UNITED STATES GOVERNMENT MEMORANDUM

July 1, 2020

To: Public Information

From: Plan Coordinator, OLP, Plans Section (GM 235D)

Subject: Public Information copy of plan

Control #	-	Control S-7994
Type	-	Supplemental Development Operations Coordination Document
Lease(s)	-	OCS-G 17565 Block - 857 Alaminos Canyon Area OCS-G 17571 Block - 901 Alaminos Canyon Area
Operator	-	Shell Offshore Inc.
Description	-	Subsea Wells GD004, GD004-Alt A, GD004-Alt B, GD005, GD005 Alt, GD006, GD006 Alt-A, GD006 Alt-B, GD007, and GD007 Alt
Rig Type	-	Drillship or DP Semisubmersible

Attached is a copy of the subject plan.

It has been deemed submitted and is under review for approval.

Michelle Griffitt Evans
Plan Coordinator

Shell Offshore Inc.
P. O. Box 61933
New Orleans, LA 70161-1933
United States of America
Tel +1 504 425 7215
Fax +1 504 425 8076
Email: Sylvia.bellone@shell.com

Public Information Copy

January 14, 2020

Mrs. Michelle Picou, Section Chief
Bureau of Ocean Energy Management
1201 Elmwood Park Boulevard
New Orleans, LA 70123-2394

Attn: Plans Group GM 235D

SUBJECT: Suppplemental Development Operations Corrdination Document (SDOCD)
Aliminos Canyon Block 857 OCS-G 17565
Aliminos Canyon Block 901 OCS-G 17571
Offshore Texas

Dear Mrs. Picou:

In compliance with 30 CFR 550.211 and NTLs 2008-G04, 2009-G27 and 2015-N01, giving Development Plan guidelines, Shell Offshore Inc. (Shell) requests your approval of this Supplemental Development Operations Coordination Document for the tieing in and production of ten new subsea wells. The wells will produce to the existing Shell Perdido Regional Host locted in Alaminos Canyon Block 857.

This plan consists of a series of attachments describing our intended operations. The attachments we desire to be exempted from disclosure under the Freedom of Information Act are marked "Proprietary" and excluded from the Public Information Copies of this submittal.

The cost recovery fee documentation is attached.

Should you require additional information, please contact Sylvia Bellone at 504.425.7215, sylvia.bellone@shell.com, or Tracy Albert at 504.425.4652, tracy.albert@shell.com.

Sincerely,

Sylvia A. Bellone

Sylvia A. Bellone

SHELL OFFSHORE INC.

SUPPLEMENTAL DEVELOPMENT OPERATIONS COORDINATION DOCUMENT

For

ALAMINOS CANYON BLOCK 857
ALAMINOS CANYON BLOCK 901
OCS-G 17565 & OCS-G 17571

PUBLIC INFORMATION COPY

JANUARY 2020

PREPARED BY:

Sylvia A. Bellone
Sr. Regulatory Specialist

504.425.7215

sylvia.bellone@shell.com

REVISIONS TABLE:

Date of Request	Plan Section	What was Corrected	Date Resubmitted
4/16/2020	1 – Schedule Update 6 – Threatened/Endangered Species 10- Environmental Monitoring 12- Environmental Mitigation 13– Related Facilities 14 – Support Vessels 18 – Environmental Impact Analysis	Updates as a result of NMFS ESA Section 7 Programmatic Biological Opinion dated 3/13/2020 (BiOp)	6/23/2020

SUPPLEMENTAL DEVELOPMENT OPERATIONS CORRDINATION DOCUMENT
OFFSHORE TEXAS

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SECTION 1: PLAN CONTENTS

A. DESCRIPTION, OBJECTIVES & SCHEDULE

This Supplemental DOCD is to add ten new wells (four primary and six back-ups) to the existing Great White Frio subsea drill centers and subsea infastructure located in Alaminos Canyon (AC) 857. The surface locations will be in Aliminos Canyon (AC) Block 857, OCS-G 17565. The wells covered are as follows:

GD004	GD004 Alt-A	GD004 Alt-B
GD005	GD005 Alt	
GD006	GD006 Alt-A	GD006 Alt-B
GD007	GD007 Alt	

The drilling of the well proposed in this DOCD was previously approved in Supplemental Exploration Plan S-07953 on July 9, 2019. This RDOCD covers the seafloor hardware required to produce the additional GD wells back to the existing Perdido Regional Host located in AC 857 for processing and delivery to flowlines. The Perdido Spar and was covered in the Initial DOCD (approved by the then MMS April 12, 2007, Control Number N-08809). This system remains as previously approved.

The installation vessels for the flowlines and jumpers will be addressed in the BSEE pipeline permits.

The Great White Frio reservoir was discovered in 2002. The initial discovery well AC857-1 drilled by Shell identified unconsolidated oil-bearing sands with good porosity and permeability in the Frio section. Additional appraisal wells were drilled: AC 857-2, AC857-3, AC857-4, AC857-5, AC856-1, AC856-2.

First production began in March 2012 from GD001, which was a 1700 ft open-hole gravel packed well producing from FR 22, FR24, and FR26 sands. GD003 and GD002 were drilled in 2018. GD003 was brought online in July but incurred early sand failure. GD002 is presently online. GD004 was previously covered in DOCD S-7322 and R-5144 but the well was never drilled. The proposed GD004 location was revised in EP S-07953 approved July 9, 2019.

The AC 857 lease is 141 statute miles from the nearest shoreline, 363 statute miles from the onshore support base at Port Fourchon, Louisiana and 220 statute miles from the helicopter base at Galveston, Texas. Water depths at the well sites range from ~8,027′ to ~8,399′ (Attachment 1A).

The proposed rig for well work will either be a dynamically positioned (DP) semi-submersible (Atwood Condor or similar) or a Drill Ship (Noble Don Taylor or similar). Both are self-contained vessels with accommodations for a crew which include quarters, galley and sanitation facilities. The activities will be supported by the support vessels and aircraft as well as onshore support facilities as listed in Sections 14 and 15 of the EP. Shell has employed or contracted with trained personnel to carry out its exploration activities. Shell is committed to local hire, local contracting and local purchasing to the maximum extent possible. Shell personnel and contractors are experienced at operating in the Gulf of Mexico and are well versed in all Federal and State laws regulating operations. Shell's employees and contractors share Shell's deep commitment to operating in a safe and environmentally responsible manner.

Shell, through its parent and affiliate corporations, has extensive experience safely exploring for oil and gas in the Gulf of Mexico. Shell will draw upon this experience in organizing and carrying out its drilling program. Shell believes that the best way to manage blowouts is to prevent them from happening. Significant effort goes into the design and execution of wells and into building and maintaining staff competence. In the unlikely event of a spill, Shell's Regional Oil Spill Response Plan (OSRP) is designed to contain and respond to a spill that meets or exceeds the worst-case discharge (WCD) as detailed in Section 9 of this EP. The WCD does not take into account potential flow mitigating factors such as well bridging, obstructions in wellbore, reservoir barriers, or early intervention. We continue to invest in research and development to improve safety and reliability of our well systems. All operations will be conducted in accordance with applicable federal and state laws, regulations and lease and permit requirements. Shell will have trained personnel and monitoring programs in place to ensure such compliance.

B. LOCATION

See attached location plat (Attachments 1A and 1B) and BOEM forms (Attachments 1C through 1M).

C. RIG SAFETY AND POLLUTION FEATURES

The rig to be used for future well work (Atwood Condor or similar DP semi-submersible or Transocean Deepwater Proteus or similar Drill Ship) will comply with the regulations of the American Bureau of Shipping (ABS), International Maritime Organization (IMO) and the United States Coast Guard (USCG). All drilling operations will be conducted under the provisions of 30 CFR, Part 250, Subpart D and other applicable regulations and notices, including those regarding the avoidance of potential drilling hazards and safety and pollution prevention control. Such measures as inflow detection and well control, monitoring for loss of circulation and seepage loss and casing design will be our primary safety measures. Primary pollution prevention measures are contaminated and non-contaminated drain system, mud drain system and oily water processing.

The following drain items are typical for rigs in Shell's fleet.

DRAIN SYSTEM POLLUTION FEATURES

Drains are provided on the rig in all spaces and on all decks where water or oil can accumulate. The drains are divided into two categories, non-contaminated and contaminated. All deck drains are fitted with a removable strainer plate to prevent debris from entering the system.

Deck drainage from rainfall, rig washing, deck washing and runoff from curbs and gutters, including drip pans and work areas, are discharged depending on if it comes in contact with the contaminated or non-contaminated areas of the Rig.

1) Non-contaminated Drains

Non-contaminated drains are designated as drains that under normal circumstances do not contain hydrocarbons and are mostly located around the main deck and outboard in places where it is unlikely that hydrocarbons will be found. Non-Contaminated drains can be directed overboard or to Non-Hazardous storage tanks. Drains are normally directed to storage tanks and only sent overboard if static sheen test is completed.

All drains that have the ability to go overboard are plugged and labeled and are lined up to normally go into Hazardous and Non-Hazardous storage tanks. Any deviation from this requires a Request for Approval Drain Plug Removal Form to be filled out prior to any plug being pulled. The rig's drain plug program consists of a daily check of all deck drains leading to the sea to verify that their status is as designated.

In the event a leak or spill on deck, the event shall be contained as all drains are lined up to the holding tanks. Emergency spill kits are located around the vessel and kit deployment and notifications will be implemented as needed.

Rig personnel shall ensure that the perimeter kick-plates on weather decks are maintained and drain plugs are in place as needed to ensure a proper seal.

2) Contaminated Drains

Contaminated drains are designated as drains that may contain hydrocarbons, drains from likely zones (rig floor, active mud tanks, etc.) cannot be discharged overboard and are directed to hazardous storage tanks. Drains from zones less likely to be contaminated (BOP setback areas, well test deck, etc.) have the option to go overboard or to the hazardous storage tanks, drains are always directed to storage tank for this system. When oil-based mud is used for drilling it will be collected from decks via a mud vac system or pumped from storage tanks to portable tanks and sent to shore for processing.

3) Oily Water Processing

Oily water is collected in an oily water tank. It must be separated and cannot be pumped overboard until oil content is <15 ppm. The separated oil is pumped to a dirty oil tank and has to be sent ashore for disposal. On board the MODU an oil record log is kept according to instructions included in the log. All waste oil that is sent in to be disposed of is recorded in the MODU's oil log book.

All discharges will be in accordance with applicable NPDES permits. See Section 18, EIA.

4) Lower Hull Bilge System

- The main bilge system is designed to have drains directed to bilge pockets in lower machinery rooms or directly to the FWD and Aft bilge storage tanks. They are electrically driven, self-priming centrifugal pumps – forward and aft that automatically pump bilge pockets to storage tanks when high level is sensed.
- Bilge water is stored onboard and pumped overboard via the Oily Water Separator if below 15 PPM.

The Bilge pumps are manual/automatic type pumps. They are equipped with sensors that give a high and a high alarm. They are set to a point at which the water gets to a certain point they will automatically turn on to pump water out in order to keep flooding under control. The pumps are also capable of being put in manual mode in which they can be turned on by hand.

5) Emergency Bilge System

The Vessel has specific procedures for emergency bilge operations. It has emergency bilge pumps forward and aft for secondary response of de-watering vessel areas. For emergency purposes these overboard valves are kept open at all times. The pumps are manually controlled by the engine room operator in the Engine control room and all bilge pockets can be pumped and controlled from this area. In addition to this there is a third means of dewatering the vessel utilizing saltwater pumps and ballast pumps in various aft spaces. These valves must be manually operated in the affected machinery room.

6) Oily Water Drain/Separation System

Oily water/engine room bilge water is collected in an oily water tank. It must be separated and not pumped overboard until oil content is <15 ppm. The separated oil is pumped to a dirty oil tank and will to be sent ashore for disposal. On board all drilling Units, an oil record log is kept according to instructions included in the log.

The rig floor drains go to the hazardous or non-hazardous drain system. From there they are pumped through a 15ppm meter before going overboard or being diverted to a drain holding tank. Once the drain holding thank is full it is processed through a decanting and centrifugal separation system. The heavy solids that cannot pass are pumped to a tote and sent in for processing, the remaining fluid is either sent back to the holding tank or if under 15ppm it is diverted overboard.

7) Drain, Effluent and Waste Systems

- The rig's drainage system is designed in line with our environmental and single point discharge policies. Drains are either hazardous, i.e. from a hazardous area as depicted on the Area Classification drawings, or non-hazardous drains from nonhazardous areas.
- To prevent migration of hazardous materials and flammable gas from hazardous to non-hazardous areas, the drainage systems are segregated.
- The rig drainage systems tie into oily water separators that take out elements in the drainage that could harm the environment.

8) Rig Floor Drainage

The rig floor drains to the hazardous or non-hazardous drain system as described above. A dedicated mud vacuum system is also installed to remove any mud that may go down the drain.

9) Cement unit Drains

The drains in the containment for the mixing skid and chemical tanks are directed to a dedicated overboard line. This line is controlled by two gate valves for double isolation and is kept normally closed with locks.

10) Main Engine Rooms

The engine rooms have their own drainage and handling system. The engine rooms are outfitted with a dirty oil tank and the drainage in the tank is processed through the separator, the waste from the separator goes back to the dirty oil tank and the clean water (<15 ppm) goes overboard.

11) Helideck Drains

The helideck has a dedicated drainage system around its perimeter to drain heli-fuel from a helicopter incident. The fuel can be diverted to the designated heli fuel recovery tank which is located under the Helideck structure.

Operating configurations are as follows:

- The overboard piping valves and hydrocarbons take on valves are closed and locked. To unlock overboard or take on valves a permit or a Bulk Transfer Certificate must be filled out.
- The oily water separator continuously circulates the oily water collection tank. Waste oil is discharged into the waste oil tank and oily water is re-circulated back into the oily water collection tank. Clean water is pumped overboard, which is controlled/monitored by the oil content detector, set at 15 ppm.
- The solids control system is capable of being isolated for cuttings collection.

D. Storage Tanks – Transocean Proteus (or similar) Drillship

Type of Storage Tank	Tank Capacity (bbls)	Number of Tanks	Total Capacity (bbls)	Fluid Gravity (Specific)
Marine Oil	14788	1	14788	Marine oil (0.85 SG)
Marine Oil	14482	2	28964	Marine oil (0.85 SG)
Marine Oil settling tank	2338	2	4676	Marine oil (0.85 SG)
Marine Oil settling tank	1415	2	2830	Marine oil (0.85 SG)
Marine Oil settling tank	1145	2	2290	Marine oil (0.85 SG)
Lube oil	214	1	214	Lube Oil (.9 SG)
Lube oil	381	1	381	Lube Oil (.9 SG)
Lube oil	127	1	127	Lube Oil (.9 SG)
Lube Oil	169	1	169	Lube Oil (.9 SG)

Storage Tanks – Atwood Condor (or similar) DP Semi-Submersible

Type of Storage Tank	Type of Facility	Tank Capacity (Bbls)	Number of Tanks	Total Capacity (Bbls)	Fluid Gravity (Specific)
Diesel Tank in stbd 1 80% fill in all hull tanks	Drilling Rig	3597	1	3597	Marine Diesel (0.91 SG)
Diesel Tank in stbd 2	Drilling Rig	2,713	1	2713	Marine Diesel (0.91 SG)
Diesel Tank in stbd 3	Drilling Rig	3,456	1	3456	Marine Diesel (0.91 SG)
Diesel Tank in stbd 4	Drilling Rig	653	1	653	Marine Diesel (0.91 SG)
Diesel Tank in port 1	Drilling Rig	2,090	1	2090	Marine Diesel (0.91 SG)
Diesel Tank in port 2	Drilling Rig	1,366	1	1366	Marine Diesel (0.91 SG)
Diesel Tank in port 3	Drilling Rig	4,787	1	4787	Marine Diesel (0.91 SG)
Diesel Tank in port 4	Drilling Rig	3,456	1	3456	Marine Diesel (0.91 SG)
Total storage hull tanks	Drilling Rig			22,118	Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	129	3	387	Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	139	1	139	Marine Diesel (0.91 SG)

E. Pollution Prevention Measures

Pursuant to NTL 2008-G04 the proposed operations covered by this EP do not require Shell to specifically address the discharges of oil and grease from the rig during rainfall or routine operations. Nevertheless, Shell has provided this information as part of its response to 1(c) above.

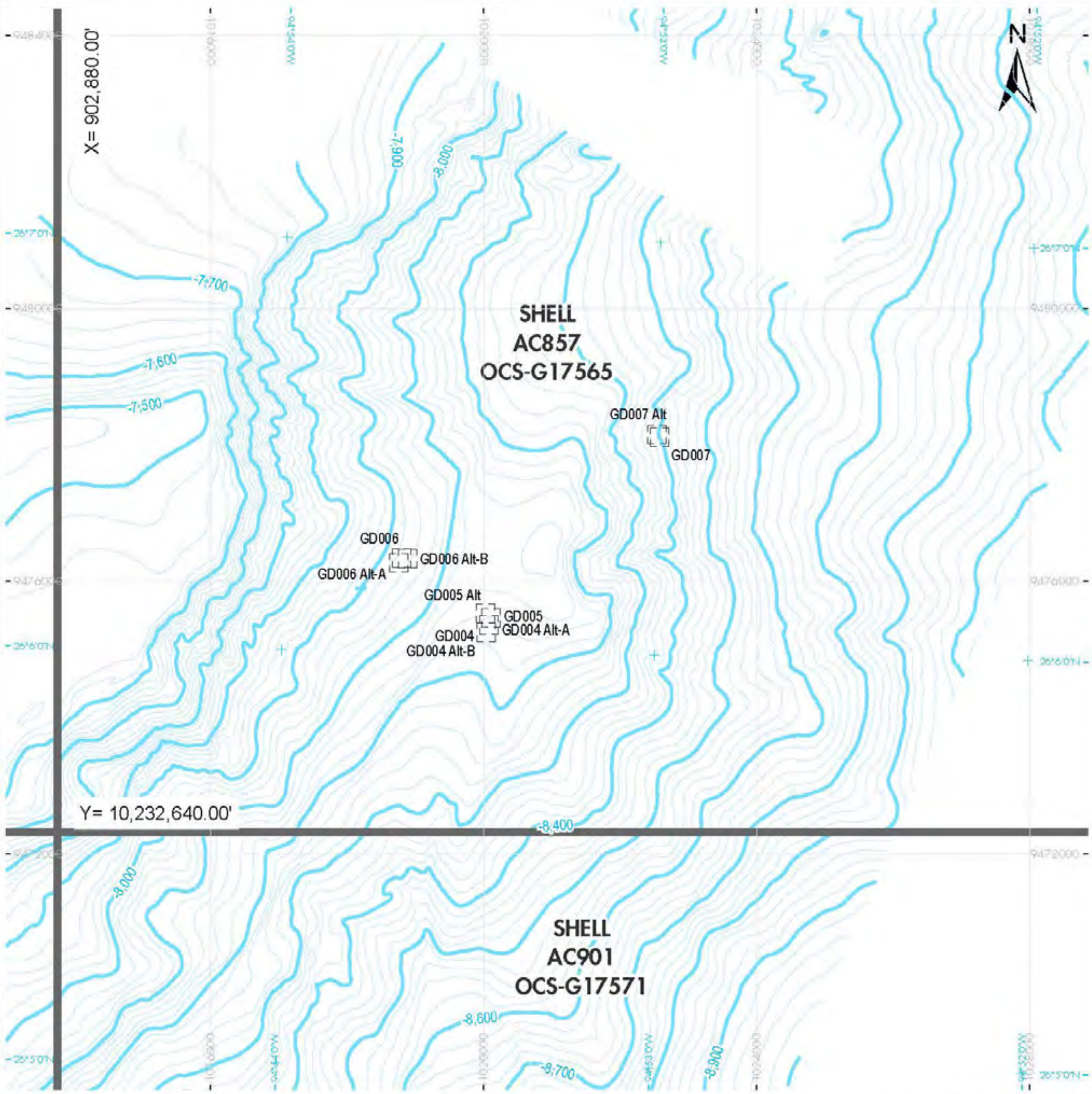
F. Additional Measures

- HSE (health safety and environment) are the primary topics in pre-tour and pre-job safety meetings. The discussion around no harm to people or environment is a key mindset. All personnel are reminded daily to inspect work areas for safety issues as well as potential pollution issues.
- All tools that come to and from the rig have their pollution pans inspected, cleaned and confirmation of plugs installed prior to leaving dock and prior to loading on the boat.
- Preventive maintenance of rig equipment includes visual inspection of hydraulic lines and reservoirs on routine scheduled basis.
- All pollution pans on rig are inspected daily.
- Containment dikes are installed around all oil containment, drum storage areas, fuel vents and fuel storage tanks.
- All used oil and fuel is collected and sent in for recycling.
- Every drain on the rig is assigned a number. The number is logged when plug is removed and replaced.
- All trash containers are checked and emptied daily. The trash containers are kept covered. Trash is disposed of in a compactor and shipped in via boat.
- Fuel hoses and SBM are changed on annual basis.
- TODO or (KLAW) spill prevention fittings are installed on all liquid take on hoses.
- Waste paint thinner is collected and sent ashore for disposal.
- Shell has obtained ISO14001 certification.
- Shell uses low sulfur fuel.

G. Description of Previously Approved Lease Activities

These leases are part of the Perdido Unit.

