probability within 10 days; and 17% probability within 30 days). Other Louisiana, Mississippi, or Alabama shorelines may be affected within 10 days, and some shorelines in Florida could be affected within 30 days. However, the 60-day OSRA modeling (**Table 4**) predicts that shorelines between Matagorda County, Texas, and Levy County, Florida, have up to a 24% conditional probability of oil contact within 60 days of a spill.

According to BOEM (2017 a,b), should an oil spill occur and contact a beach area or other recreational resource, it would cause some disruption during the impact and cleanup phases of the spill. However, these effects are also likely to be small in scale and of short duration, in part because the probability of an offshore spill contacting most beaches is small. In the unlikely event that a spill occurs that is sufficiently large enough to affect large areas of the coast and, through public perception, have effects that reach beyond the damaged area, effects to recreation and tourism could be significant (BOEM, 2017 a,b).

Impacts of the Macondo spill on recreation and tourism provide some insight into the potential effects of a large spill. NOAA (2016b) estimated that the public lost 16,857,116 user days of fishing, boating, and beach-going experiences as a result of the spill. The U.S. Travel Association has estimated the economic impact of the Macondo spill on tourism across the Gulf Coast over a 3-year period at $22.7 billion (Oxford Economics, 2010). Hotels and restaurants were the most affected tourism businesses, but charter fishing, marinas, and boat dealers and sellers were among the others affected (Eastern Research Group, 2014).

C.8.5 Land Use

Land use along the northern Gulf Coast is discussed by BOEM (2016a, 2017a). There are no routine IPFs that could affect land use. The project will use existing onshore support facilities in Louisiana. The land use at the existing shorebase sites is industrial. The project will not involve any new construction or changes to existing land use and therefore will not have any impacts. Levels of boat and helicopter traffic as well as demand for goods and services including scarce coastal resources will represent a small fraction of the level of activity occurring at the shorebases.

A large oil spill is the only relevant IPF on land use. A small diesel fuel spill would not have any impacts on land use, as the response would be staged out of existing shorebases and facilities.

Impacts of a Large Oil Spill

The initial response for a large oil spill would be staged out of existing facilities with no effect on land use. A large spill could have limited temporary impacts on land use along the coast if additional staging areas were needed. For example, during the Macondo spill, temporary staging areas were established in Louisiana, Mississippi, Alabama, and Florida for spill response and cleanup efforts. In the event of a large spill in the lease area, similar temporary staging areas could be needed. These areas would eventually return to their original use as the response is demobilized.

An accidental oil spill is not likely to significantly affect land use and coastal infrastructure in the region, in part because an offshore spill would have a small probability of contacting onshore resources. BOEM (2016b) states that landfill capacity would probably not be an issue at any phase of an oil spill event or the long-term recovery. In the case of the Macondo spill and response, the USEPA reported that existing landfills receiving oil spill waste had plenty of capacity to handle waste volumes; the wastes that were disposed of in landfills represented <7% of the total daily waste normally accepted at these landfills (USEPA, 2016).

C.8.6 Other Marine Uses

The lease area is not located within any USCG-designated fairway orshipping lane, but is located within Military Warning Area W-155B. The site clearance letter for the wellsite where the proposed activities will occur one well, one umbilical, and two pipelines within 2,000 ft (610 m) (Geoscience Earth & Marine Services Inc., 2014). Anadarko will comply with BOEM requirements and lease stipulations to avoid impacts to other marine uses.

There are no IPFs from routine project activities that are likely to affect other marine uses of the lease area. A large oil spill is the only relevant accident-related IPF on other marine uses. A small diesel fuel spill would not have any impacts on other marine uses because spill response activities would be mainly within the lease area and the duration would be brief.

Impacts of a Large Oil Spill

In the event of a large spill requiring numerous response vessels, coordination would be required to manage the vessel traffic for safe operations and to ensure that no anchoring or seafloor-disturbing activities occur near the existing wells. Other OCS activities located nearby the location of a large spill may be temporarily interrupted, which could include evacuation of non-essential personnel. Anadarko will comply with BOEM requirements and lease stipulations to avoid impacts on uses of the area by military vessels and aircraft.

C.9 Cumulative Impacts

For purposes of the National Environmental Policy Act, cumulative impact is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 CFR 1508.7). Any single activity or action may have a negligible impact(s) by itself, but when combined with impacts from other activities in the same area or time period, substantial impacts may result.