Attachment 1A - Bathymetry and Surface Locations



MAP INFORMATION

NAME	Eastings	Northings	LATITUDE	LONGITUDE	Block Calls
GD004	1020045.00	9475243.00	26.1008276	-94.8908003	6285.0' FWL & 2923 ' FSL of BLK AC857
GD004 Alt-A	1020085.00	9475357.00	26.1011428	-94.8906835	6325.0' FWL & 3037 ' FSL of BLK AC857
GD004 Alt-B	1020045.00	9475243.00	26.1008276	-94.8908003	6285.0' FWL & 2923 ' FSL of BLK AC857
GD005	1020118.00	9475458.00	26.1014220	-94.8905874	6358' FWL & 3138 ' FSL of BLK AC857
GD005 Alt	1020038.00	9475524.00	26.1016003	-94.8908341	6278.0' FWL & 3204 ' FSL of BLK AC857
GD006	1018814.00	9476339.00	26.1037933	-94.8945992	5054' FWL & 4019 ' FSL of BLK AC857
GD006 Alt-A	1018764.00	9476269.00	26.1035988	-94.8947484	5004.0' FWL & 3949 ' FSL of BLK AC857
GD006 Alt-B	1018899.84	9476333.33	26.1037812	-94.8943374	5139.84' FWL & 4013.33 ' FSL of BLK AC857
GD007	1022590.00	9478112.00	26.1088214	-94.8831733	7010.0' FEL & 5792' FSL of BLK AC857
GD007 Alt	1022550.00	9478152.00	26.1089298	-94.8832970	7050.0' FEL & 5832' FSL of BLK AC857

Legend

- Surface Hole Location
- Lease Block
- Bathymetry Contours 20ft
  - Major
  - Minor
- Graticule Grid Tick
- Measured Grid Line

MAP SCALE

0 1,000 2,000 4,000
Feet

1:24,000
Print size: 8.5"x11" (ANSI A)

SHELL EXPLORATION & PRODUCTION COMPANY

Surface Location and Bathymetry Plat

Gulf of Mexico
Alaminos Canyon Area
OCS-G 17565 Block 857

GEODETIC PARAMETERS

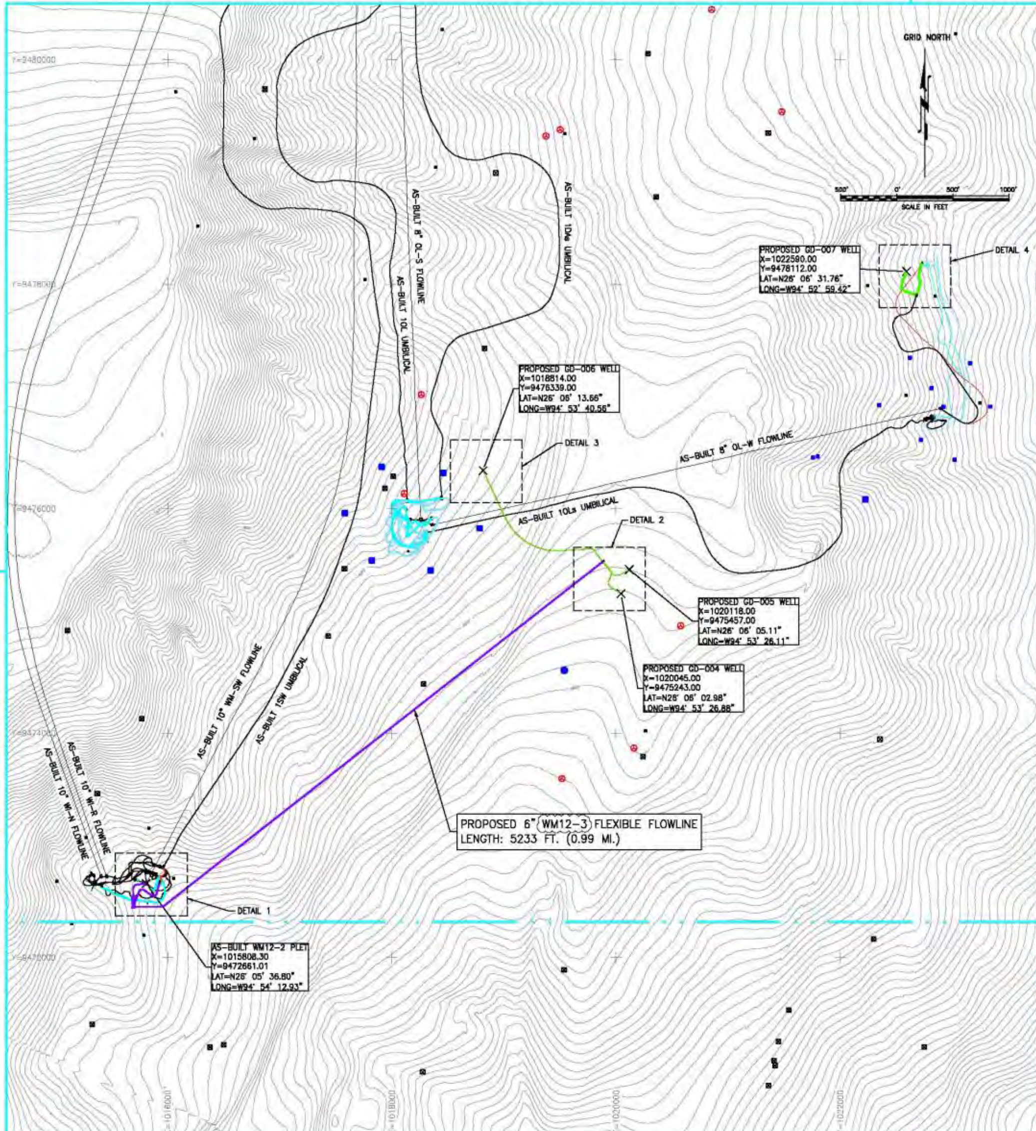
Horizontal Coordinate Reference System
CRS name (ESRI): NAD 1927 BLM Zone 15N (US Feet)
CRS name (Shell): NAD27 / BLM 15N (ftUS)
CRS code (EPSG): 32065
Geodetic datum: North American 1927
Projection name: Transverse Mercator
Horizontal units: Foot US

Author: S.W.Bridges	Date: 4/9/2019
Reviewed By: Charles Bopp	EP Catalog No.: EP201904201096

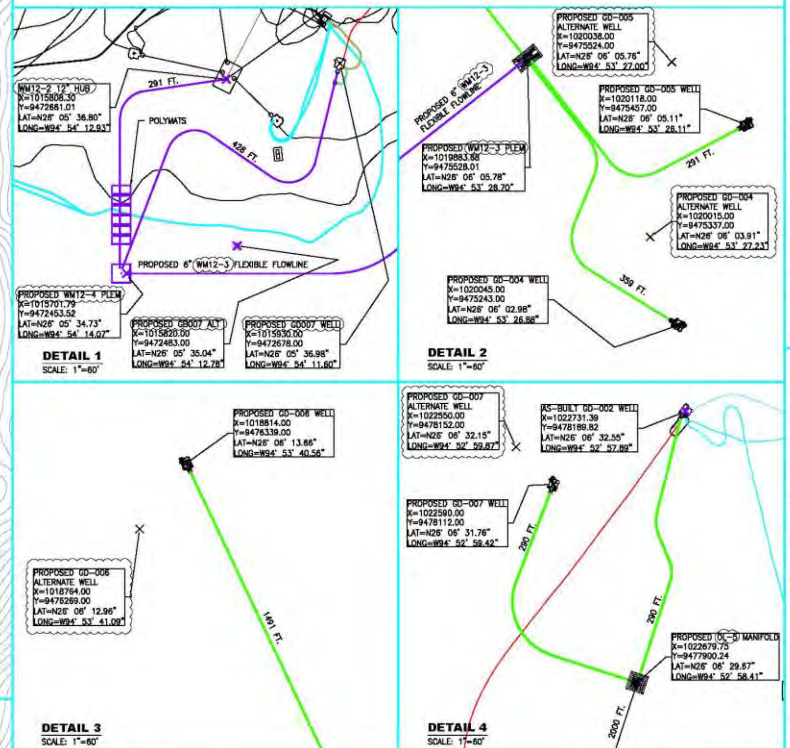
Document Path: G:\30_Project\CAD_NewOrleans\Maps\Permit Plats\Great White\Great White AC857 AC901 SHL EP.mxd

Attachment 1B - Bottom-Hole Locations

Proprietary Data



GEODETIC PARAMETERS	
HORIZONTAL COORDINATE REFERENCE SYSTEM	
CRS Name (EPSG):	NAD27/ BLM 15N (FtUS)
Alias:	NAD27/ UTM zone 15N (FtUS)
CRS Code (EPSG):	32065
TRANSFORMATION:	NAD27 to NAD83(1) [1241]
Map Units:	US survey feet
VERTICAL COORDINATE REFERENCE SYSTEM	
Vertical Datum	Mean Sea Level
Elevation/Depth	Depth
Vertical Units:	Feet



REV	DATE	DESCRIPTION	DRAWN	CHK or TECH REP	DES ENG.	PROJ ENG.
A	2019-11-20	ISSUED FOR INTERNAL REVIEW	MGS			
001	2019-10-28	ISSUED FOR INFORMATION	MGS			

SHELL EXPLORATION & PRODUCTION COMPANY

SIEP SHELL INTERNATIONAL EXPLORATION AND PRODUCTION INC.

PHASE 2 – FIELD LAYOUT – OPTION 1
WITH FLEXIBLE FLOWLINE

PERDIDO DEVELOPMENTS

DRG No. PD-500-UA-4180-2501077-007 REV. 01a

Martin.Soto 11/20/2019 1:00:37 PM N:\Drafting_Projects\Perdido\Subsea\PD-500-UA-4180-Flowlines\Dwg\Current\PD-500-UA-4180-2501077.DWG

U.S. Department of the Interior
Bureau of Ocean Energy Management

Attachment 1C

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: Shell Offshore Inc.	BOEM Operator Number: 0689
Address: 701 Poydras St., Room 2418	Contact Person: Sylvia Bellone
New Orleans, LA 70131	Phone Number: 504.425.7215
	Email Address: Sylvia.bellone@shell.com

If a service fee is required under 30 CFR 550.125(a) provide:	Amount Paid: $42,380.00	Receipt Nos. 26MPQST2, 26MQUHUB

Project and Worst-Case Discharge (WCD) Information

Lease(s) OCS-G 17565, 17571	Area: AC	Block(s): 857, 901	Project Name: Great White Frio

Objectives(s):	X	Oil		Gas		Sulphur		Salt

Onshore Support Base(s) Fourchon & Galveston

Platform/Well Name: D (GA14)	Total Volume of WCD: 129,000 BOPD	API Gravity: 34°

Distance to Closest Land (Miles): 140	Volume from uncontrolled blowout: 5.4 MMBBL

Have you previously provided information to verify the calculations and assumptions of your WCD?	X	Yes		No
If so, provide the Control Number of the EP or DOCD with which this information was provided	R-5144 (9/1/2011)			
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
Exploratory drilling			
Development drilling			
Well completion and well flow testing			
Well test flaring (for more than 48 hours)			
Installation or modification of structure			
Installation of production facilities			
Installation of subsea wellheads and/or dry hole tree			
Installation of lease term pipelines	See Attached		
Commence production	See attached		
Other (Future well work)	See Attached		

Description of Drilling Rig / Description of Structure

	Description of Drilling Rig				Description of Structure		
	Jackup	x	Drillship		Caisson		Tension Leg Platform
	Gorilla Jackup		Platform rig		Fixed Platform		Compliant Tower
	Semisubmersible		Submersible		Spar Other		Guyed tower
x	DP Submersible		Other (attached description)		Floating production system	X	Other (attached description) Subsea tie back

Drilling Rig Name (If known): Transocean Proteus or similar, Atwood Condor or Similar

Description of Lease Term Pipelines

From (Facility/Area/Block)	To (Facility/Area/Block)	Diameter (Inches)	Length (Feet)
AC 857 Hub (WM12-2 manifold)	AC 857 manifold (WM 12-3)	6″ flowline	5,233′
AC 857 Wells	AC 857 manifolds (WM 12-3 or OL5)	6″ jumpers (10)	290-1491′
AC 857 Hub (WM12-2 manifold)	AC 857 GB007 well (R-6831)	6″ jumper	428′
AC 857 Hub (WM12-2 manifold)	AC 857 Hub (WM 12-4 manifold)	6″ jumper	291′

Attachment 1C.1 Schedule

Schedule to drill, complete, conduct flowtest and install tree:

Activity	Start date	End	Duration
Install flowline & jumpers (3)	8/12/2020	9/10/2020	30
Install jumpers (3) and plems	8/12/2020	9/6/2020	25
Produce wells	9/11/2010		
Install jumpers (3) and plem	9/8/2020	9/30/2020	22
Produce wells	10/01/2020		
Install jumpers (3) and manifold	7/10/2021	8/9/2021	30
Produce wells	8/10/2021		
Future Well work	2020	2030	200

Attachment 1D

Proposed Well/Structure Location			
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD004	Previously reviewed under an approved EP or DOCD? Reviewed R-5144 but moving >500′	X Yes	No

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 17565	OCS-G 17565	OCS OCS
Area Name	AC	AC	
Block No.	857	857	
Blockline Departure (in feet)	N/S Departure: 2,923′ FSL		N/S Departure: N/S Departure:
	E/W Departure 6,285′ FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 1,020,045		X:
	Y: 9,475,243		Y:
Lat/Long	Latitude: 26.1008276		Latitude
	Longitude: -94.8908003		Longitude

Water Depth (Feet): 8,168′			MD (Feet)	TVD (Feet
Anchor Radius (if applicable) in feet:				

Anchor locations for drilling rig or construction barge (if anchor radius is 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=	

Attachment 1E

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD004 Alt-A	Previously reviewed under an approved EP or DOCD?		Yes	X	No

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 17565	OCS-G 17565	OCS OCS
Area Name	AC	AC	
Block No.	857	857	
Blockline Departure (in feet)	N/S Departure: 3,037′ FSL		N/S Departure: N/S Departure:
	E/W Departure 6,325′ FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 1,020,085		X:
	Y: 9,475,357		Y:
Lat/Long	Latitude: 26.1011428		Latitude
	Longitude: -94.8906835		Longitude

Water Depth (Feet): 8,168′			MD (Feet)	TVD (Feet

Anchor Radius (if applicable) in feet:

Anchor locations for drilling rig or construction barge (if anchor radius is 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=	

Attachment 1F

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD004 Alt-B	Previously reviewed under an approved EP or DOCD?		Yes	X	No

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 17565	OCS-G 17571	OCS OCS
Area Name	AC	AC	
Block No.	857	901	
Blockline Departure (in feet)	N/S Departure: 2,923' FSL		N/S Departure: N/S Departure:
	E/W Departure 6,285' FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 1,020,045		X:
	Y: 9,475,243		Y:
Lat/Long	Latitude: 26.1008276		Latitude
	Longitude: -94.8908003		Longitude

Water Depth (Feet): 8,168'			MD (Feet)	TVD (Feet

Anchor Radius (if applicable) in feet:

Anchor locations for drilling rig or construction barge (if anchor radius is 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=	

Attachment 1G

Proposed Well/Structure Location						
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD005	Previously reviewed under an approved EP or DOCD?		Yes	X	No	

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 17565	OCS-G 17565	OCS OCS
Area Name	AC	AC	
Block No.	857	857	
Blockline Departure (in feet)	N/S Departure: 3,138′ FSL		N/S Departure: N/S Departure:
	E/W Departure 6,358′ FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 1,020,118		X:
	Y: 9,475,458		Y:
Lat/Long	Latitude: 26.1014220		Latitude
	Longitude: -94.8905874		Longitude

Water Depth (Feet): 8,158′			MD (Feet)	TVD (Feet
Anchor Radius (if applicable) in feet:				

Anchor locations for drilling rig or construction barge (if anchor radius is 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=	

Attachment 1H

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD005 Alt	Previously reviewed under an approved EP or DOCD?		Yes	X	No

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 125,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 17565	OCS-G 17565	OCS OCS
Area Name	AC	AC	
Block No.	857	857	
Blockline Departure (in feet)	N/S Departure: 3,204' FSL		N/S Departure: N/S Departure:
	E/W Departure 6,278' FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 1,020,038		X:
	Y: 9,475,524		Y:
Lat/Long	Latitude: 26.1016003		Latitude
	Longitude: -94.8908341		Longitude

Water Depth (Feet): 8,158'			MD (Feet)	TVD (Feet

Anchor Radius (if applicable) in feet:

Anchor locations for drilling rig or construction barge (if anchor radius is 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=	

Attachment 1I

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD006	Previously reviewed under an approved EP or DOCD?		Yes	X	No

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 17565	OCS-G 17565	OCS OCS
Area Name	AC	AC	
Block No.	857	857	
Blockline Departure (in feet)	N/S Departure: 4,019′ FSL		N/S Departure: N/S Departure:
	E/W Departure 5,054′ FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 1,018,814		X:
	Y: 9,476,339		Y:
Lat/Long	Latitude: 26.1037933		Latitude
	Longitude: -94.8945992		Longitude

Water Depth (Feet): 8,027′			MD (Feet)	TVD (Feet

Anchor Radius (if applicable) in feet:

Anchor locations for drilling rig or construction barge (if anchor radius is 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=	

Attachment 1J

Proposed Well/Structure Location						
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD006 Alt-A	Previously reviewed under an approved EP or DOCD?		Yes	X	No	
Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA
Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No		

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)	
Lease Number	OCS-G 17565	OCS-G 17565	OCS OCS	
Area Name	AC	AC		
Block No.	857	857		
Blockline Departure (in feet)	N/S Departure: 3,949' FSL		N/S Departure: N/S Departure:	
	E/W Departure 5,004' FWL		E/W Departure: E/W Departure:	
Lambert X-Y Coord.	X: 1,018,764		X:	
	Y: 9,476,269		Y:	
Lat/Long	Latitude: 26.1035988		Latitude	
	Longitude: -94.8947484		Longitude	
Water Depth (Feet): 8,027'			MD (Feet)	TVD (Feet
Anchor Radius (if applicable) in feet:				

Anchor locations for drilling rig or construction barge (if anchor radius is 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=	

Attachment 1K

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD006 Alt-B	Previously reviewed under an approved EP or DOCD?		Yes	X	No

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 17565	OCS-G 17565	OCS OCS
Area Name	AC	AC	
Block No.	857	857	
Blockline Departure (in feet)	N/S Departure: 4,013′ FSL		N/S Departure: N/S Departure:
	E/W Departure 5,140′ FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 1,018,900		X:
	Y: 9,476,333		Y:
Lat/Long	Latitude: 26.1037812		Latitude
	Longitude: -94.8943374		Longitude

Water Depth (Feet): 8,027′			MD (Feet)	TVD (Feet
Anchor Radius (if applicable) in feet:				

Anchor locations for drilling rig or construction barge (if anchor radius is 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=	

Attachment 1L

Proposed Well/Structure Location								
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD007				Previously reviewed under an approved EP or DOCD?		Yes	X	No
Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA		
Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?					X	Yes		No
WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD		For structures, volume of all storage and pipelines (bbls): NA		API Gravity of fluid	34°		
	Surface Location		Bottom Hole Location (for Wells)		Completion (for multiple enter separate lines)			
Lease Number	OCS-G 17565		OCS-G 17565		OCS OCS			
Area Name	AC		AC					
Block No.	857		857					
Blockline Departure (in feet)	N/S Departure: 5,792′ FSL				N/S Departure: N/S Departure:			
	E/W Departure 7,010′ FEL				E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,022,590				X:			
	Y: 9,478,112				Y:			
Lat/Long	Latitude: 26.1088214				Latitude			
	Longitude: -94.8831733				Longitude			
Water Depth (Feet): 8,399′					MD (Feet)	TVD (Feet		
Anchor Radius (if applicable) in feet:								

Anchor locations for drilling rig or construction barge (if anchor radius is 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=	

Attachment 1M

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD007 Alt	Previously reviewed under an approved EP or DOCD?		Yes	X	No

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 17565	OCS-G 17565	OCS OCS
Area Name	AC	AC	
Block No.	857	857	
Blockline Departure (in feet)	N/S Departure: 5,832′ FSL		N/S Departure: N/S Departure:
	E/W Departure 7,050′ FEL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 1,022,550		X:
	Y: 9,478,152		Y:
Lat/Long	Latitude: 26.1088298		Latitude
	Longitude: -94.8832970		Longitude

Water Depth (Feet): 8,399′			MD (Feet)	TVD (Feet

Anchor Radius (if applicable) in feet:

Anchor locations for drilling rig or construction barge (if anchor radius is 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=	

SECTION 2: GENERAL INFORMATION

A. Application and Permits

There are no individual or site-specific permits other than general NPDES permit and rig move notification that need to be obtained. Prior to beginning operations, an Application for Permit to Drill (APD) will be submitted and approved by the Bureau of Safety and Environmental Enforcement (BSEE).

B. Drilling Fluids - future sidetracks (well work)

See Section 7, Tables 7A and 7B for fluids to be used and disposal of same.

C. Production

Type	Average Production Rate	Peak Production Rate	Life of Reservoir
Oil	Proprietary Data		
Gas			

D. Oil Characteristics

Characteristic	Analytical Methodologies Should Be Compatible With:
1. Gravity (API) 18.4°	ASTM D4052
2. Flash Point (°C) *	ASTM D93/IP 34
3. Pour Point (°C) <-35°C	ASTM D97
4. Viscosity 80cP @ 80°F and 14.7 psia, 11.9cP @ 80°F and 4980 psia (reservoir conditions)	ASTM D445
5. Wax Content (wt %) - Negligible	Precipitate with 2-butanon/dichloromethane (1 to 1 volume) at -10 °C
6. Asphaltene Content (wt %) 0.46%	IP-Method 143/84
7. Resin Content (wt %) 12.73%	Jokuty et al., 1996
8. Boiling point distribution including, for each fraction, the percent volume or weight and the boiling point range in °C	ASTM D2892 (TBP distillation) or ASTM D2887/5307
9. Sulphur (wt %) 2.34%	ASTM D4294

Note: If the distillation information in Item No. 8 in the above table is not available, the GOMR may accept the following information in lieu of Items Nos. 5, 6, 7, and 8: weight percent total of saturates, aromatics, waxes*, asphaltenes, and resins; and total BTEX (ppm) using analytical methods compatible with the Hydrocarbon Groups methodology found in Jokuty et al., 1996).

*No Data Available.

All in wt% Topped Basis

SARA (Topped Basis) All in wt %				
Well #	Saturates	Aromatics	Resin	Asphaltenes
OCS-G 17565 #4	29.98	57.81	11.66	0.55
OCS-G-17565 AC857 #3	34.30	52.49	12.73	0.48

Identify the oil you analyze. Refer to the following sample chart.

Oil from one well	Oil from more than one well sampled on a facility	Oil from a pipeline system
·Area/Block-SeeTable Below ·MMS platform ·API Well No. ·Completion perforation interval ·MMS's reservoir name ·Sample date ·Sample No.(if more than one is taken)	·Area/Block ·MMS platform ID ·Field/Unit ·Sample date ·Sample No. (if more than one is taken) ·Listing of API Well Nos. ·Storage tank ID No. (if sampled at a storage tank)	·Pipeline segment number ·For each pipeline that feeds into the system, the ID codes for the closest upstream LACT units and/or facility measurement points ·Storage tank ID No. (if sampled at a storage tank)

Sample Detail:

Area/Block	AC857	AC857
MMS platform	OCS-G 17565 #3	OCS-G 17565 #4
API Well No.	608054002300	608054002900
Completion perforation	10352'	10355'
MMS's reservoir name	FR20	FR22
Sample date	11/2003	09/02/2004
Sample No. (if more than one is taken)	NG-O-4517A	NG-O-4816A

E. New or Unusual Technology

Shell is not proposing to use new or unusual technology as defined in 30 CFR 250.200 to carry out the proposed activities in this EP.

F. Bonding

The bond requirement for the activities proposed in this EP are satisfied by an area-wide bond furnished and maintained according to 30 CFR Part 556; NTL No. 2015-N04, "General Financial Assurance", and BOEM NTL 2016-N01, "Requiring Additional Security."

G. Oil Spill Financial Responsibility (OSFR)

Shell Offshore Inc., BOEM Operator Number 0689, has demonstrated oil spill financial responsibility for the activities proposed in this plan according to 30 CFR Part 553 and NTL No. 2008-N05, "Guidelines for Oil Spill Financial Responsibility for Covered Facilities."

H. Deepwater well control statement

Shell Offshore Inc., BOEM Operator Number 0689, has the financial capability to drill a relief well and conduct other emergency well control operations if required.

I. Suspension of Production

The leases in this plan are not held by a Suspension of Production.

J. Blowout scenario

The blowout scenario for this area was provided by Shell and accepted by BOEM in plan R-5144 on September 1, 2011 for the Alaminos Canyon Block 857 Unit (Great White Field). The wells proposed in this plan do not exceed the amount discussed in the data provided and accepted by BOEM.

a) Summary

This Section 2j was prepared by Shell Offshore Inc. (Shell) pursuant to the guidance provided in the Bureau of Ocean Energy Management Notice to Lessees (NTL) No. 2010-N05 (now NTL 2015-N01) with respect to blowout and worst-case discharge scenario descriptions.

Shell focuses on an integrated, three-pronged approach to a blowout, including prevention, intervention /containment, and recovery. Shell believes that the best way to manage blowouts is to prevent them from happening. Maintaining well control at all times and thus preventing a blowout is the key focus of our operations. Significant effort goes into the design and execution of wells and into building and maintaining staff competence with the goal of safe and environmentally sound well construction. Shell continues to invest independently in Research and Development (R&D) to improve the safety and reliability of our well systems. Shell intends to comply with all applicable laws, regulations, rules, and Notice to Lessees.

Shell is a founding member of the Marine Well Containment Company (MWCC) and will have access to an integrated subsea well control and containment system that can be rapidly deployed through the MWCC. MWCC is a non-profit organization that owns, manages, and provides fully trained crews and operates the subsea containment system during a response. The near-term containment response capability will include lessons learned and equipment used in the Macondo response. Shell is also investing in R&D to improve future containment systems. Shell is a member of Clean Caribbean America (CCA), Marine Spill Response Corporation (MSRC), Clean Gulf Associates (CGA), and OSRL/EARL to provide the resources necessary to respond to a spill as outlined in our Regional Oil Spill Response Plan.

The Worst Case Discharge (WCD) blowout scenario for the Alaminos Canyon Block 857 Unit (Great White Field) is calculated for the AC 814 GA014 proposed development well penetration of the target sand and based on the guidelines outlined in NTL No. 2010-N06 (now NTL No. 2015-N01) along with the subsequent Frequently Asked Questions (FAQ). Shell submitted AC 814 GA014 (this well) as the new worst-case scenario to the BOEM for inclusion in the previously approved plan for Great White Field. In the unlikely event of a spill, Shell's Regional OSRP is designed to contain and respond to a spill that meets or exceeds this WCD. This WCD does not take into account potential flow mitigating factors such as well bridging, obstructions in the wellbore, reservoir barriers, or early intervention.

Uncontrolled blowout (volume first day)	129,000 bbl
Uncontrolled blowout rate (first 30-days average daily rate)	78,700 bopd
Duration of flow (days) based on relief well	100 days
Total volume of spill (bbls) for 100 days	5.4 MMBO

Table 1 Worst Case Discharge Summary

b) Purpose

Pursuant with 30 CFR 250.213(g), 250.219, 250.250, and NTL No. 2010-N06 (NTL 2015-N01), this document provides a blowout scenario description, further information regarding any potential oil spill, the assumptions and calculations used to determine the worst case discharge (WCD) and the measures taken to: (1) enhance our ability to prevent a blowout and (2) respond and manage a blowout if it were to occur. These calculations are based on our best technical estimates of subsurface parameters that are derived from the Great White reservoir simulation model incorporating all Sand well control and the available high resolution 3D seismic data. The parameters are better than or consistent with the estimates used by Shell to justify the investment. Therefore, these assumed parameters were used to calculate the WCD. They do not reflect probabilistic estimates.

This attachment has been developed to document the additional information requirements for Development Operations Coordination Documents (DOCD) as requested by NTL No. 2010-N06 in response to the explosion and sinking of the Mobile Offshore Drilling Unit (MODU) Deepwater Horizon and the resulting subsea well blowout and recovery operations of the exploration well at the MC-252 Macondo location.

c) Information Requirements

Blowout scenario

All well locations in the approved Great White plan were assessed for WCD. The AC814 GA014 well represented the highest flow potential. The WCD blowout scenario was calculated for the GA014 penetration of the Sand and based on the guidelines outlined in NTL No. 2010-N06 (NTL 2015-N01) and subsequent Frequently Asked Questions (FAQ) documents. The AC814 GA014 well will be drilled using the H&P 205 Perdido Spar platform rig with a high-pressure riser and surface BOP. The well will be deepened to the target sand as outlined in the Geological and Geophysical Information Section of the plan, using a typical subsea wellhead system and casing program that will be described in detail later and is also shown in the attachments. A hydrocarbon influx and a well control event are modeled to occur from the reservoir. The simulated blowout modeled results in unrestricted flow from the well at the surface which represents the WCD scenario (no restrictions in the wellbore, failure/loss of the surface BOP, and a blowout to the surface).

Estimated flow rate of the potential blowout

Category	DOCD
Type of Activity	Drilling
Facility Location (area/block)	AC857
Facility Designation	Perdido Spar HP205 Platform Rig
Distance to Nearest Shoreline (miles)	140 miles
Uncontrolled blowout (volume first day)	129,000 bbl
Uncontrolled blowout rate (first 30-days average daily rate)	78,700 bopd

Table 2: Estimated Flow Rates of a Potential Blowout

Total volume and maximum duration of the potential blowout

Duration of flow (days)	100 days total duration to drill relief well (14 rig mob, 4 transit, 52 spud to top WM12, 30 ranging).
Total volume of spill (bbls)	5.4MMBO based on 100 days flowing. Note: From CMG IMEX dynamic reservoir models

Table 3: Estimated Duration and Volume of a Potential Blowout

There is a significant decline in the discharge rate as time proceeds, which is illustrated by the differences between the first 24-hour volume and 30-day average rate. At very short times, e.g. during the first 24 hours, the pressure profile in the reservoir changes from the moment the well first starts flowing to a pseudo-steady state pressure profile with time, and as a result the rate declines. At somewhat longer time scales, effects such as reservoir voidage and the impact of boundaries can cause the rate to drop continuously with production. Simulation and material balance models can include these effects and form the basis of the NTL No. 2010-N06 (NTL 2015-N01) calculations for 24-hour and 30-day rates as well as maximum duration volumes.

d) Assumptions and calculations used in determining the worst-case discharge
(Proprietary Data - See Plan R-5144)

e) Potential for the well to bridge over

Mechanical failure/collapse of the borehole in a blowout scenario is influenced by several factors including in-situ stress, rock strength and fluid velocities at the sand face. Based on the nodal analysis and reservoir simulation models outlined above, a surface blowout would create a high drawdown at the sand face. Given the substantial fluid velocities inherent in the worst-case discharge, and the scenario as defined where the formation is not supported by a cased and cemented wellbore, it is possible that the borehole may fail/collapse/bridge over within the span of a few days, significantly reducing outflow rates. However, this WCD scenario does not include any bridging or consideration of solids production with the oil and gas.

f) Likelihood for intervention to stop the blowout.

Safety of operations is our top priority. Maintaining well control at all times to prevent a blowout is the key focus of our operations. Our safe drilling record is based on our robust standards, conservative well design, prudent operations practices, competency of personnel, and strong HSE focus. Collectively, these constitute a robust system making blowouts extremely rare events.

Intervention Devices: Notwithstanding these facts, the main scenario for recovery from a blowout event is via intervention with the BOP attached to the well. There are built in redundancies in the BOP system to allow activation of selected components with the intent to seal off the well bore. As a minimum, the Shell contracted rig fleet in the GOM will have redundancies meeting the Final Drilling Safety Rule with respect to Remotely Operated Vehicle (ROV) hot stab capabilities, a deadman system, and an autoshear system.

Containment: The experience of gaining control over the Macondo well has resulted in a better understanding of the necessary equipment and systems for well containment. As a result, industry and government are better equipped and prepared today to contain an oil well blowout in. Shell is further analyzing these advances and incorporating them into its comprehensive approach to help prevent and, if needed, control another deepwater control incident.

Shell is a founding member of the Marine Well Containment Company (MWCC), which provides robust well containment (shut-in and controlled flow) capabilities. Pursuant to NTL No. 2010-N10, Shell will provide additional information regarding our containment capabilities in a subsequent filing.

g) Availability of a rig to drill a relief well and rig package constraints

There are no platforms near this location to drill a relief well. Blowout intervention can be conducted from an ROV equipped vessel, the existing drilling rig or from another drilling rig. The dynamically positioned rigs under contract below will be preferred rigs for blowout intervention work. However, moored rigs can also be used in some scenarios. Additionally, in the event of a blowout, there are other non-contracted rigs in the GoM which could be utilized for increased expediency or better suitability. All efforts will be made at the time to secure the appropriate rig. Shell's current contracted rigs capable of operating at these water depths and reservoir depths without technical constraints are shown in the table below.

Rig Name	Rig Type
TO Deepwater Poseidon	Dynamically Positioned Drill ship
TO Deepwater Thalassa	Dynamically Positioned Drill ship
TO Deepwater Proteus	Dynamically Positioned Drill ship

Table 4: Available Rigs in Shell's fleet

Future modifications may change the rig's capability. Rig capabilities need to be assessed on a work scope basis.

h) Time taken to contract a rig, mobilize, and drill a relief well

Relief well operations will immediately take priority and displace any activity from Shell's contracted rig fleet. The list of rigs capable of operating at Great White is tabled above. It is expected to take an average of 14 days to safely secure the well that the rig is working on up to the point the rig departs location, and an additional 4 days transit to mobilize to the relief well site depending on distance to the site. The relief well will take approximately 52 days to drill down to the last casing string above the blowout zone, plus approximately 30 days for precision ranging activity to intersect the blowout well bore. Total time to drill a relief well would be ~100 days for the Great White wells.

Although not likely, if a moored rig is chosen to conduct the relief well operations, anchor handlers would be obtained to prepare mooring on the relief well site while the rig is being mobilized. This activity is not expected to delay initiation of relief well drilling operations.

i) Measures proposed to enhance ability to prevent blowout and to reduce likelihood of a blowout

Shell believes that the best way to manage blowouts is to prevent them from happening. Detailed below are the measures employed by Shell with the goal of no harm to people or the environment. The Macondo incident has highlighted the importance of these practices. The lessons learned from the investigation are, and will continue to be, incorporated into our operations.

Standards: Shell's well design and operations adhere to internal corporate standards, the Code of Federal Regulations, and industry standards. A robust management of change process is in place to handle un-defined or exception situations. Ingrained in the Shell standards for well control is the philosophy of multiple barriers in the well design and operations on the well.

Risk Management: Shell believes that prevention of major incidents is best managed through the systematic identification and mitigation process (Safety Case). All Shell contracted rigs in the GoM have been operating with a Safety Case and will continue to do so. A Safety Case requires both the owner and contractors to systematically identify the risks in drilling operations and align plans to mitigate those risks; an alignment which is critical before drilling begins.

Well Design Workflow: The Well Delivery Process (WDP) is a rigorous internal assurance process with defined decision gates. The WDP leverages functional experts (internal and external) to examine the well design at the conceptual and detailed design stages for robustness before making a recommendation to the management review board. Shell's involvement in global deepwater drilling, starting in the GOM in the mid-1980's, provides a significant depth and breadth of internal drilling and operational expertise. Third party vendors and rig contractors are involved in all stages of the planning, providing their specific expertise. A Drill the Well on Paper (DWOP) exercise is conducted with rig personnel and vendors involved in execution of the well. This forum communicates the well plan and solicits input as to the safety of the plan and procedures proposed.

Well and rig equipment qualification, certification, and quality assurance: All rigs will meet all applicable rules, regulations, and Notice to Lessees. Shell works closely with rig contractors to ensure proper upkeep of all rig equipment, which meets or exceeds the strictest of Shell, industry, or regulatory requirements. Well tangibles are governed by our internal quality assurance/control standards and industry standards.

MWD/LWD/PWD Tools: Shell intends to use these tools on this project. The MWD/LWD/PWD tools are run on the drill string so that data on subsurface zones can be collected as the well advances in real time instead of waiting until the drill string is pulled to run wireline logs. Data from the tools are monitored and interpreted real time against prognosis to provide early warning of abnormal pressures to allow measures to be taken to progress the well safely.

Mud Logger: Mud logging personnel continually monitor returning drilling fluids for indications of hydrocarbons, utilizing both a hot wire and a gas chromatograph. An abrupt increase in gas or oil carried in the returning fluid can be an indication of an impending kick. The mud logger also monitors drill cuttings returned to the surface in the drilling fluid for changes in lithology that can be an indicator that the well has penetrated or is about to penetrate a hydrocarbon-bearing interval. Mud logging instruments also monitor penetration rate to provide an early indication of drilling breaks that show the bit penetrating a zone that could contain hydrocarbons. The mud logging personnel are in close communication with both the offshore drilling foremen and onshore Shell representative(s) to report any observed anomalies so appropriate action can be taken.

Remote Monitoring: The Real Time Operating Center has been used by Shell to complement and support traditional rig-site monitoring since 2003. Well site operations are lived virtually by onshore teams consisting of geoscientists, petrophysicists, well engineers, and 24/7 monitoring specialists. The same real time well control indicators monitored by the rig personnel are watched by the monitoring specialist for an added layer of redundancy.

Competency and Behavior: A structured training program for Well Engineers and Foreman is practiced, which includes internal professional examinations to verify competency. Other industry training in well control, such as by International Association of Drilling Contractors (IADC) and International Well Control Forum (IWCF) are also mandated. Progressions have elements of competency and Shell continues to have comprehensive internal training programs. The best systems and processes can be defeated by lack of knowledge and/or improper values. We believe that a combination of HSE tools (e.g. stop work, pre-job analysis, behavior-based safety, DWOPs, audits), management HSE involvement and enforcement (e.g. compliance to life saving rules) have created a strong safety culture in our operations.

j) Measures to conduct effective and early intervention in the event of a blowout

The response to a blowout is contained in our Well Control Contingency Plan (WCCP) which is a specific requirement of our internal well control standards. The WCCP in turn is part of the wider emergency response framework within Shell that addresses the overall organization response to an emergency situation. Resources are dedicated to these systems and drills are run frequently to test preparedness (security, medical, oil spill, and hurricane). This same framework is activated and tested during hurricane evacuations, thereby maintaining a fresh and responsive team.

The WCCP specifically addresses implementing actions at the emergency site that will ensure personnel safety, organizing personnel and their roles in the response, defining information requirements, establishing protocols to mobilize specialists and pre-selecting sources, and developing mobilization plans for personnel, material and services for well control procedures. The plan references individual activity checklists, a roster of equipment and services, initial information gathering forms, a generic description of relief well drilling, strategy and guidelines, intervention techniques and equipment, site safety management, exclusion zones, and re-boarding.

As set forth in 3f of this document, Shell is currently analyzing recent advances in containment technology and equipment and will incorporate them as they become available.

k) Arrangements for drilling a relief well

The size of the Shell contracted rig fleet in the GoM from 2018-2035 ensures that there is adequate well equipment (e.g. casing and wellhead) available for relief wells. Rigs and personnel will also be readily available within Shell, diverted from their active roles elsewhere. Resources from other operators can also be leveraged should the need arise. Generally, relief well plans will mirror the blowout well, incorporating any learning on well design based on root cause analysis of the blowout. A generic relief well description is outlined in the WCCP.

l) Assumptions and calculations used in approved or proposed OSRP

Shell has designed a response program (Regional OSRP) based upon a regional capability of responding to a range of spill volumes, from small operational spills up to and including the WCD from an exploration or development well blowout. Shell's program is developed to fully satisfy federal oil spill planning regulations. The Regional OSRP presents specific information on the response program that includes a description of personnel and equipment mobilization, the incident management team organization, and the strategies and tactics used to implement effective and sustained spill containment and recovery operations.

4) Chemical Products

Information regarding chemical products is not included in this plan as such information is not required by BOEM GOMR.

SECTION 3: GEOLOGICAL AND GEOPHYSICAL INFORMATION

Proprietary Data

A. Geological description

B. Structure Contour Map(s)

C. Interpreted 2D and/or 3D Seismic line(s)

D. Geological Structure Cross-section(s)

E. Stratigraphic Column with Time vs Depth Table

F. Shallow Hazards Report

The following reports (previously provided to BOEM) were used in our analysis in this filing:

- Shallow Hazards Assessment, Multi-Temporal Subsidence Monitoring, & Archaeological Assessment Perdido Field Block 857 & Vicinity Alaminos Canyon Area Gulf of Mexico Report No. 2414-5056 July 2015 Fugro Geoservices Inc.
- Hazards and Subsidence Monitoring Report Perdido AUV Survey Portions of Blocks 812-816, 856-80, and 900-902 Alaminos Canyon Area. June 28, 2018 Oceaneering, Project No. 182843.
- Seafloor and Near-Surface Geologic Assessment Blocks 812-814, 856-858, and 900-902 Alaminos Canyon Area Gulf of Mexico, Project No. 0204-780, GEMS July 28, 2004.
- Geologic and Stratigraphic Assessment Blocks 756, 857, 900 and 901 Alaminos Canyon Gulf of Mexico, Project No. 0600-271, GEMS, May 21, 2001.
- Perdido ROV Interpretation Report 11-14-2017, Shell.

G. Shallow Hazards Assessment

See Section 6A of this plan for detailed site assessment. See SEP S-07953, approved 7/9/19, for Power Spectrums and Top-hole Prognosis.

H. Geochemical Information

This information is not required for plans submitted in the GoM Region.

I. Future G&G Activities

This information is not required for plans submitted in the GoM Region.

SECTION 4: HYDROGEN SULFIDE (H_2S)

A. Concentration

0 ppm

B. Classification

Alaminos Canyon 857 and 901

Based on 30 CFR 250.490 and 30 CFR 550.215, Shell requests that the Regional Supervisor, Field Operations, classify the area in the proposed operations as an area where the presence of H_2S is absent.

C. H_2S Contingency Plan

Shell will not be required to provide a H_2S Contingency Plan with the Application for Permit to Drill before conducting the proposed exploration activities.

D. Modeling Report

We do not anticipate encountering or handling H_2S at concentrations greater than 500 parts per million (ppm) and therefore have not included modeling for H_2S.

SECTION 5 – MINERAL RESOURCE CONSERVATION INFORMATION

Proprietary Data

A. Technology and reservoir engineering practices and procedures

B. Technology and recovery practices and procedures

C. Reservoir Development

SECTION 6: BIOLOGICAL, PHYSICAL AND SOCIOECONOMIC INFORMATION

A. ARCHAEOLOGICAL CLEARANCE AND CHEMOSYNTHETIC ORGANISMS COMMENTS

Shell Offshore Inc. (Shell) is submitting a Supplemental DOCD for Alaminos Canyon Block 857 (AC 857) for the addition of new proposed wells and seafloor equipment to continue its development. The SDOCD will add proposed wells, flexible flowline, well jumpers and other seafloor equipment in the area of existing infrastructure previously approved in DOCD No. S-7322, RDOCDs R-5144, R-6668 and R-6831. The proposed wells were previously approved in SEP Plan No. S-7953. This letter addresses specific seafloor conditions within the three areas of installation.

Two of the installation sites fall within 2000 ft. of the previously approved wells GD-004, GD-005, GD-006, and GD-007, SEP No. S-7953. The supplemental EP cleared a 2000 ft. radius around the proposed wellsites and therefore includes the areas of installation. The assessment below addresses the seafloor conditions around the proposed well jumpers, seafloor equipment and a 1000 ft. radius around each of the installation sites.