<u>Prior Studies:</u>

BOEM (2017a) prepared a multisale EIS in which it analyzed the environmental impact of activities that might occur in the multisale area. The level and types of activities planned in Anadarko's DOCD are within the range of activities described and evaluated by BOEM in the 2017 to 2022 Programmatic EIS for the OCS Oil and Gas Leasing Program (BOEM, 2016a), and the Final EIS for Gulf of Mexico OCS Oil and Gas Lease Sales 2017-2022 (BOEM, 2017a). Past, present, and reasonably foreseeable activities are identified in the cumulative effects scenario of these documents, which are incorporated by reference. The proposed activities should not result in any additional impacts beyond those evaluated in the multisale and Final EISs.

Description of Activities Reasonably Expected to Occur in the Vicinity of Project Area:

Other exploration and development activities are ongoing in the vicinity of the proposed project area. Anadarko does not anticipate other projects in the vicinity of the proposed project location beyond the types of projects analyzed in the lease sale and Supplemental EISs (BOEM, 2012 a,b, 2013a, 2014a, 2015, 2016b, 2017a,b).

Cumulative Impacts of Activities in this DOCD:

The BOEM (2017a) Final EIS included a lengthy discussion of cumulative impacts, which analyzed the environmental and socioeconomic impacts from the incremental impacts of the 10 proposed lease sales, in addition to all activities (including non-OCS activities) projected to occur from past, proposed, and future lease sales. The following activities were considered in development of the EISs: exploration, delineation, and development of wells, platform installation, service vessel trips, and oil spills. The EISs examined the potential cumulative effects on each specific resource for the entire Gulf of Mexico.

The level and type of activity proposed in Anadarko's DOCD are within the range of activities described and evaluated in the recent lease sale EISs. The EIA incorporates and builds on these analyses by examining the potential impacts on physical, biological, and socioeconomic resources from the work planned in this DOCD along with other reasonably foreseeable activities expected to occur in the Gulf of Mexico. Thus, for all impacts, the incremental contribution of Anadarko's proposed actions to the cumulative impacts in these prior analyses should not be significant.

D. Environmental Hazards

D.1 Geologic Hazards

The location of the wellsiute where the proposed activities will occcur is free of constraining seafloor conditions (Geoscience Earth & Marine Services Inc., 2014). See **DOCD Section D** for supporting geological and geophysical information.

D.2 Severe Weather

Under most circumstances, weather is not expected to have any effect on the proposed activities. Extreme weather, including high winds, strong currents, and large waves, was considered in the design criteria for the construction vessel under consideration for this project. High winds and limited visibility during a severe storm could disrupt support activities (vessel and helicopter traffic) and make it necessary to suspend some activities for safety reasons until the storm or weather event passes. In the event of a hurricane, procedures as outlined in the Hurricane Evacuation Plan would be adhered to. Evacuation in the event of a hurricane or other severe weather would increase the number and frequency of support vessel and helicopter trips to and from the project area.

D.3 Currents and Waves

Metocean conditions such as sea states, wind speed, and ocean currents will be continuously monitored. Under most circumstances, physical oceanographic conditions are not expected to have any effect on the proposed activities. Strong currents (e.g., caused by Loop Current eddies and intrusions) and large waves were considered in the design criteria for the construction vessel under consideration for this project. High waves during a severe storm could disrupt support activities (i.e., vessel and helicopter traffic) and make it necessary to suspend some activities for safety reasons until the storm or weather event passes.

E. Alternatives

No formal alternatives were evaluated in the EIA for this DOCD. However, various technical and operational options, including the locations of the wellsites and the selection of the construction vessel were considered by Anadarko in developing the proposed action.

F. Mitigation Measures

The proposed action includes numerous mitigation measures required by laws, regulations, and BSEE and BOEM lease stipulations and NTLs. The project will comply with all applicable federal, state, and local requirements concerning air pollutant emissions, discharges to water, and solid waste disposal. All project activities will be conducted under guidance by Anadarko's OSRP and Safety and Environmental Management System. Additional information can be found in **DOCD Section I**.

G. Consultation

No persons or agencies beyond those cited as Preparers (**Section H**) were consulted during the preparation of the EIA.

H. Preparers

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ADMINISTRATIVE INFORMATION

(a) Proprietary Information

Proprietary copies of this plan contain information not available to the public and include structure maps, seismic information, cross sections, depths of wells, etc.

(b) Bibliography

1. Shallow Hazards Report
2. C&C Technologies Survey Services. Archaeological Report (Job No. 072217)
3. Revised EP Control No. R-6011
4. Supplemental EP Control No. S-7864
5. Final Sale Packages for Gulf of Mexico, Sale Number 81