The third installation site follows the route of the proposed flexible flowline from the Perdido Southwest Cluster, GB007 (GWE-DD-A), to the proposed Manifold near the GD005 well locations. The GB007 (GWE-DD-A) was approved in SEP No. S-7917 and added to the field development in RDCOD Plan No. R-6831. The SEP cleared a 2000 ft. radius around the GB-007(GWE-DD-A). The assessment addresses the seafloor conditions around the proposed flexible flowline and a 500 ft. buffer zone.

Seafloor conditions appear favorable within the vicinity of the proposed equipment installation. There are no potential sites for deepwater high-density benthic communities and no sonar targets of archaeological significance within above described installation areas.

Geohazard and Archaeological Assessments.

The following geohazard discussions are based on the findings provided within the following geohazard reports:

- Shallow Hazards Assessment, Multi-Temporal Subsidence Monitoring, & Archaeological Assessment Perdido Field Block 857 & Vicinity Alaminos Canyon Area Gulf of Mexico Report No. 2414-5056 July 2015 Fugro Geoservices Inc. Previously submitted.
- Hazards and Subsidence Monitoring Report Perdido AUV Survey Portions of Blocks 812-816, 856-80, and 900-902 Alaminos Canyon Area. June 28, 2018 Oceaneering, Project No. 182843. Previously submitted.
- Seafloor and Near-Surface Geologic Assessment Blocks 812-814, 856-858, and 900-902 Alaminos Canyon Area Gulf Of Mexico, Project No. 0204-780, GEMS July 28, 2004. Previously submitted.
- Geologic and Stratigraphic Assessment Blocks 756, 857, 900 and 901 Alaminos Canyon Gulf of Mexico, Project No. 0600-271, GEMS, May, 21, 2001. Previously submitted.
- Perdido ROV Interpretation Report 11-14-2017, Shell. Previously submitted.

Available Data

This assessment is based on the analysis of: a) high-resolution geophysical datasets b) reprocessed exploration 3D seismic data volume.

Oil Field Infrastructure and Military Warning Areas

The wellsite area is within Military Warning Area W-602. Pursuant to public information obtained from the BOEM database (2019), there is existing infrastructure within the proposed installation areas. Operations will be conducted using state of the art DGP for positioning to depict all existing pipelines, wells, and other seafloor equipment located within installation areas.

Proposed Installation Location

The location of the installation area is in the southwestern corner of block AC 857. Table A-1 proposed and as-built location coordinates:

Table A-1. Location Coordinates of Proposed / AS-BUILT Equipment

Equipment	Spheroid & Datum: Clarke 1866 NAD27 Projection: BLM Zone 15 North	
WM 12-3 PLEM (Proposed)	X: 1019756.13 ft.	Y: 9475423.23 ft.
WM12-2 PLET (AS-BUILT)	X: 1015808.30 ft.	Y: 9472661.01 ft.
GD-005 (proposed)	X: 1020118.00 ft.	Y: 9475457.00 ft.
GD-004 (proposed)	X: 1020045.00 ft.	Y: 9475243.00 ft.
GD-006 (proposed)	X: 1018814.00 ft.	Y: 9476339.00 ft.
OL-5 Manif0old (Proposed)	X: 1022732.649 ft.	Y: 9477878.917 ft.
GD-002 (AS-BUILT)	X: 1022731.39 ft.	Y: 9478189.82 ft.
GD-007 (proposed)	X: 1022590.00 ft.	Y: 9478112.00 ft.
WM 12-4 PLEM (Proposed)	X: 1015982.124 ft.	Y: 9472415.863 ft.
GB-007 (Proposed)	X: 1015930.00 ft	Y: 9472678.00 ft.

Installation Site Conditions.
The installation site is located along the Perdido Escarpment south of the Perdido Canyon and is characterized by complex seafloor morphology from regional tectonics. Slopes are variable and can exceed 20° along the seafloor escarpments and Perdido Canyon.

Proposed Wellsites GD-004, GD-004 Alt A, GD-004 Alt B, GD-005, GD-005 Alt, GD-006, GD-006 Alt A, GD-006 Alt B, 4 Hub Manifold, and Well Jumpers, Alaminos Canyon 857 (OCS-G-17565)

Shell proposes to install a 4 Hub Manifold and header (PLEM) and an approximately 291 ft. well jumper from the 4 Hub Manifold to proposed well GD-005, an approximately 359 ft. well jumper from proposed 4 Hub Manifold to proposed well GD-004, and an approximately 1491 ft. well jumper from proposed 4 Hub Manifold to proposed well GD-006. See Table A-1 for coordinate information.

Man-Made Features.
Infrastructure consisting of one transponder frame, one PMT (Pressure Monitoring Transponder), an umbilical and an 8″ flowline are within 1000 ft. of the subsea installation and will be considered during installation activities. The well jumper from GD-006 to the proposed 4 Hub Manifold will cross the installed umbilical and 8″ flowline.

Water Depth and Seafloor Conditions.
The water depths at the proposed installation site ranges from approximately -8010 ft to -8190 ft. and the seafloor slopes approximately 6° to the east. The area of installation is just east of existing infra-structure. The infra-structure is not within 1000 ft. radius of installation site. There are drag scars, well cuttings and fault scarps within the installation area.

Deepwater Benthic Communities.
Deepwater high density benthic communities are not expected at the proposed installation site. There are no features or areas that could or have been observed to support significant, high-density, benthic communities within 1000 ft of the proposed seafloor equipment. There are no water bottom anomalies (positive possible oil) as defined by BOEM (BOEM, June 2019) within 1000 ft. of the proposed installation site. See Figure 1.

Archaeological Assessment.
The archaeological assessments of side-scan sonar covering AC 857 and the surrounding area resulted in no sonar contacts being identified within 1000 ft. of the proposed installation site. There are no archaeological significant areas within 1000 ft. of proposed installation site.

Proposed Wellsites GD007, GD007 Alt, AS-BUILT GD002, OL-5 Manifold, and Well Jumpers, Alaminos Canyon 857 (OCS-G-17565)

Shell proposes to install the OL-5 Manifold, an approximately 290 ft. well jumper from proposed OL-5 Manifold to the as-built well GD-002, an approximately 290 ft. well jumper from proposed OL-5 Manifold to proposed well GD-007. Also planned is to replace the GD002 2000' jumper with and an approximately 2000 ft. well jumper from proposed OL-5 Manifold to the existing GD002 XT OLW flowline Sled.

Man-Made Features.
Infrastructure consisting of a manifold, wells, six transponder frames, an umbilical and an 8" flowline are within 1000 ft. of the subsea installation and will be considered during installation activities.

Water Depth and Seafloor Conditions.
The water depths at the proposed installation site ranges from approximately -8010 ft to -8190 ft. and the seafloor slopes approximately 12° to the east. Drag scars and gullies were identified within the installation area.

Deepwater Benthic Communities.
Deepwater high density benthic communities are not expected at the proposed installation site. There are no features or areas that could or have been observed to support significant, high-density, benthic communities within 1,000 ft of the proposed seafloor equipment. There are no water bottom anomalies (positive possible oil) as defined by BOEM (BOEM, June 2019) within 1,000 ft. of the proposed installation site. One area just to the north of the proposed installation area, but not within the 1000 ft., was identified as having potential for high density benthic communities but visual ROV inspection of this area indicated that this area did not have high density benthic communities, (ROV,2017). See Figure 2.

Archaeological Assessment.
The archaeological assessments of side-scan sonar covering AC 857 and the surrounding area resulted in four sonar contacts being identified within 1000 ft. of the proposed installation site. None of the sonar contacts were identified as archaeological significance within 1000 ft. of proposed installation site. Contacts Numbers 42, 44, and 48 were identified in OCN,2018 Job No. 182843 report. One sonar contact number 33 was identified in GEMS,2004 Project No. 0204-780 report. All sonar contacts were identified as debris from development activities or created by geological processes. Recommended avoidance distance is 100 ft. as suggested by BOEM/BSEE guidance. See reports for further details.

Proposed Flexible Flowline, Rubber Mats, and Jumpers at Southwest Cluster, Alaminos Canyon 857 (OCS-G-17565)

Shell proposes to install new WM 12-4 PLEM, a 6 inch flexible flowline from WM 12-4 HUB (Sled 1) to proposed WM12-3 Manifold/PLEM approximate length of 5233 ft, a well jumper of approximately 291 ft from proposed WM 12-4 HUB (Sled 1) to the as-built WM12-2 PLET polymats over existing EFLs just north of the proposed WM12-4 PLEM, an approximately 428 ft well jumper from proposed GB-007 well to proposed WM 12-4 HUB (Sled 1). See Table A-1 for coordinate information.

Man-Made Features.
Infrastructure consisting of a manifold, wells, transponder frames, an umbilical and a flowline are within 500 ft. of the subsea installation area and will be considered during installation activities. Further details of the proposed pipeline and umbilical routes will be handled in the pipeline / umbilical permit. Operations will be conducted using state of the art DGPS for positioning to depict all existing pipelines located within 500 ft. of the operations.

Water Depth and Seafloor Conditions.
The water depths at the proposed installation site and along the flexible flowline route ranges from approximately -8000 ft to -8210 ft. Drag scars, faults scarps, well cuttings, and gullies were identified within the installation site and along the flexible flowline route.

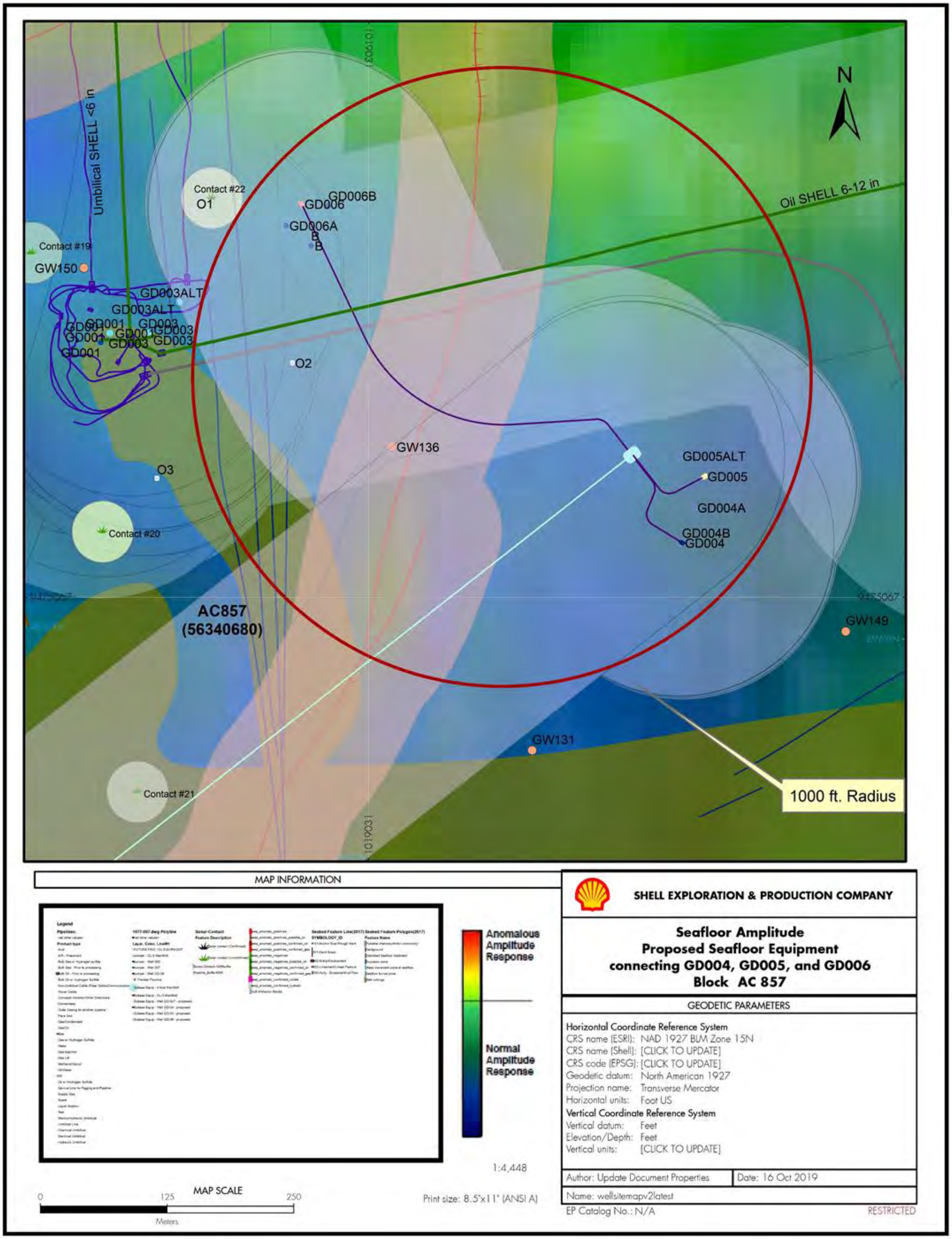
Deepwater Benthic Communities High-Density deepwater benthic communities are not expected in the installation area or along the flexible flowline route. No expulsion features were observed. No seafloor features related to possible high-density deepwater benthic communities were identified with in 500 ft. of the installation area or along the flexible flowline route. No seafloor anomalies related to fluid expulsion were identified within 500 ft. of the installation site or the along the flexible flowline route. There are no water bottom anomalies (positive possible oil) as defined by BOEM (BOEM, June 2019) within 500 ft. of the proposed installation site or along the flowline route. See Figure 3.

Archaeological Assessment.

The archaeological assessments of side-scan sonar covering AC 857 and the surrounding area resulted in one sonar contacts being identified within 500 ft. of the proposed installation site. None of the sonar contacts were identified as archaeological significance within 500 ft. of proposed installation site. Contacts Number 21 was identified in OCN,2018 Job No. 182843 report. All sonar contacts were identified as debris from development activities or created by geological processes. Recommended avoidance distance is 100 ft. as suggested by BOEM/BSEE guidance. See reports for further details.

Proposed Seafloor Equipment Installation: Concluding Remarks

The Proposed Seafloor Equipment, Alaminos Canyon 857 (OCS-G-17571), appears suitable for development producing operations. No seafloor obstructions or conditions exist that will be a constraint to equipment at the proposed installation areas.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SHELL EXPLORATION & PRODUCTION COMPANY
Seafloor Amplitude
Proposed Seafloor Equipment
connecting GD004, GD005, and GD006
Block AC 857
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Figure 1

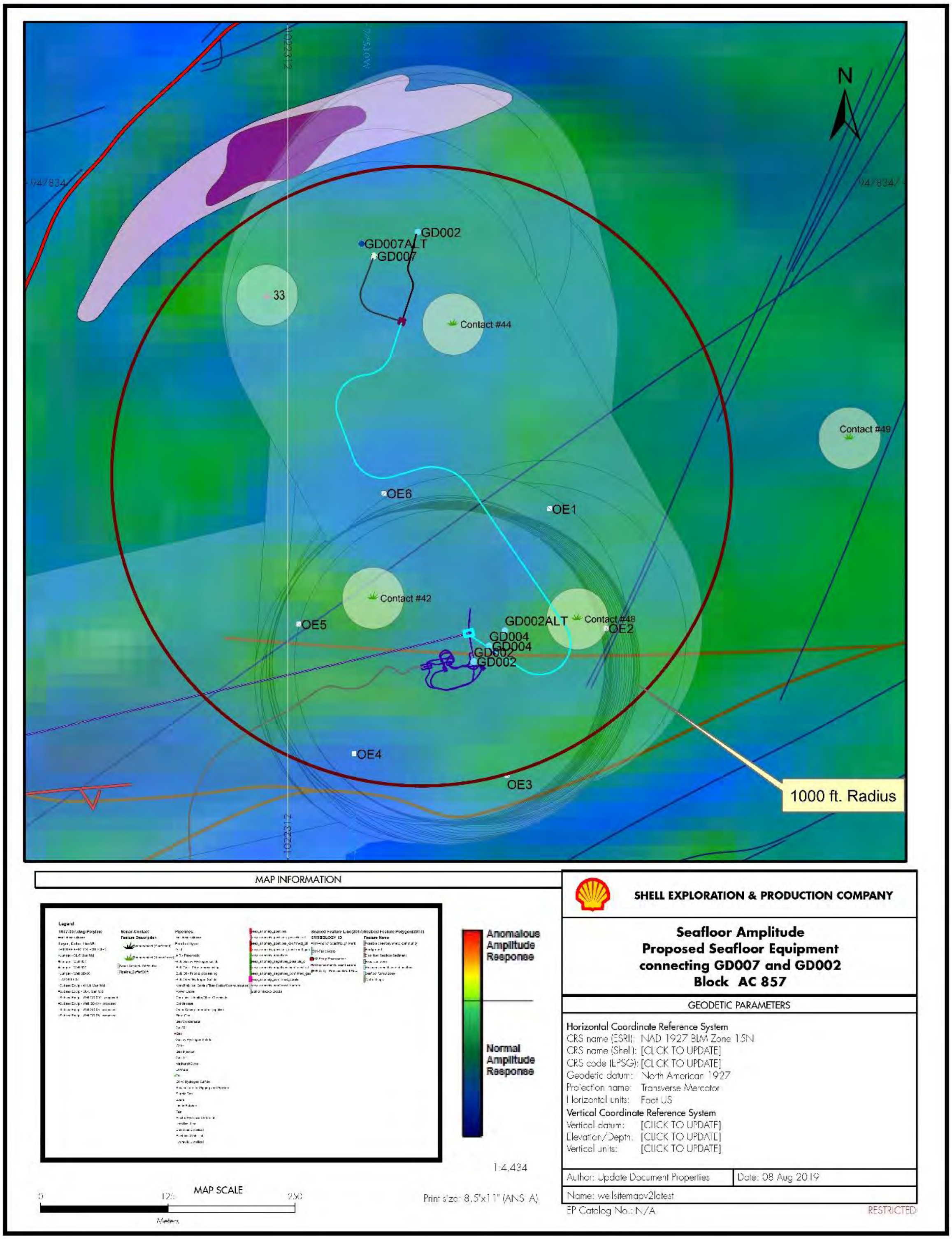

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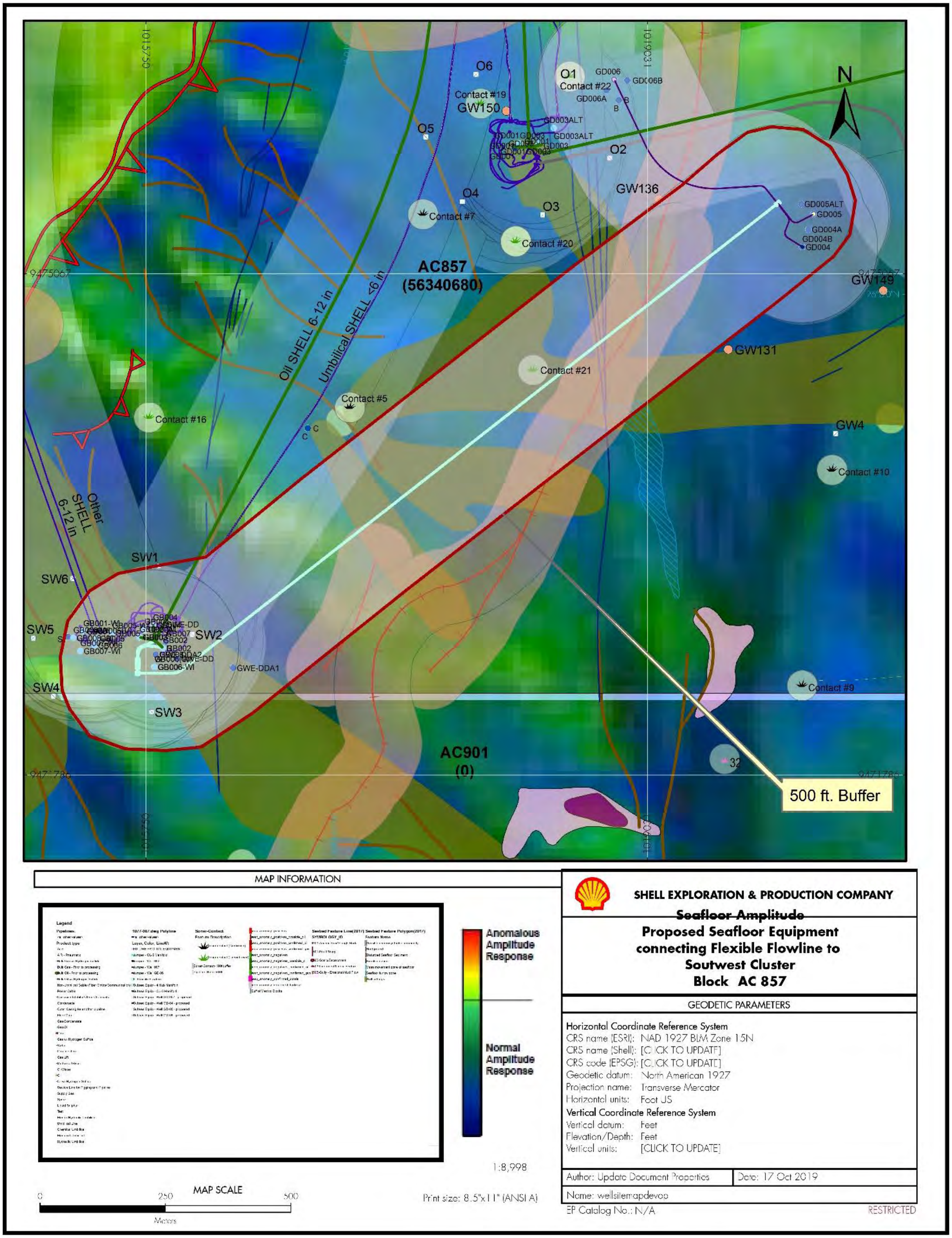
Figure 2



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GD006
GD006B
GD006A
Contact #19
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GD003ALT
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O4
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Contact #20
GD005ALT
GD005
GD004A
GD004B
GD004
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SW6
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SW2
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SHELL EXPLORATION & PRODUCTION COMPANY
Seafloor Amplitude
Proposed Seafloor Equipment connecting Flexible Flowline to Soutwest Cluster
Block AC 857
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Horizontal Coordinate Reference System
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EP Catalog No.: N/A
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Figure 3

B. Topographic Features Map

The proposed activities are not within 1,000' 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)

Shell 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' of any pinnacle trend feature with vertical relief equal to or greater than 8'. 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' 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' of any potentially sensitive biological features. Therefore, no map is required per NTL No. 2008-G04.

G. Remotely Operated Vehicle (ROV) Monitoring Plan

This information is no longer required by BOEM GoM.

H. 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 30 CFR 250, Subpart B, effective May 14, 2007 and further outlined in Notice to Lessees (NTL) 2008-G04, and the Biological Opinion on the National Marine Fisheries Service. 2020. Endangered Species Act, Section 7 Consultation – Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. St. Petersburg, FL. (NMFS 2020 Endangered Species Act, Section 7 Consultation – Biological Opinion), 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 proposed activities under this plan.

Currently the only designated critical habitat is *Sargassum* habitat for the Loggerhead sea turtle in the proposed project area; however, it is possible that this species and one or more of the other listed 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:

Common Name	Scientific Name	T/E Status
Hawksbill Turtle	*Eretmochelys imbricata*	E
Green Turtle	*Chelonia mydas*	T/E
Kemp's Ridley Turtle	*Lepidochelys kempii*	E
Leatherback Turtle	*Dermochelys coriacea*	E
Loggerhead Turtle	*Caretta caretta*	T

Table 6.1 – Threatened and Endangered Sea Turtles

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

There are 29 species of marine mammals that may be found in the Gulf of Mexico (see Table 6.7 below). Of the species listed as Endangered, only the Sperm whale is commonly found in the project area. No critical habitat for these species has been designated in the Gulf of Mexico.

Common Name	Scientific Name	T/E Status
Atlantic Spotted Dolphin	*Stenella frontalis*	
Blainville's Beaked Whale	*Mesoplodon densirostris*	
Blue Whale	*Balaenoptera musculus*	E
Bottlenose Dolphin	*Tursiops truncatus*	
Bryde's Whale	*Balaenoptera edeni*	E
Clymene Dolphin	*Stenella clymene*	
Cuvier's Beaked Whale	*Ziphius cavirostris*	
Dwarf Sperm Whale	*Kogia simus*	
False Killer Whale	*Pseudorca crassidens*	
Fin Whale	*Balaenoptera physalus*	E
Fraser's Dolphin	*Lagenodelphis hosei*	
Gervais' Beaked Whale	*Mesoplodon europaeus*	
Humpback Whale	*Megaptera novaeangliae*	E
Killer Whale	*Orcinus orca*	
Melon-headed Whale	*Peponocephala electra*	
Minke Whale	*Balaenoptera acutorostrata*	
North Atlantic Right Whale	*Eubalaena glacialis*	E
Pantropical Spotted Dolphin	*Stenella attenuata*	
Pygmy Killer Whale	*Feresa attenuata*	
Pygmy Sperm Whale	*Kogia breviceps*	
Risso's Dolphin	*Grampus griseus*	
Rough-toothed Dolphin	*Steno bredanensis*	
Sei Whale	*Balaenoptera borealis*	E
Short-finned Pilot Whale	*Globicephala macrorhynchus*	
Sowerby's Beaked Whale	*Mesoplodon bidens*	
Sperm Whale	*Physeter macrocephalus*	E
Spinner Dolphin (Long-snouted)	*Stenella longirostris*	
Striped Dolphin	*Stenella coeruleoalba*	
Florida manatee	*Trichechus manatus*	E

Table 6.2 Threatened and Endangered Marine Mammals

The blue, fin, humpback, North Atlantic right and sei whales are rare or extralimital in the Gulf of Mexico and are unlikely to be present in the lease area. The Environmental Impact Analysis found in Section 18 discusses potential impacts and mitigation measures related to threatened and endangered species.

There are also listed species of birds, fishes, invertebrates and terrestrial mammals in the Gulf of Mexico waters and coastal environments. Of these, it is possible that Giant manta ray may be present in the lease area, but it is highly unlikely that any other birds, fish species and terrestrial mammals, given their coastal ranges, will be present in the lease area. The presence of invertebrates is identified through different lease operations, as biologically sensitive habitat features that must be avoided per BOEM NTL 2009-G40.

Birds		
Piping Plover	*Charadrius melodus*	T
Whooping Crane	*Grus americana*	E
Fishes		
Oceanic whitetip shark	*Carcharhinus longimanus*	T
Giant manta ray	*Mobula birostris*	T
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T
Nassau grouper	*Epinephelus striatus*	T
Smalltooth sawfish	*Pristis pectinata*	E
Invertebrates		
Elkhorn coral	*Acropora palmata*	T
Staghorn coral	*Acropora cervicornis*	T
Pillar coral	*Dendrogyra cylindrus*	T
Rough cactus coral	*Mycetophyllia ferox*	T
Lobed star coral	*Orbicella annularis*	T
Mountainous star coral	*Orbicella faveolata*	T
Boulder star coral	*Orbicella franksi*	T
Terrestrial Mammals		
Beach mice (Alabama, Choctawhatchee, Perdido Key, St. Andrew)	*Peromyscus polionotus*	E
Florida salt marsh vole	*Microtus pennsylvanicus dukecampbelli*	E

Table 6.3– Birds, fishes, invertebrates and terrestrial mammals

I. Archaeological Report

See previous Section 6A for this data.

J. Air and Water Quality Information

Proposed operations will produce air pollutant emissions, but as provided in the Air Emissions Spreadsheet (see Section 8 of this Plan), these operations are below the exemption levels.

These operations will result in the discharge of authorized effluents under the EPA Region VI General permit. Impacts of these discharges are expected to be minimal on water quality in the area.

For specific information relating to air and water quality information please refer to Section 18.

K. Socioeconomic Information

1) Shell will utilize its existing shorebase located in Fourchon, Louisiana which is fully staffed and operational and does not expect to employ persons from within the State of Florida.

2) Shell does not expect to purchase major supplies, services, energy, water or other resources from within the State of Florida for these operations.

3) Shell does not expect to hire contractors or vendors from within the State of Florida.

For specific information relating to socioeconomic information please refer to Section 18 in this Plan.

SECTION 7: WASTE AND DISCHARGE INFORMATION

A. Projected Ocean Discharges

TABLE 7A: WASTES YOU WILL GENERATE, TREAT AND DOWNHOLE DISPOSE OR DISCHARGE TO THE GOM

Note: Please specify if the amount reported is a total or per well amount

Projected generated waste			Projected ocean discharges		Projected Downhole Disposal
Type of Waste and Composition	**Composition**	**Projected Amount**	**Discharge rate**	**Discharge Method**	**Answer yes or no**
Will drilling occur ? If yes, you should list muds and cuttings					
EXAMPLE: Cuttings wetted with ynthetic based fluid	*Cuttings generated while using synthetic based drilling fluid.*	*X bbl/well*	*X bbl/day/well*	*discharge pipe*	*No*
Water-based drilling fluid	barite, additives, mud	85000 bbls/well	17000 bbls/day	marine riser installation	No
Cuttings wetted with water-based fluid	Cuttings coated with water based drilling mud	11520 bbls/well	768 bbls/day	Seafloor prior to marine riser installation	No
Cuttings wetted with synthetic-based fluid	Cuttings generated while using synthetic based drilling fluid.	16360 bbls/well	409 bbls/day	Overboard discharge line below the water level	No
Synthetic based drilling fluid adhering to washed drill cuttings	Synthetic based drilling fluid adhering to washed drill cuttings	280 bbls/well	7 bbls/day	Overboard discharge line below the water level	No
Spent drilling fluids - synthetic	Synthetic-based drilling mud	0 bbls / well	0 bbls/day	Overboard discharge line below the water level	No
Spent drilling fluids - water based	Synthetic-based drilling mud	0 bbls / well	0 bbls/day	Overboard discharge line below the water level	No
Chemical product waste	Chemical product waste	0 bbls / well	0 bbls/day	Treated to meet NPDES limits and discharged overboard	No
Brine	brine	N/A	N/A	N/A	No
Will humans be there? If yes, expect conventional waste					
EXAMPLE: Sanitary waste water		*X liter/person/day*	*NA*	*chlorinate and discharge*	*No*
Domestic waste (kitchen water, shower water)	grey water	16000 bbls/well	200 bbls/day/well	Ground to less than 25 mm mesh size and discharge overboard	No
Sanitary waste (toilet water)	treated sanitary waste	12000 bbls/well	150 bbls/day/well	Treated in the MSD** prior to discharge to meet NPDES limits	No
Is there a deck? If yes, there will be Deck Drainage					
Deck Drainage	Wash and rainwater	1600 bbls/well	20 bbls/day	Drained overboard through deck scuppers	No
Will you conduct well treatment, completion, or workover?					
well treatment fluids	Linear Frac Gel Flush Fluids, Crosslinked Frac Fluids carrying ceramic proppant and acidic breaker fluid	200 bbls/well	10 bbls/day	Overboard discharge line below the water level if oil and greese free.	No
well completion fluids	Completion brine contaminated with WBDM and displacement spacers	300 bbls/well	15 bbls/day	Overboard discharge line below the water level if oil and greese free.	No
workover fluids	Linear Frac Gel Flush Fluids, Crosslinked Frac Fluids carrying ceramic proppant, spacers, flushes, and acidic breaker fluid	300 bbls/well	15 bbls/day	NA	No
Miscellaneous discharges. If yes, only fill in those associated with your activity.					
Desalinization unit discharge	Rejected water from watermaker unit	32000 bbls/well	400 bbls/day/well	RO Desalinization Unit Discharge Line below waterline	No
Blowout preventer fluid	Water based	16 bbls/well	0 bbls/day	Discharge Line @ Subsea BOP @ seafloor	No
Ballast water	Uncontaminated seawater	262080 bbls/well	3276 bbls/day	Discharge line overboard just above water line	No
Bilge water	Bilge and drainage water will be treated to MARPOL standards (< 15ppm oil in water).	123440 bbls/well	1543 bbls/day	Bilge and drainage water will be treated to MARPOL standards (< 15ppm oil in water).	No
Excess cement at seafloor	Cement slurry	12000 bbls/well (assume planned 100% excess is discharged)	200 bbls/day	Discharged at seafloor.	No
Fire water	Treated seawater	5333 bbls/well	2000 bbls/month	Discharged below waterline	No
Cooling water	Treated seawater	36507440 bbls/well	456343 bbls/day/well	Discharged below waterline	No
Untreated or treated seawater	Treated Seawater	5000 bbls / flowline	300 gpm	Discharged at seafloor.	No
Hydrate Inhibitor	Hydrate Inhibitor	50 bbl glycol plug / flowline 15 bbl methanol / well	300 gpm	Discharged at seafloor.	No
Sub sea Production Control Fluid	Water-based	72 bbls/year	72 bbls/year	Discharged at seafloor.	No
Will you produce hydrocarbons? If yes fill in for produced water.					
Produced water	NA	NA	NA	NA	
Will you be covered by an individual or general NPDES permit ?			GENERAL PERMIT	GMG290103	
NOTE: If you will not have a type of waste, enter NA in the row.					

B. Projected Generated Wastes

TABLE 7B. WASTES YOU WILL TRANSPORT AND/OR DISPOSE OF ONSHORE

Note: Please specify whether the amount reported is a total or per well

Projected generated waste		**Solid and Liquid Wastes transportation**	**Waste Disposal**		
Type of Waste	**Composition**	**Transport Method**	**Name/Location of Facility**	**Amount**	**Disposal Method**
Will drilling occur ? If yes, fill in the muds and cuttings.					
EXAMPLE: Oil-based drilling fluid or mud	*NA*	*NA*	*NA*	*NA*	*NA*
Oil-based drilling fluid or mud	NA	NA	NA	NA	NA
Synthetic-based drilling fluid or mud	used SBF and additives	Drums/tanks on supply boat/barges	Halliburton Drilling Fluids, MiSwaco, Newpark Drilling Fluids - Fourchon, LA; Ecoserv (Fourchon, La.), or R360 Environmental Solutions (Fourchon, La.),	6,500 bbls/well	Recycled/Reconditioned ; Deep Well Injection
Cuttings wetted with Water-based fluid	NA	NA	NA	NA	NA
Cuttings wetted with Synthetic-based fluid	Drill cuttings from synthetic based interval.	storage tank on supply boat.	Ecoserv (Fourchon, La.), or R360 Environmental Solutions (Fourchon, La.),	300 bbls / well	Deep Well Injection, or landfarm
Cuttings wetted with oil-based fluids	NA	NA	NA	NA	NA
Completion Fluids	Completion and treatment fluids	Storage tank on supply boat	Halliburton, Baker Hughes, Superior, or Tetra - Fourchon, LA; Ecoserv (Fourchon, La.), or R360 Environmental Solutions (Fourchon, La.),	4,000 bbls/well	Recycled/Reconditioned ; Deep Well Injection
Salvage Hydrocarbons	Well completion fluids, formation water, formation solids, and hydrocarbon	Barge or vessel tank	PSC Industrial Outsourcing, Inc. (Jeanerette, LA)	<8000 bbl./well	Recycled or Injection
Will you produce hydrocarbons? If yes fill in for produced sand.					
Produced sand	Sand Produced from formation	Drums/tanks on supply boat	Ecoserv (Fourchon, La.), or R360 Environmental Solutions (Fourchon, La.)	200 bbls/year	Disposal or Deep Well Injection
Will you have additional wastes that are not permitted for discharge? If yes, fill in the appropriate rows.					
EXAMPLE: trash and debris	*cardboard, aluminum,*	*barged in a storage bin*	*shorebase*	*z tons total*	*recycle*
Trash and debris - recyclables	trash and debris	various storage containers on supply boat	Omega Waste Managment, W. Patterson, LA; Lamp Environmental, Hammond, LA	200 lbs/month	Recycle
Trash and debris - non-recyclables	trash and debris	various storage containers on supply boat	Republic/BFI landfill, Sorrento, LA or the parish landfill, Avondale, LA	400 lbs/month	Landfill
E&P Wastes	Completion and treatment wastes	various storage containers on supply boat	Ecoserv (Fourchon, La.), or R360 Environmental Solutions (Fourchon, La.)	200 bbls / well	Deep Well Injection, or landfarm
Used oil and glycol	used oil, oily rags and pads, empty drums and cooking oil	various storage containers on supply boat	Omega Waste Managment, W. Patterson, LA	20 bbls/month	Recycle
Non-Hazardous Waste	paints, solvents, chemicals, completion and treatment fluids	various storage containers on supply boat	Republic/BFI landfill, Sorrento, LA Lamp Environmental, Hammond, LA	60 bbls/mo	Incineration or RCRA Subtitle C landfill
Non-Hazardous Oilfield Waste	Chemicals, completion and treatment fluids	various storage containers on supply boat	Ecoserv (Port Arthur, TX)	60 bbls/mo	Deep Well Injected
Hazardous Waste	paints, solvents, chemicals, completion and treatment fluids	various storage containers on supply boat	Omega Waste Managment, W. Patterson, LA; Lamp Environmental, Hammond, LA	60 bbls/mo	Recycle, treatment, incineration, or landfill
Universal Waste Items	Batteries, lamps, glass and mercury-contaminated waste	various storage containers on supply boat	Lamp Environmental, Independence, LA	50 bbls/mo	Recycle, treatment, incineration, or landfill
NOTE: If you will not have a type of waste, enter NA in the row.					

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 EP.

SECTION 8: AIR EMISSIONS INFORMATION

A. Emissions Worksheet and Screening Questions

Screening Questions for **DOCD's**	Yes	No
Is any calculated Complex Total (CT) Emission amount (in 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 250.1160(a)(4) or (7)?		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

*Note: The following AQR is using fuel limitations and Shell will perform fuel monitoring for this project.

B. If you answer *no* to all of the above screening questions from the appropriate table, provide:

(1) Summary information regarding the peak year emissions for both Plan Emissions and Complex Total Emissions, if applicable. This information is compiled on the summary form of the two sets of worksheets. You can submit either these summary forms or use the format below. You do not need to include the entire set of worksheets.

Note: There are no collocated wells, activities or facilitates associated with this plan. The complex total is the same as Plan Emissions.

Air Pollutant		Plan Emission Amounts (tons)	Calculated Exemption Amounts (tons)		Calculated Complex Total Emission Amounts (tons)
PM					
SO_x					
NOx					
VOC					
CO					

(1) Contact: Josh O'Brien, (504) 425-9097, Joshua.E.OBrien@shell.com

C. Worksheets

See attached.

The schedule in Form BOEM-0137 will not match the days presented in the AQR, as the AQR contains extra days for contingency delays.

Note: The Perdido host emissions, approved in Plan R-06850, do not increase or change as a result of the operations proposed in this plan.

Emissions Reduction Measures

Emission Source	Reduction Control Method	Amount of Reduction	Monitoring System
Prime mover	Actual fuel consumption	2,272 tons NO_x/year	Fuel log
Supply Vessels	Actual fuel consumption	393 tons NO_x/year	Fuel log

COMPANY	Shell Offshore Inc
AREA	Alaminos Canyon
BLOCK	857
LEASE	OCS-G 17565
PLATFORM	DP MODU, DP Semi
WELL	GD wells and well work (incl. workover and maintenance)
DISTANCE TO LAND	142
COMPANY CONTACT	Joshua O'Brien
TELEPHONE NO.	504-425-9097
REMARKS	GW Frio-DOCD AQR-MODU INST-20191229-BOEM.xlsx Install and commission manifolds/flying leads/flowlines/jumpers/umbilical.

LEASE TERM PIPELINE CONSTRUCTION INFORMATION:

YEAR	NUMBER OF PIPELINES	TOTAL NUMBER OF CONSTRUCTION DAYS
2020	10	77
2021	3	30
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		

Remarks:

Some activities associated with these sources, specifically Service/Support Vessls, are not currently planned but are included as a contingency, per BOEM guidance, Tips to Avoid Common Emissions Spreadsheet Errors, #10, https://www.boem.gov/Air-Quality-Submission-Tips/. Therefore, the schedule in Form BOEM-0137 will not match the days presented in the AQR.

Purpose

Shell has reviewed engine information for its GOM fleet of Drillship and DP semi-sub MODUs. Of the proposed MODUs, the highest fuel consumption is Shell's contracted Transocean Deepwater MODUs, which has six, main engines of 9,387 hp/engine. (Shell's contracted Noble MODUs have lower total horsepower and fuel consumption.) The projected fuel usages presented below would therefore be conservative across the fleet of Drillships and DP Semi-subs.

Step 1 - Determine Typical Operating Loads

Description	Value	Notes
Actual average daily fuel use (gal/day)	13,006	Based on daily fuel records for the Deepwater Thalassa from January 1, 2016 to December 31, 2016.
Contingency factor	1.55	The contingency factor is used to allow for more usage if need be.
Proposed MODU Campaign Average Daily Fuel Use (gal/day)	20,000	Calculated Value - PTE fuel use * Proposed Operating Load and rounded up to nearest thousand (for additional conservatism). This represents total fuel use on the MODU and is allocated equally amongst the six prime movers.
2020-2045 Annual Fuel Limits, gals	4,000,000	Calculated Value - Campaign Average Daily Fuel Use * Campaign Days

Step 2 - Support Vessel Fuel Loads

Description	Value	Notes
Proposed Operating Loads	50%	Shell policy restricts D/P to < 50% near rig. When in standby away from rig but within 25 miles load will be < 50% (conserve fuel). When transiting through field (25 nm), traveling at economical speeds.
OSV - PTE Fuel Use (gal/day)	11,708	Offshore Support Vessels are rated at 10,098hp (rounded to 10,100 hp). The PTE fuel use is then estimated using the AQR conversion factor of 0.0483 gal/hp-hr.
Campaign Average Daily Fuel Use (gal/day)	5,854	Calculated Value - PTE fuel use * Proposed Operating Load.
Crew Vessel - PTE Fuel Use (gal/day)	9,274	Crew Vessels are rated at 7,944 hp (rounded to 8,000 hp). The PTE fuel use is then estimated using the AQR conversion factor of 0.0483 gal/hp-hr.
Crew Vessel - Campaign Average Daily Fuel Use (gal/day)	1,391	Calculated Value - PTE fuel use * Proposed Operating Load. Note that Crew Vessels are only in field 30% of campaign and daily average value has been
Proposed Vessel Campaign Average Daily Fuel Use (gal/day)	7,245	Calculated Value - Average fuel use * Contigency Factor and rounded up to nearest thousand (for additional conservatism). This represents total fuel use on the Support and Crew vessels.
Total Vessel Activity		
2020-2045 Annual Fuel Limits, gals	1,683,158	Sum of (vessel daily fuel use * corresponding campaign days)

Additional Notes

1 - Operating loads are campaign specific and may change in future AQRs depending on the future fuel usage tracking. Fuel levels depicted in this AQR does not restrict Shell from using a different value in future AQRs.

2 - If tracked fuel usage associated with this activity indicates emissions may exceed the approved emissions, Shell will submit revised AQR calculations.

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	Notes
NG Turbines	gms/hp-hr		0.00247	1.3	0.01	0.83	AP42 3.2-1& 3.1-1	10/96	Factors not used in this spreadsheet
NG Turbines	lb/MMBtu	0.0066	0.00031	0.32	0.0021	0.177	AP42 3.1-1& 3.1-2	04/00	
NG 2-cycle lean	gms/hp-hr		0.00185	10.9	0.43	1.5	AP42 3.2-1	10/96	Factors not used in this spreadsheet
NG 4-cycle lean	gms/hp-hr		0.00185	11.8	0.72	1.6	AP42 3.2-1	10/96	Factors not used in this spreadsheet
NG 4-cycle rich	gms/hp-hr		0.00185	10	0.14	8.6	AP42 3.2-1	10/96	Factors not used in this spreadsheet
Diesel Recip. < 600 hp.	gms/hp-hr	1	0.367	14	1.12	3.03	AP42 3.3-1	10/96	Typical BOEM Factors
Diesel Recip. > 600 hp.	gms/hp-hr	0.32	0.367	11	0.33	2.4	AP42 3.4-1	10/96	Typical BOEM Factors
Diesel Boiler	lbs/bbl	0.084	0.605	0.84	0.008	0.21	AP42 1.3-12,14	9/98	Typical BOEM Factors
NG Heaters/Boilers/Burners	lbs/mmscf	7.6	0.593	100	5.5	84	?42 1.4-1, 14-2, & 14	7/98	Factors not used in this spreadsheet
NG Flares	lbs/mmscf		0.593	71.4	60.3	388.5	AP42 11.5-1	9/91	Typical BOEM Factors
Liquid Flaring	lbs/bbl	0.42	6.83	2	0.01	0.21	AP42 1.3-1 & 1.3-3	9/98	Factors not used in this spreadsheet
Tank Vapors	lbs/bbl				0.03		E&P Forum	1/93	Factors not used in this spreadsheet
Fugitives	lbs/hr/comp.				0.0005		API Study	12/93	Factors not used in this spreadsheet
Glycol Dehydrator Vent	lbs/mmscf				6.6		La. DEQ	1991	Factors not used in this spreadsheet
Gas Venting	lbs/scf				0.0034				Factors not used in this spreadsheet

Sulphur Content Source	Value	Units
Fuel Gas	3.33	ppm
Diesel Fuel (7)	0.1	% weight
Produced Gas(Flares)	3.33	ppm
Produced Oil (Liquid Flaring)	1	% weight

365	days/yr - Follows FLAG 2010 Guidance
2000	lb/ton conversion factor
454	g/lb conversion factor
1000	SCF/MSCF conversion factor
1.341	hp/kW conversion factor

Notes

1. Reserved
2. Reserved
3. Reserved
4. Reserved
5. Reserved
6. Reserved
7. Per 40 CFR Part 80 Subpart I, as of June 1, 2014, ECA marine fuel is subject to a maximum per-gallon sulfur content of 1,000 ppm. BOEM has indicated that use of low sulfur fuel content on the AQRs will not result in mitigations in Plan approval documents.

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL	CONTACT	PHONE	REMARKS
Shell Offshore Inc	Alaminos Canyon	857	OCS-G 17565		GD w ells and w ell w ork (incl. w orkover a	Joshua O'Brien	504-425-9097	GW Frio-DOCD AQR-MODU INST-20200107-FINAL.xlsxInstall and commission manifolds/flying l

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
DP MODU	PRIME MOVER>600hp diesel	9387	453	3333	24	200	6.62	7.59	227.44	6.82	49.62	4.86	5.58	167.21	5.02	36.48
DRILLING AND/OR	PRIME MOVER>600hp diesel	9387	453	3333	24	200	6.62	7.59	227.44	6.82	49.62	4.86	5.58	167.21	5.02	36.48
WELLWORK	PRIME MOVER>600hp diesel	9387	453	3333	24	200	6.62	7.59	227.44	6.82	49.62	4.86	5.58	167.21	5.02	36.48
	PRIME MOVER>600hp diesel	9387	453	3333	24	200	6.62	7.59	227.44	6.82	49.62	4.86	5.58	167.21	5.02	36.48
	PRIME MOVER>600hp diesel	9387	453	3333	24	200	6.62	7.59	227.44	6.82	49.62	4.86	5.58	167.21	5.02	36.48
	PRIME MOVER>600hp diesel	9387	453	3333	24	200	6.62	7.59	227.44	6.82	49.62	4.86	5.58	167.21	5.02	36.48
	Energency Generator>600hp diese	2547	123	2952	1	200	1.80	2.06	61.71	1.85	13.46	0.18	0.21	6.17	0.19	1.35
	Emergency Air Compressor< 600h	26	1	30	1	200	0.06	0.02	0.80	0.06	0.17	0.01	0.00	0.08	0.01	0.02
	All other rig-equipment is electric (e.g cranes) or negligible in emissions potential (e.g. life boats, welding equipment, etc.)															
	Supply Vessel>600hp diesel (gene	10100	488	5854	24	200	7.12	8.16	244.71	7.34	53.39	8.54	9.80	293.66	8.81	64.07
	Supply Vessel>600hp diesel (gene	10100	488	5854	24	20	7.12	8.16	244.71	7.34	53.39	0.85	0.98	29.37	0.88	6.41
	Supply Vessel>600hp diesel (gene	10100	488	5854	24	20	7.12	8.16	244.71	7.34	53.39	0.85	0.98	29.37	0.88	6.41
	Crew Vessel>600hp diesel	8000	386	1391	24	200	5.64	6.47	193.83	5.81	42.29	2.03	2.33	69.78	2.09	15.22
	SERVICE/SUPPORT Vessel Diesel - General (1)	37500	1811	43470.00	24	10	26.43	30.31	908.59	27.26	198.24	3.17	3.64	109.03	3.27	23.79
	SERVICE/SUPPORT Vessel Diesel - General (1)	26000	1256	30139.20	24	20	18.33	21.02	629.96	18.90	137.44	4.40	5.04	151.19	4.54	32.99
	SERVICE/SUPPORT Vessel >600hp diesel (1)	42000	2029	48686.40	24	20	29.60	33.95	1017.62	30.53	222.03	7.10	8.15	244.23	7.33	53.29
PIPELINE	SERVICE/SUPPORT Vessel Diesel (1)	45000	2173.5	52164.00	24	10	31.72	36.38	1090.31	32.71	237.89	3.81	4.37	130.84	3.93	28.55
INSTALLATION	SERVICE/SUPPORT Vessel Diesel (1)	12605	608.8215	14611.72	24	20	8.88	10.19	305.41	9.16	66.63	2.13	2.45	73.30	2.20	15.99
	SERVICE/SUPPORT Vessel Diesel (1)	24500	1183.35	28400.40	24	80	17.27	19.81	593.61	17.81	129.52	16.58	19.01	569.87	17.10	124.33
	VESSELS>600hp diesel(supply)	10100	487.83	11707.92	24	10	7.12	8.16	244.71	7.34	53.39	0.85	0.98	29.37	0.88	6.41
2020	TOTAL						207.90	238.39	7145.33	214.40	1558.98	79.70	91.40	2739.51	82.19	597.71
EXEMPTION CALCULATION	DISTANCE FROM LAND IN MILES											4728.60	4728.60	4728.60	4728.60	92541.77
	142.0															

(1) SERVICE/SUPPORT Vessel Diesel-General: The days allocated per year will be for temporary activities of installation of umbilicals, manifolds, flowlines, jumpers, flying leads, etc.), inspections, equipment maintenance, stimulations, or other service/support needs; some of which may not occur in any given year and are yet to be planned.

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL		CONTACT	PHONE	REMARKS
Shell Offshore Inc	Alaminos Canyon	857	OCS-G 17565		GD wells and well work (incl. workover a		Joshua O'Brien	504-425-9097	GW Frio-DOCD AQR-MODU INST-20200107-FINAL.xlsxInstall and commission manifolds/flying l

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
DP MODU	PRIME MOVER>600hp diesel	9387	453	3333	24	200	6.62	7.59	227.44	6.82	49.62	4.86	5.58	167.21	5.02	36.48
DRILLING AND/OR	PRIME MOVER>600hp diesel	9387	453	3333	24	200	6.62	7.59	227.44	6.82	49.62	4.86	5.58	167.21	5.02	36.48
WELLWORK,	PRIME MOVER>600hp diesel	9387	453	3333	24	200	6.62	7.59	227.44	6.82	49.62	4.86	5.58	167.21	5.02	36.48
INSTALLATION,	PRIME MOVER>600hp diesel	9387	453	3333	24	200	6.62	7.59	227.44	6.82	49.62	4.86	5.58	167.21	5.02	36.48
MAINTENANCE	PRIME MOVER>600hp diesel	9387	453	3333	24	200	6.62	7.59	227.44	6.82	49.62	4.86	5.58	167.21	5.02	36.48
	PRIME MOVER>600hp diesel	9387	453	3333	24	200	6.62	7.59	227.44	6.82	49.62	4.86	5.58	167.21	5.02	36.48
	Energency Generator>600hp diese	2547	123	2952	1	200	1.80	2.06	61.71	1.85	13.46	0.18	0.21	6.17	0.19	1.35
	Emergency Air Compressor< 600h	26	1	30	1	200	0.06	0.02	0.80	0.06	0.17	0.01	0.00	0.08	0.01	0.02
	All other rig-equipment is electric (e.g cranes) or negligible in emissions potential (e.g. life boats, welding equipment, etc.)															
	Supply Vessel>600hp diesel (gene	10100	488	5854	24	200	7.12	8.16	244.71	7.34	53.39	8.54	9.80	293.66	8.81	64.07
	Supply Vessel>600hp diesel (gene	10100	488	5854	24	20	7.12	8.16	244.71	7.34	53.39	0.85	0.98	29.37	0.88	6.41
	Supply Vessel>600hp diesel (gene	10100	488	5854	24	20	7.12	8.16	244.71	7.34	53.39	0.85	0.98	29.37	0.88	6.41
	Crew Vessel>600hp diesel	8000	386	1391	24	200	5.64	6.47	193.83	5.81	42.29	2.03	2.33	69.78	2.09	15.22
	SERVICE/SUPPORT Vessel Diesel - General (1)	37500	1811	43470.00	24	10	26.43	30.31	908.59	27.26	198.24	3.17	3.64	109.03	3.27	23.79
	SERVICE/SUPPORT Vessel Diesel - General (1)	26000	1256	30139.20	24	30	18.33	21.02	629.96	18.90	137.44	6.60	7.57	226.78	6.80	49.48
	SERVICE/SUPPORT Vessel >600hp diesel (1)	42000	2029	48686.40	24	45	29.60	33.95	1017.62	30.53	222.03	15.99	18.33	549.52	16.49	119.89
	SERVICE/SUPPORT Vessel Diesel (1)	12605	609	14611.72	24	30	8.88	10.19	305.41	9.16	66.63	3.20	3.67	109.95	3.30	23.99
2021-2045	ANNUAL TOTAL						151.79	174.04	5216.69	156.54	1138.19	70.61	80.97	2426.97	72.81	529.52
EXEMPTION CALCULATION	DISTANCE FROM LAND IN MILES											4728.60	4728.60	4728.60	4728.60	92541.77
	142.0															

(1) SERVICE/SUPPORT Vessel Diesel-General: The days allocated per year will be for temporary activities of installation of umbilicals, manifolds, flowlines, jumpers, flying leads, etc.), inspections, equipment maintenance, stimulations, or other service/support needs; some of which may not occur in any given year and are yet to be planned.

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL
Shell Offshore Inc	Alaminos Canyon	857	OCS-G 17565	DP MODU, DP Semi	GD wells and well work (incl. workover and maintenance)

Year	**Emitted**			**Substance**	
	PM	**SOx**	**NOx**	**VOC**	**CO**
AQR Emissions if DP MODU(Semi-sub or Drillship) is Utilized					
2020	**79.70**	**91.40**	**2739.51**	**82.19**	**597.71**
2021-2045	**70.61**	**80.97**	**2426.97**	**72.81**	**529.52**
Allowable	**4728.60**	**4728.60**	**4728.60**	**4728.60**	**92541.77**

Notes

SECTION 9: OIL SPILL INFORMATION

A. Oil Spill Response Planning

All the proposed activities and facilities in this EP will be covered by the Regional OSRP filed by Shell Offshore Inc. (0689) in accordance with 30 CFR 550 and 254. Shell's Regional OSRP was approved by BSEE in June 2017, the bi-annual review was found to be in compliance on November 22, 2019.

Spill Response sites are as follows:

Primary Response Equipment Locations	Preplanned Staging Location(s)
Ingleside, TX; Galveston, TX; Venice, LA; Ft Jackson, LA; Harvey, LA; Stennis, MS; Pascagoula, MS; Theodore, AL; Tampa, FL	Galveston, TX; Port Fourchon; Venice, LA; Pascagoula, MS ; Mobile, AL; Tampa, FL

Table 9.1 – Response Equipment and Staging Areas

OSRO Information:
The names of the oil spill removal organizations (OSRO's) under contract include Clean Gulf Associates (CGA), Marine Spill Response Company (MSRC) and Oil Spill Response Limited (OSRL). These OSRO's provide equipment and will in some cases provide trained personnel to operate their response Equipment (OSRVs, etc.) and Shell also has the option to pull from their trained personnel as needed for assistance/expertise in the Command Post and in the field.

	Drilling		Production	
Category	Regional OSRP	EP	Regional OSRP	DOCD
Type of Activity	Subsea Drilling	Exploratory Drilling	Production >10 miles to shore	Production and Subsea Installation
Facility Location (area/block)	MC 812	AC 857	MC 812	AC 857
Facility Designation	Subsea well B◇	Subsea well GA-14◇◇	Subsea Well B◇	Subsea well GA-14◇◇
Distance to Nearest Shoreline (miles)	59	142	59	142
Volume Storage tanks (total) Flowlines (on facility) Pipelines Uncontrolled blowout (volume per day) Total Volume	468,000 BOPD*	N/A N/A N/A 129,000** BOPD 129,000 Bbls	16,600 Bbls 100 Bbls 27,428 Bbls 468,000 BOPD* 458,867	4,000 Bbls 100 Bbls. 8,300 Bbls. 129,000** BOPD 141,400 Bbls
Type of Oil(s) - (crude oil, condensate, diesel)	Crude oil	Crude oil	Crude oil	Crude oil
API Gravity(s)	31°	34°	31°	34°

*24 hour rate (432,000 BOPD 30 day average)
**24 hour rate (78,700 BOPD 30 day average)

◇This well was reviewed and accepted by BOEM in Plan N-9840.
◇◇This well was accepted by BOEM in plan R-5085/R-5144 for Great White Unit.

Since Shell Offshore Inc. has the capability to respond to the appropriate worst-case spill scenario included in its Regional OSRP approved by BSEE in June 2017, the bi-annual review found to be in compliance on October 3, 2017, and updated April 30, 2019 and since the worst-case scenario determined for our Plan does not replace the appropriate worst-case scenario in our regional OSRP, I hereby certify that Shell Offshore Inc. 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.

Modeling: Based on the requirement per BSEE NTL 2008-G04 and the outcome of the OSRAM Model, Shell determined no additional modeling was needed for potential oil or hazardous substance spill for operations proposed in this exploration plan, as the current, approved OSRP adequately meets the necessary response capabilities.

B. Oil Spill Response Discussion

1. Volume of the Worst-Case Discharge

Please refer to Section 2j and 9(iv) of this plan.

2. Trajectory Analysis

Trajectories of a spill and the probability of it impacting a land segment have been projected utilizing information in the BSEE Oil Spill Risk Analysis Model (OSRAM) for the Central and Western Gulf of Mexico available on the BSEE website using 30-day impact. Offshore areas along the trajectory between the source and land segment contact could be impacted. The land segment contact probabilities are shown in Table 9.C.1.

Area/Block	OCS-G	Launch Area	Land Segment Contact	%
AC 857		11	Cameron, TX	1
			Willacy, TX	2
			Kenedy, TX	8
			Kleberg, TX	6
			Nueces, TX	4
			Aransas, TX	5
			Calhoun, TX	6
			Matagorda, TX	10
			Brazoria, TX	2
			Galveston, TX	3
			Jefferson, TX	1
			Cameron, LA	1

Table 9.C.1 Probability of Land Segment Impact

C. Resource Identification

The locations identified in Table 9.C.1 are the highest probable land segments to be impacted using the BSEE Oil Spill Risk Analysis Model (OSRAM). The environmental sensitivities are identified using the appropriate National Oceanic and Atmospheric Administration (NOAA) Environmental Sensitivity Index (ESI) maps for the given land segment. ESI maps provide a concise summary of coastal resources that are at risk if an oil spill occurs nearby. Examples of at-risk resources include biological resources (such as birds and shellfish beds), sensitive shorelines (such as marshes and tidal flats), and human-use resources (such as public beaches and parks).

In the event an oil spill occurs, ESI maps can help responders meet one of the main response objectives: reducing the environmental consequences of the spill and the cleanup efforts. Additionally, ESI maps can be used by planners to identify vulnerable locations, establish protection priorities, and identify cleanup strategies.

The following is a list of resources of special economic or environmental importance that potentially could be impacted by the Alaminos Canyon 815 WCD scenario.

Onshore/Nearshore: Matagorda County is identified as the most probable impacted County within the Gulf of Mexico for the Exploratory Worst-Case Discharge. The Matagorda County has a total area of 1,612 square miles of which, 1,114 square miles of it is land and 498 square miles is water. Matagorda County includes two National Wildlife Refuges and one Wildlife Management Area including the Big Boggy National Wildlife Refuge, part of San Bernard National Wildlife Refuge, and the Mad Island Wildlife Management Area (WMA). The Big Boggy National Wildlife Refuge and San Bernard National Wildlife Refuge form a vital complex of coastal wetlands harboring more than 300 bird species. The Mad Island WMA is 5,700 acres and wildlife consists of a variety of different species. Key ESI maps for Plaquemines Parish and the legend are shown in Figures 9.C.1, 9.C.2, 9.C.3, 9.C.4, and 9.C.5.

Offshore: An offshore spill may require an Essential Fishing Habitat (EFH) Assessment. This assessment would include a description of the spill, analysis of the potential adverse effects on EFH and the managed species; conclusions regarding the effects on the EFH; and proposed mitigation, if applicable.

Significant pre-planning of joint response efforts was undertaken in response to provisions of the National Contingency Plan (NCP). Area Contingency Plans (ACPs) were developed to provide a well-coordinated response to oil discharges and other hazardous releases. The One Gulf Plan is specific to the Gulf of Mexico to advance the unity of policy and effort in each of the Gulf Coast ACPs. Strategies used for the response to an oil spill regarding protection of identified resources are detailed in the One Gulf Plan and relevant Gulf Coast ACP.

D. Worst Case Discharge Response

Shell will make every effort to respond to the AC 857 Worst Case Discharge as effectively as possible. Below is a table outlining the applicable evaporation and surface dispersion quantity:

	Alaminos Canyon Block 857	Calculations (BBLS)
i.	TOTAL WCD (based on 30-day average (per day))	78,700
ii.	Loss of volume of oil to natural surface dispersion and evaporation base (approximate bbls per day) * (28% Natural surface evaporation and dispersion in 24 hrs)	-22,036
	TOTAL REMAINING	~56,664

Table 9.D.1 Oil Remaining After Subsurface and Surface Dispersion

Shell has contracted OSROs to provide equipment, personnel, materials and support vessels as well as temporary storage equipment to be considered in order to cope with a WCD spill. Under adverse weather conditions, major response vessels and Transrec skimmers are still effective and safe in sea states of 6-8 ft. If sea conditions prohibit safe mechanical recovery efforts, then natural dispersion and airborne chemical dispersant application (visibility & wind conditions permitting) may be the only safe and viable recovery option.

MSRC OSRV	8-foot seas
VOSS System	4-foot seas
Expandi Boom	6-foot seas, 20 knot winds
Dispersants	Winds more than 25 knots, Visibility less than 3 nautical miles, or Ceiling less than 1,000 feet.

Table 9.D.2 Operational Limitations of Response Equipment

Upon notification of the spill, Shell would request a partial or full mobilization of contracted resources, including, but not limited to, skimming vessels, oil storage vessels, dispersant aircraft, subsea dispersant, shoreline protection, wildlife protection, and containment equipment. Following is a list of the contracted resources including de-rated recovery capacity, personnel, and estimated response times (procurement, load out, travel time to the site, and deployment). The Incident Commander or designee may contact other service companies if the Unified Command deems such services necessary to the response efforts.

Based on the anticipated worst-case discharge scenario, Shell can be onsite with dedicated, contracted on water oil spill recovery equipment with adequate response capacity to contain and recover surface oil, and prevent land impact, within 28 hours (based on the equipment's Estimated Daily Response Capacity (EDRC)). Shell will continue to ramp up additional on-water mechanical recovery resources as 3.well as apply dispersants and in-situ burning as needed and as approved under the supervision of the USCG Captain of the Port (COTP) and the Regional Response Team (RRT).

Subsea Control and Containment: Shell, as a founding member of the MWCC, will have access to the IRCS that can be rapidly deployed through the MWCC. The IRCS is designed to contain oil flow in the unlikely event of an underwater well blowout, and is designed, constructed, tested, and available for rapid response. Shell's specific containment response for AC 857 will be addressed in Shell's NTL10 submission at the time the APD is submitted.

Table 9.D.9 Control, Containment, and Subsea Dispersant Package Activation List

Mechanical Recovery (skimming): Response strategies include skimming utilizing available OSROs Oil Spill Response Vessels (OSRVs), Oil Spill Response Barges (OSRBs), ID Boats, and Quick Strike OSRVs. There is a combined de-rated recovery rate capability of approximately 583,000 barrels/day. Temporary storage associated with the identified skimming and temporary storage equipment equals approximately 468,000 barrels.

	De-rated Recovery Rate (bopd)	Storage (bbls)
Offshore Recovery and Storage	268,509	452,949
Nearshore Recovery and Storage	315,008	15,979
Total	583,517	468,928

Table 9.D.3 Mechanical Recovery Combined De-Rated Capability

Table 9.D.4 Offshore On-Water Recovery and Storage Activation List
Table 9.D.5 Nearshore On-Water Recovery and Storage 5ctivation List

Oil Storage: The strategy for transferring, storing and disposing of oil collected in these recovery zones is to utilize two 150,000-160,000 ton (dead weight) tankers mobilized by Shell (or any other tanker immediately available). The recovered oil would be transferred to Motiva's Norco, LA storage and refining facility, or would be stored at Delta Commodities, Inc. Harvey, LA facility.

Aerial Surveillance: Aircraft can be mobilized to detect, monitor, and target response to oil spills. Aircraft and spotters can be mobilized within hours of an event.

Table 9.D.6 Aerial Surveillance Activation List

Aerial Dispersant: Depending on proximity to shore and water depth, dispersants may be a viable response option. If appropriate and approved, 4 to 5 sorties from three DC-3's can be made within the first 12-hour operating day of the response. These aerial systems could disperse approximately 7,704 to 9,630 barrels of oil per day. Additionally, 3 to 4 sorties from the BE90 King Air and 3 to 4 sorties from the Hercules C-130A within the first 12-hour operating day of the response could disperse 4,600 to 6,100 barrels of oil per day. For continuing dispersant operations, the CCA's Aerial Dispersant Delivery System (ADDS) would be mobilized. The ADDS has a dispersant spray capability of 5,000 gallons per sortie.

Table 9.D.7 Offshore Aerial Dispersant Activation List

Vessel Dispersant: Vessel dispersant application is another available response option. If appropriate, vessel spray systems can be installed on offshore vessels of opportunity using inductor nozzles (installed on fire-water monitors), skid mounted systems, or purpose-built boom arm spray systems. Vessels can apply dispersant within the first 12-24 hours of the response and continually as directed.

Table 9.D.8 Offshore Boat Spray Dispersant Activation List

Subsea Dispersant: Shell has contracted with MWCC and Wild Well Control for subsea dispersant packages. Subsea dispersant application has been found to be highly effective at reducing the amount of oil reaching the surface. Additional data collection, laboratory tests and field tests will help in facilitating the optimal application rate and effectiveness numbers. For planning purposes, these systems have the potential to disperse approximately 24,500 to 34,000 barrels of oil per day.

Table 9.D.9 Control, Containment, and Subsea Dispersant Package Activation List

In-Situ Burning: Open-water in-situ burning (ISB) also may be used as a response strategy, depending on the circumstances of the release. ISB services may be provided by the primary OSRO contractors. If appropriate conditions exist and approvals are granted, one or multiple ISB task forces could be deployed offshore. Task forces typically consist of two to four fire teams, each with two vessels capable of towing fire boom, guide boom or tow line with either a handheld or aerially-deployed oil ignition system. At least one support/safety boat would be present during active burning operations to provide logistics, safety and monitoring support. Depending upon a number of factors, up to 4 burns per 12-hour day could be completed per ISB fire team. Most fire boom systems can be used for approximately 8-12 burns before being replaced. Fire intensity and weather will be the main determining factors for actual burns per system. Although the actual amount of oil that will be removed per burn is dependent on many factors, recent data suggests that a typical burn might eliminate approximately 750 barrels. For planning purposes and based on the above assumptions, a single task force of four fire teams with the appropriate weather and safety conditions could complete four burns per day and remove up to ~12,000 bbls/day. In-situ burning nearshore and along shorelines may be a possible option based on several conditions and with appropriate approvals, as outlined in Section 19, In-situ Burn Plan (OSRP). In-situ burning along certain types of shorelines may be used to minimize physical damage where access is limited or if it is determined that mechanical/manual removal may cause a substantial negative impact on the environment. All safety considerations will be evaluated. In addition, Shell will assess the situation and can make notification within 48 hours of the initial spill to begin ramping up fire boom production through contracted OSRO(s). There are potential limitations that need to be assessed prior to ISB operations. Some limitations include atmospheric and sea conditions; oil weathering; air quality impacts; safety of response workers; and risk of secondary fires.

Table 9.D.10 In-Situ Burn Equipment Activation List

Shoreline Protection: If the spill went unabated, shoreline impact in Plaquemines Parish, LA would depend upon existing environmental conditions. Nearshore response may include the deployment of shoreline boom on beach areas, or protection and sorbent boom on vegetated areas. Strategies would be based upon surveillance and real time trajectories provided by The Response Group that depict areas of potential impact given actual sea and weather conditions. Strategies from the New Orleans, Louisiana Area Contingency Plan, Unified Command would be consulted to ensure that environmental and special economic resources would be correctly identified and prioritized to ensure optimal protection. Shell has access to shoreline response guides that depict the protection response modes applicable for oil spill clean-up operations. Each response mode is schematically represented to show optimum deployment and operation of the equipment in areas of environmental concern. Supervisory personnel have the option to modify the deployment and operation of equipment allowing a more effective response to site-specific circumstances.

Table 9.D.11 Shoreline Protection and Wildlife Support List

Wildlife Protection: If wildlife is threatened due to a spill, the contracted OSRO's have resources available to Shell, which can be utilized to protect and/or rehabilitate wildlife. The resources under contract for the protection and rehabilitation of affected wildlife are in Table 9.D.11.

New or unusual technology in regards to spill, prevention, control and clean-up:
Shell will use our normal well design and construction processes with multiple barrier approach as well as new stipulations mandated by NTL 05. Response techniques will utilize new learnings from Macondo response to include in-situ burning and subsea dispersant application. Mechanical recovery advancements are continuing to be made to incorporate utilization of Koseq arms outfitted on barges,

conversion of Platform Support Vessels for Oil Spill Response, and inclusion of nighttime spill detection radar to improve tracking capabilities (X-Band radar, Infrared sensing, etc.). In addition, new response technologies/techniques are continuing to be considered by Shell and the appropriate government organizations for incorporation into our planned response. Any additional response technologies/techniques presented at the time of response will be used at the discretion of the Unified Command and USCG.

Figure 9.C.1 Environmental Sensitivity Index Map Legend

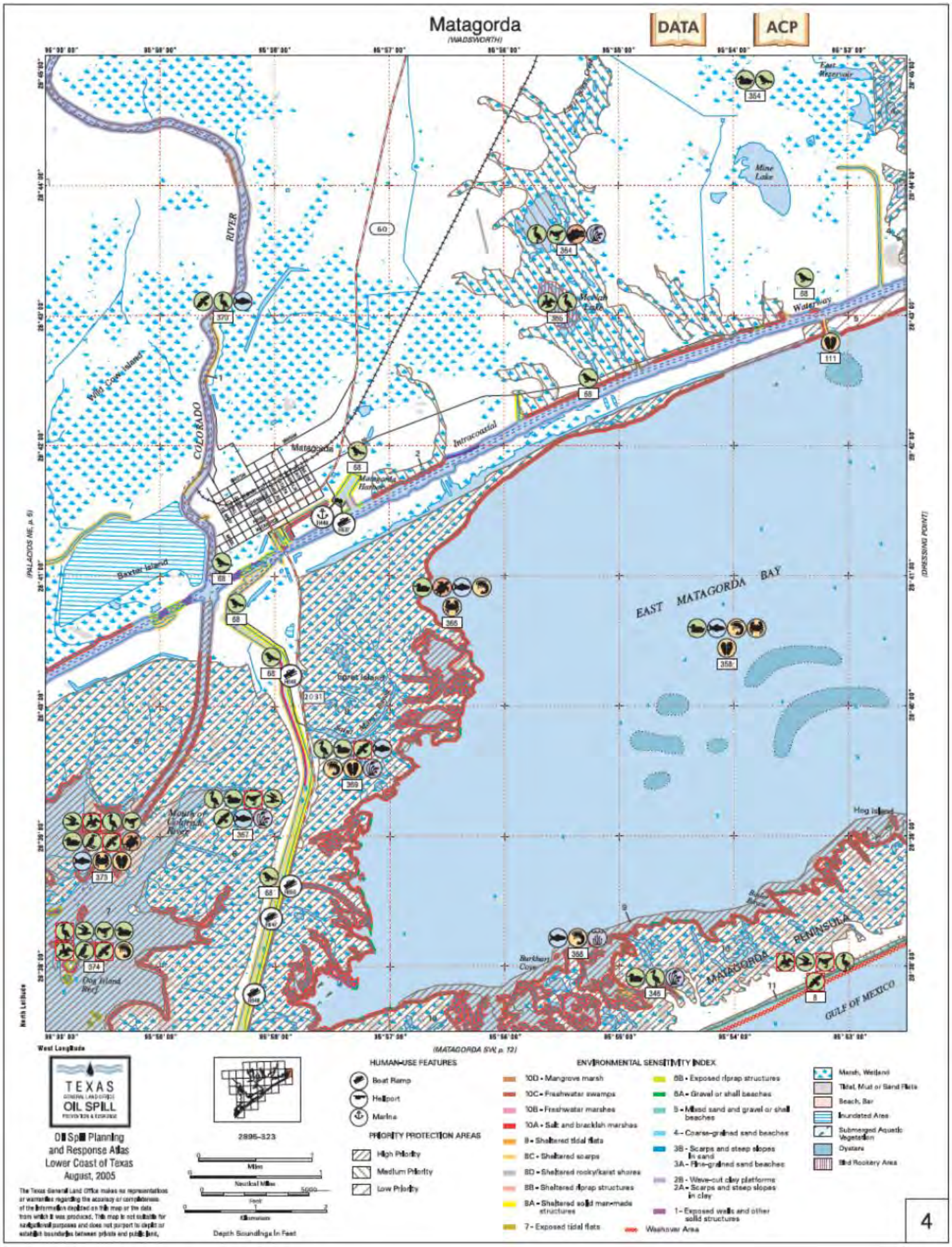


Figure 9.C.2 South Pass ESI Map

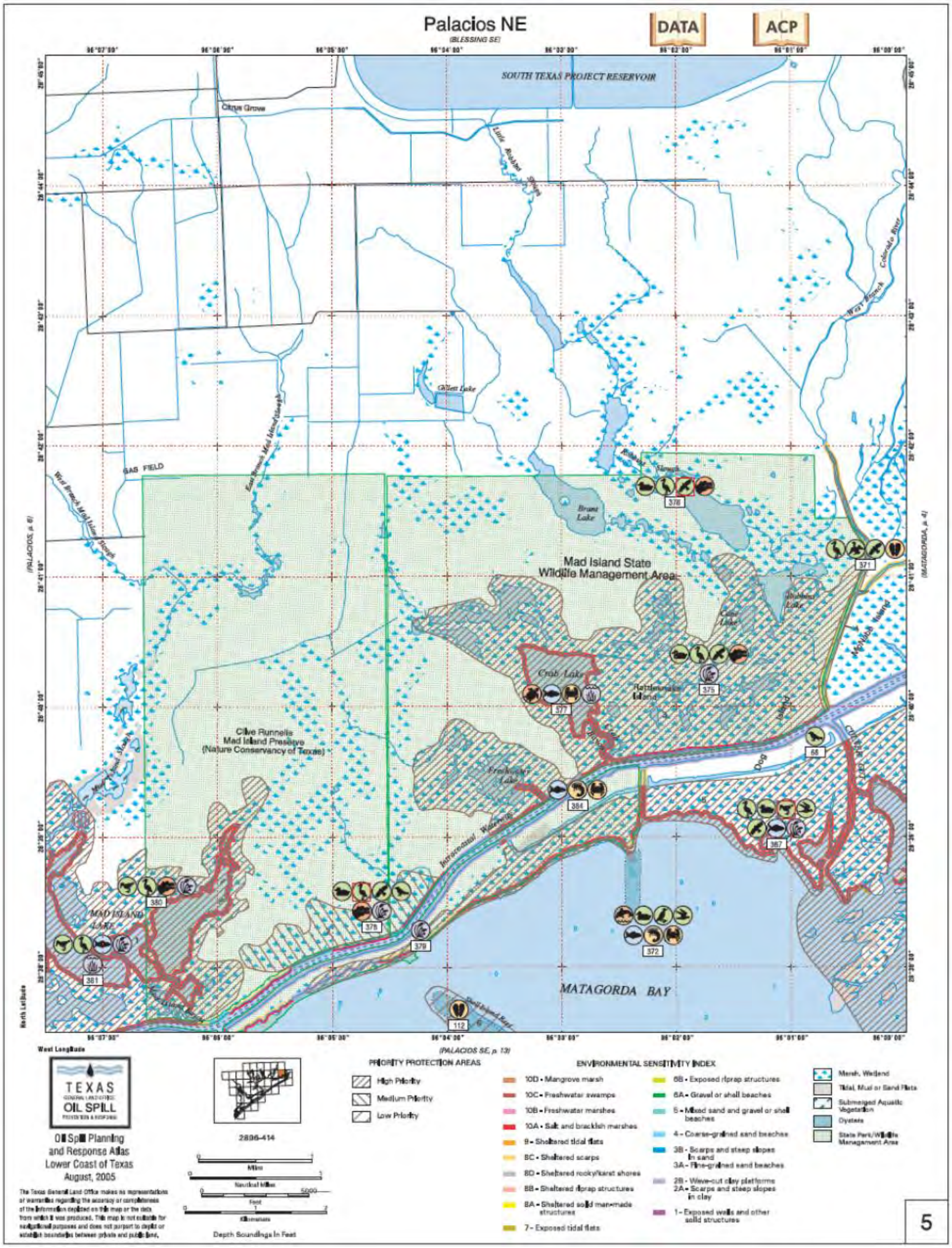


Figure 9.C.3 Garden Island Pass ESI Map

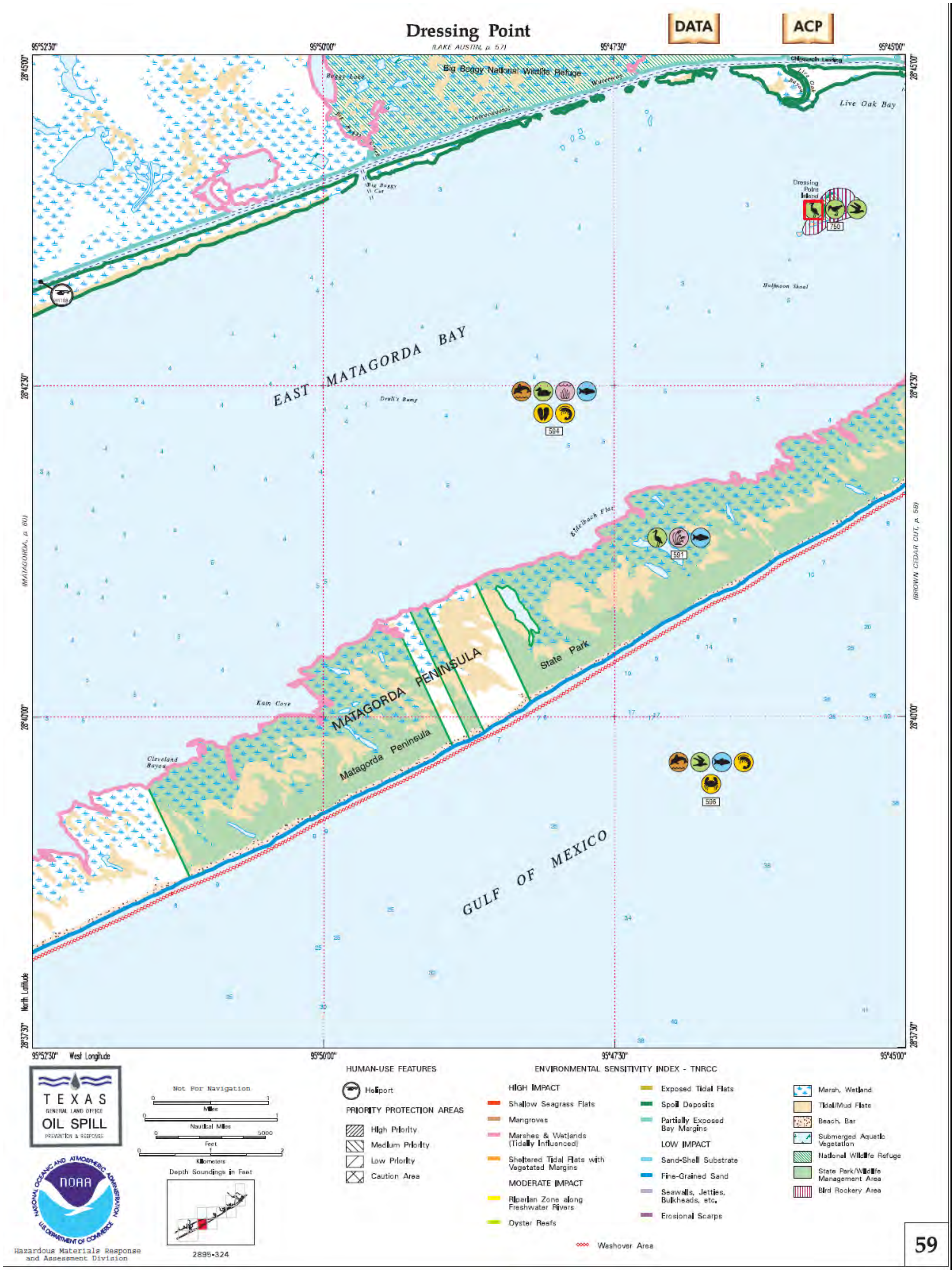


Figure 9.C.4 Pass a Loutre West ESI Map

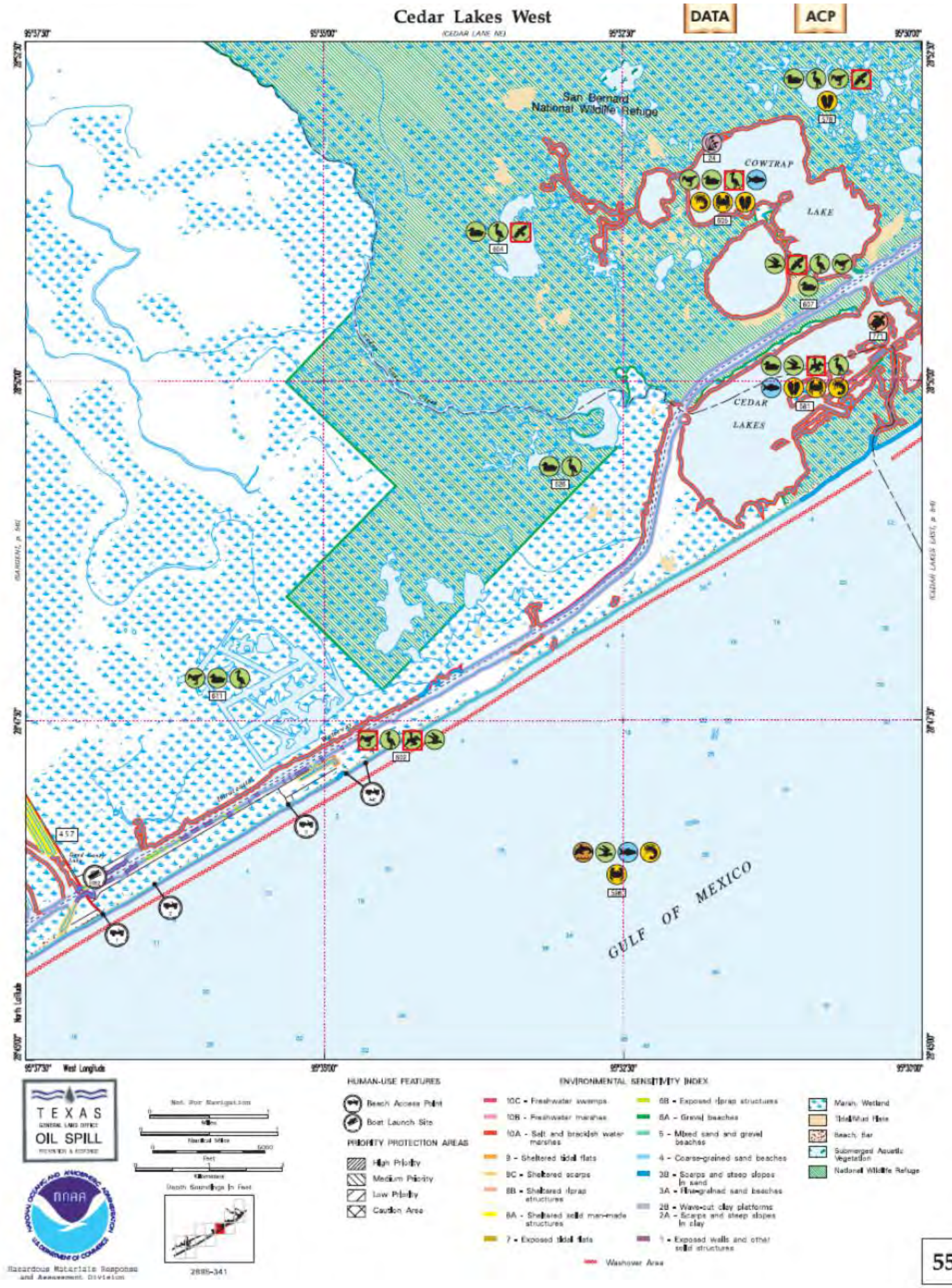


Figure 9.C.5 Main Pass ESI Map

Alaminos Canyon 857
Sample Offshore On-Water Recovery & Storage Activation List

Note: Total ETA might be effected by weather, sea state, lock closure, 3rd party vessel availability.
** - These components are additional operational requirements that must be procured in addition to the system identified.*
*** - These components are additional operational requirements for the packages to be used in an enhanced skimming deployment.*
**** - Specific Barge Names May Vary.*

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Southern Responder Transrec-350	MSRC (800) OIL-SPIL	Ingleside, TX	Transrec Skimmer	1	10,567	4,000	Ingleside, TX	195	2	1	14	1	18
			Backup - Stress 1 Skimmer	1									
			67" Pressure Inflatable Boom	2640'									
			210' Vessel	1									
			Personnel	10									
			32' Support Boat	1									
			X Band Radar	1									
			Infrared Camera	1									
			FAES #4 "Buster"	1									
Texas Responder Transrec-350	MSRC (800) OIL-SPIL	Galveston, TX	Transrec Skimmer	1	10,567	4,000	Galveston, TX	234	2	1	16.5	1	21
			Backup - Stress 1 Skimmer	1									
			67" Pressure Inflatable Boom	2640'									
			210' Vessel	1									
			Personnel	10									
			32' Support Boat	1									
			X Band Radar	1									
			Infrared Camera	1									
			FAES #4 "Buster"	1									
FRV Galveston Island	CGA (888) 242-2007	Galveston, TX	Lamor Brush Skimmer	2	22,885	249	Galveston, TX	234	2	0	16	1	19
			36" Boom	64									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	6									
FRV H.I. Rich	CGA (888) 242-2007	Vermilion, LA	Lamor Brush Skimmer	2	22,885	249	Vermilion, LA	329	2	0	21.5	1	25
			36" Boom	64									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	6									
Gulf Coast Responder Transrec-350	MSRC (800) OIL-SPIL	Lake Charles, LA	Transrec Skimmer	1	10,567	4,000	Lake Charles, LA	296	2	1	21	1	25
			Backup - Stress 1 Skimmer	1									
			67" Pressure Inflatable Boom	2640'									
			210' Vessel	1									
			Personnel	10									
			32' Support Boat	1									
			X Band Radar	1									
			Infrared Camera	1									
			FAES #4 "Buster"	1									
FRV JL O'Brien	CGA (888) 242-2007	Leeville, LA	Lamor Brush Skimmer	2	22,885	249	Leeville, LA	365	2	0	23.5	1	27
			36" Boom	64									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	6									
MSRC-403 Offshore Barge	MSRC (800) OIL-SPIL	Ingleside, TX	Offshore Barge	1	11,122	40,300	Ingleside, TX	195	4	1	21.5	1	28
			67" Pressure Inflatable Boom	2640'									
			Crucial Disc Skimmer 88/30	1									
			Backup - Crucial Disc Skimmer 56/30	1									
			*Appropriate Vessel	1									
			Personnel	9									
			* Offshore Tug	2									
			X Band Radar	1									
			Infrared Camera	1									
FRV Breton Island	CGA (888) 242-2007	Venice, LA	Lamor Brush Skimmer	2	22,885	249	Venice, LA	417	2	0	26.5	1	30
			36" Boom	64									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	6									

Table 9.D.4 Offshore On-Water Recovery and Storage Activation List

Alaminos Canyon 857
Sample Offshore On-Water Recovery & Storage Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours) Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Note: Total ETA might be effected by weather, sea state, lock closure, 3rd party vessel availability. * - These components are additional operational requirements that must be procured in addition to the system identified. ** - These components are additional operational requirements for the packages to be used in an enhanced skimming deployment. *** - Specific Barge Names May Vary.													
S.T. Benz Responder LFF 100 Brush	MSRC (800) OIL-SPIL	Port Fourchon, LA	LFF 100 Brush Skimmer	1	18,086	4,000	Port Fourchon, LA	355	3	1	25.5	1	31
			Backup - Stress 1 Skimmer	1									
			67" Pressure Inflatable Boom	2640'									
			210' Vessel	1									
			Personnel	10									
			32' Support Boat	1									
			X Band Radar	1									
			Infrared Camera	1									
			FAES #4 "Buster"	1									
MSRC-570 Offshore Barge	MSRC (800) OIL-SPIL	Galveston, TX	Offshore Barge	1	11,122	56,900	Galveston, TX	234	4	1	26	1	32
			67" Pressure Inflatable Boom	2640'									
			Crucial Disc Skimmer 88/30	1									
			Backup - Crucial Disc Skimmer 88/30	1									
			*Appropriate Vessel	1									
			Personnel	9									
			* Offshore Tug	2									
			X Band Radar	1									
			Infrared Camera	1									
Louisiana Responder Transec 350	MSRC (800) OIL-SPIL	Fort Jackson, LA	Transrec Skimmer	1	10,567	4,000	Fort Jackson, LA	426	2	1	30.5	1	35
			Back - Stress 1 Skimmer	1									
			67" Pressure Inflatable Boom	2640'									
			210' Vessel	1									
			Personnel	10									
			32' Support Boat	1									
			X Band Radar	1									
			Infrared Camera	1									
			FAES #4 "Buster"	1									
PSV-VOO Skimming System (Brush)	MSRC (800) OIL-SPIL	Lake Charles, LA	Lamor Brush Skimmer	1	18,086	0	Aransas Pass, TX	188	24	1	13.5	1	40
			67" Pressure Inflatable Boom	1320'									
			* PSV-VOO	1									
			Personnel	9									
			Thermal Infrared Camera	1									
			*Appropriate Vessel	1									
			* Marine Portable Tank	2		1,000							
CGA-200 HOSS Barge (OSRB)	CGA (888) 242-2007	Harvey, LA	Marco Skimmer	4	76,285	4,000	Harvey, LA	479	6	0	69.5	2	78
			67" Sea Sentry	2640'									
			Personnel	12									
			* Tug - 1,200 HP	2									
			X Band Radar	1									
			* Tug - 1,800 HP	1									
***K-Sea DBL 103 Offshore Barge	CGA (888) 242-2007	Belle Chasse, LA	Offshore Barge	1	N/A	107,285	Houma, LA	371	24-72	0	43.5	1	69 to 117
			Personnel	10									
			* Offshore Tug	1									
***K-Sea DBL 104 Offshore Barge	CGA (888) 242-2007	Belle Chasse, LA	Offshore Barge	1	N/A	107,285	Houma, LA	371	24-72	0	43.5	1	69 to 117
			Personnel	10									
			* Offshore Tug	1									
***K-Sea DBL 105 Offshore Barge	CGA (888) 242-2007	Belle Chasse, LA	Offshore Barge	1	N/A	115,183	Houma, LA	371	24-72	0	43.5	1	69 to 117
			Personnel	10									
			* Offshore Tug	1									
DERATED RECOVERY RATE (BBLS/DAY)													268,509
STORAGE CAPACITY INCLUDING SKIMMING VESSELS (BARRELS)													452,949

able 9.D.4 Offshore On-Water Recovery and Storage Activation List (Continued)

Alaminos Canyon 857
Sample Nearshore On-Water Recovery Activation List

** - These components are additional operational requirements that must be procured in addition to the system identified.*
NOTE: Total ETA might be effected by weather, sea state, lock closure, 3rd party vessel availability.

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Nearshore Environment (Miles)	Response Times (Hours)				
									Staging ETA	Loadout Time	ETA to Nearshore Environment	Deployment Time	Total ETA
SWS CGA-75 FRV	CGA (888) 242-2007	Galveston, TX	Lori Brush Skimmer 36" Boom 60' Vessel X Band Radar Personnel	2 150 1 1 4	22,885	249	Galveston, TX	100	2	0	6	1	9
FRV CGA 58 Timbalier Bay	CGA (888) 242-2007	Aransas Pass, TX	Lori Brush Skimmer 36" Boom 46' Vessel Personnel	2 46' 1 4	15,257	65	Aransas Pass, TX	100	2	0	8	1	11
SW CGA-71 FRV	CGA (888) 242-2007	Aransas Pass, TX	Marco Belt Skimmer 36" Auto Boom Personnel 56' SWS Vessel * 14'-16' Alum. Flatboat	2 150' 5 1 2	21,500	249	Aransas Pass, TX	100	4	0	6	1	11
SWS CGA-51 MARCO Shallow Water Skimmer	CGA (888) 242-2007	Lake Charles, LA	Marco Belt Skimmer * 18" Boom (contractor) Personnel 34' Skimming Vessel Shallow Water Barge	1 100' 3 1 1	3,588	20 249	Port O'Connor, TX	35	7	2	2	1	12
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	905	400	Port O'Connor, TX	35	7	1	2.5	1	12
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	905	400	Port O'Connor, TX	35	7	1	2.5	1	12
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	905	400	Port O'Connor, TX	35	7	1	2.5	1	12
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel Self-propelled barge	1 50' 4 1	905	400	Port O'Connor, TX	35	7	1	2.5	1	12
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel Self-propelled barge	1 50' 4 1	905	400	Port O'Connor, TX	35	7	1	2.5	1	12
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Ingleside, TX	Marco I Skimmer Personnel 30' Shallow Water Vessel	1 2 1	3,588	24	Aransas Pass, TX	96	4	1	7	1	13
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Ingleside, TX	Skimmer 18" Boom Personnel Self-propelled barge	1 50' 4 1	1,371	400	Aransas Pass, TX	96	4	1	7	1	13
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Galveston, TX	Marco I Skimmer Personnel 30' Shallow Water Vessel	1 2 1	3,588	24	Galveston, TX	100	4	1	7	1	13

Table 9.D.5 Nearshore On-Water Recovery Activation List

Alaminos Canyon 857
Sample Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Nearshore Environment (Miles)	Response Times (Hours): Staging ETA	Response Times (Hours): Loadout Time	Response Times (Hours): ETA to Nearshore Environment	Response Times (Hours): Deployment Time	Total ETA
*- These components are additional operational requirements that must be procured in addition to the system identified. NOTE: Total ETA might be effected by weather, sea state, lock closure, 3rd party vessel availability.													
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Galveston, TX	Skimmer	1	905	400	Galveston, TX	100	4	1	7	1	13
			18" Boom	50'									
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Galveston, TX	Skimmer	1	1,371	400	Galveston, TX	100	4	1	7	1	13
			18" Boom	50'									
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Baton Rouge, LA	Skimmer	1	1,371	400	Port O'Connor, TX	35	8.5	1	2.5	1	13
			18" Boom	50'									
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									
CGA-54 Egmopol Shallow Water Skimmer	CGA (888) 242-2007	Galveston, TX	Marco Belt Skimmer	1	1,810	100	Port O'Connor, TX	35	6	2	5	1	14
			* 18" Boom (contractor)	100'									
			Personnel	3									
			34' Skimming Vessel	1									
			Shallow Water Barge	1		249							
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Belle Chasse, LA	Skimmer	1	905	400	Port O'Connor, TX	35	10.25	1	2.5	1	15
			18" Boom	50'									
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Belle Chasse, LA	Marco I Skimmer	1	3,588	24	Port O'Connor, TX	35	10.25	1	2.5	1	15
			Personnel	2									
			30' Shallow Water Vessel	1									
SW CGA-74 FRV	CGA (888) 242-2007	Vermilion, LA	Marco Belt Skimmer	2	21,500	249	Vermilion, LA	217	2	0	13	1	16
			36" Auto Boom	150'									
			Personnel	4									
			56' SW Vessel	1									
			* 14'-16' Alum. Flatboat	2									
SW CGA-73 FRV	CGA (888) 242-2007	Lake Charles, LA	Marco Belt Skimmer	2	21,500	249	Lake Charles, LA	210	2	0	12.5	1	16
			36" Auto Boom	150'									
			Personnel	5									
			56' SWS Vessel	1									
			* 14'-16' Alum. Flatboat	2									
SWS CGA-53 MARCO Shallow Water Skimmer	CGA (888) 242-2007	Leeville, LA	Marco Belt Skimmer	1	3,588	34	Port O'Connor, TX	35	11	2	2	1	16
			* 18" Boom (contractor)	100'									
			Personnel	3									
			38' Skimming Vessel	1									
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Pascagoula, MS	Marco I Skimmer	1	3,588	24	Port O'Connor, TX	35	11.25	1	2.5	1	16
			Personnel	2									
			30' Shallow Water Vessel	1									
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Pascagoula, MS	Skimmer	1	905	400	Port O'Connor, TX	35	11.25	1	2.5	1	16
			18" Boom	50'									
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									

Table 9.D.5 Nearshore On-Water Recovery Activation List (continued)

Alaminos Canyon 857
Sample Nearshore On-Water Recovery Activation List

									Response Times (Hours)				
Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Nearshore Environment (Miles)	Staging ETA	Loadout Time	ETA to Nearshore Environment	Deployment Time	Total ETA
* - These components are additional operational requirements that must be procured in addition to the system identified. NOTE: Total ETA might be effected by weather, sea state, lock closure, 3rd party vessel availability.													
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Pascagoula, MS	Skimmer	1	1,371	400	Port O'Connor, TX	35	11.25	1	2.5	1	16
			18" Boom	50'									
			Personnel	4									
			Self-propelled barge	1									
AARDVAC	MSRC (800) OIL-SPIL	Pascagoula, MS	Skimmer	1	3,840		Port O'Connor, TX	35	11	1	2.5	1	16
			18" Boom	50'									
			Personnel	5									
			* Appropriate Vessel	2									
			* Temporary Storage	1		500							
SWS CGA-52 MARCO Shallow Water Skimmer	CGA (888) 242-2007	Venice, LA	Marco Belt Skimmer	1	3,588	34	Port O'Connor, TX	35	12	2	2	1	17
			* 18" Boom (contractor)	100'									
			Personnel	3									
			36' Skimming Vessel	1									
			Shallow Water Barge	1		249							
SWS CGA-55 Egmopol Shallow Water Skimmer	CGA (888) 242-2007	Morgan City, LA	Marco Skimmer	1	1,810	100	Port O'Connor, TX	35	9	2	5	1	17
			* 18" Boom (contractor)	100'									
			Personnel	3									
			38' Skimming Vessel	1									
			Shallow Water Barge	1		249							
FRV M/V Bastian Bay	CGA (888) 242-2007	Lake Charles, LA	Lori Brush Skimmer	2	15,257	65	Lake Charles, LA	210	2	0	14.5	1	18
			36" Boom	46'									
			46' Vessel	1									
			Personnel	4									
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Memphis, TN	Skimmer	1	905	400	Port O'Connor, TX	35	13.5	1	2.5	1	18
			18" Boom	60'									
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									
SW CGA-72 FRV	CGA (888) 242-2007	Morgan City, LA	Marco Belt Skimmer	2	21,500	249	Morgan City, LA	266	2	0	15.5	1	19
			36" Auto Boom	150'									
			Personnel	4									
			56' SWS Vessel	1									
			* 14'-16' Alum. Flatboat	2									
FRV M/V RW Armstrong	CGA (888) 242-2007	Morgan City, LA	Lori Brush Skimmer	2	15,257	65	Morgan City, LA	266	2	0	17.5	1	21
			36" Boom	46'									
			46' Vessel	1									
			Personnel	4									
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Jacksonville, FL	Skimmer	1	1,371	400	Port O'Connor, TX	35	17	1	2.5	1	22
			18" Boom	60'									
			Personnel	5									
			Non-self-propelled barge	1									
			*Appropriate Vessel	1									
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Roxana, IL	Skimmer	1	905	400	Port O'Connor, TX	35	18	1	2.5	1	22
			18" Boom	50'									
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Savannah, GA	Skimmer	1	1,371	400	Port O'Connor, TX	35	19	1	2.5	1	24
			18" Boom	50'									
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									

Table 9.D.5 Nearshore On-Water Recovery Activation List (continued)

Alaminos Canyon 857
Sample Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Nearshore Environment (Miles)	Response Times (Hours): Staging ETA	Response Times (Hours): Loadout Time	Response Times (Hours): ETA to Nearshore Environment	Response Times (Hours): Deployment Time	Total ETA
* - These components are additional operational requirements that must be procured in addition to the system identified. NOTE: Total ETA might be effected by weather, sea state, lock closure, 3rd party vessel availability.													
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Tampa, FL	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 5 1 1	1,371	400	Port O'Connor, TX	35	19	1	2.5	1	24
MSRC "Quick Strike"	MSRC (800) OIL-SPIL	Lake Charles, LA	LORI Brush Skimmer Personnel 47' Fast Response Boat	2 3 1	5,000	50	Lake Charles, LA	296	2	1	21	1	25
SWS CGA-76 FRV	CGA (888) 242-2007	Leeville, LA	Lori Brush Skimmer 36" Boom 60' Vessel X Band Radar Personnel	2 150 1 1 4	22,885	249	Leeville, LA	375	2	0	22	1	25
AARDVAC	MSRC (800) OIL-SPIL	Miami, FL	Skimmer 18" Boom Personnel * Appropriate Vessel * Temporary Storage	1 50' 5 2 1	3,840	500	Port O'Connor, TX	35	22	1	2.5	1	26
WP-1	MSRC (800) OIL-SPIL	Miami, FL	Skimmer 18" Boom Personnel *Appropriate Vessel *Temporary Storage	1 50' 5 2 1	3,017	500	Port O'Connor, TX	35	22	1	2.5	1	26
AARDVAC	MSRC (800) OIL-SPIL	Miami, FL	Skimmer 18" Boom Personnel * Appropriate Vessel *Temporary Storage	1 50' 5 2 1	3,840	500	Port O'Connor, TX	35	22	1	2.5	1	26
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Miami, FL	Marco I Skimmer Personnel 30' Shallow Water Vessel	1 2 1	3,588	24	Port O'Connor, TX	35	21.5	1	2.5	1	26
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Whiting, IN	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 60' 4 1 1	905	400	Port O'Connor, TX	35	21.25	1	2.5	1	26
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Toledo, OH	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	905	400	Port O'Connor, TX	35	23.5	1	2.5	1	28
SWS CGA-77 FRV	CGA (888) 242-2007	Venice, LA	Lori Brush Skimmer 36" Boom 60' Vessel X Band Radar Personnel	2 150 1 1 4	22,885	249	Venice, LA	417	2	0	24.5	1	28
FRV M/V Grand Bay	CGA (888) 242-2007	Venice, LA	Lori Brush Skimmer 36" Boom 46' Vessel Personnel	2 46' 1 4	15,257	65	Venice, LA	417	2	0	26.5	1	30

Table 9.D.5 Nearshore On-Water Recovery Activation List (continued)

Alaminos Canyon 857
Sample Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Nearshore Environment (Miles)	Response Times (Hours): Staging ETA	Response Times (Hours): Loadout Time	Response Times (Hours): ETA to Nearshore Environment	Response Times (Hours): Deployment Time	Total ETA
* - These components are additional operational requirements that must be procured in addition to the system identified. NOTE: Total ETA might be effected by weather, sea state, lock closure, 3rd party vessel availability.													
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Virginia Beach, VA	Marco I Skimmer	1	3,588	24	Port O'Connor, TX	35	25.25	1	2.5	1	30
			Personnel	2									
			30' Shallow Water Vessel	1									
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Virginia Beach, VA	Skimmer	1	1,371	400	Port O'Connor, TX	35	25	1	2.5	1	30
			18" Boom	50'									
			Personnel	4									
			Self-propelled barge	1									
SBS w/ GT - 185 w/adapter	MSRC (800) OIL-SPIL	Chesapeake City, MD	Skimmer	1	1,371	400	Port O'Connor, TX	35	27	1	2.5	1	32
			18" Boom	50'									
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									
SBS w/ GT - 185 w/adapter	MSRC (800) OIL-SPIL	Edison/Perth Amboy, NJ	Skimmer	1	1,371	400	Port O'Connor, TX	35	28	1	2.5	1	33
			18" Boom	50'									
			Personnel	4									
			Self-propelled barge	1									
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Edison/Perth Amboy, NJ	Marco I Skimmer	1	3,588	24	Port O'Connor, TX	35	28	1	2.5	1	33
			Personnel	2									
			30' Shallow Water Vessel	1									
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Bayonne, NJ	Skimmer	1	1,371		Port O'Connor, TX	35	28	1	2.5	1	33
			18" Curtain Internal Foam	50'									
			Personnel	4									
			Non-self-propelled barge	1		400							
			*Appropriate Vessel	1									
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Providence, RI	Skimmer	1	1,371		Port O'Connor, TX	35	31	1	2.5	1	36
			18" Curtain Internal Foam	60'									
			Personnel	4									
			Non-self-propelled barge	1		400							
			Push Boat	1									
SBS w/ GT-185	MSRC (800) OIL-SPIL	Everett, MA	Skimmer	1	1,371	400	Port O'Connor, TX	35	31	1	2.5	1	36
			18" Boom	60'									
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Portland, ME	Marco I Skimmer	1	3,588	24	Port O'Connor, TX	35	34	1	2.5	1	39
			Personnel	2									
			30' Shallow Water Vessel	1									
SBS w/ WP-1	MSRC (800) OIL-SPIL	Portland, ME	Skimmer	1	3,017	400	Port O'Connor, TX	35	34	1	2.5	1	39
			18" Boom	50'									
			Personnel	4									
			Self-propelled barge	1									
MSRC "Lightning"	MSRC (800) OIL-SPIL	Tampa, FL	LORI Brush Skimmer	2	5,000	50	Tampa, FL	780	2	1	55.5	1	60
			Personnel	3									
			47' Fast Response Boat	1									
DERATED RECOVERY RATE (BBLS/DAY)											315,008		
SKIMMING VESSEL STORAGE CAPACITY (BARRELS)											15,979		

Table 9.D.5 Nearshore On-Water Recovery Activation List (continued)

Alaminos Canyon 857 Sample Aerial Surveillance Activation List										
Aerial Surveillance System	Supplier & Phone	Airport/City, State	Aerial Surveillance Package	Quantity	Staging Location	Distance to Site from Staging (nautical miles)	Response Times (Hours)			
							Staging ETA	Loadout Time	ETA to Site	Total ETA
* - These components are additional operational requirements that must be procured in addition to the system identified.										
Twin Commander Air Speed - 260 Knots	Airborne Support (985) 851-6391	Houma, LA	Surveillance Aircraft	1	Houma, LA	352	1	0.25	1.17	2.45
			Spotter Personnel	2						
			Crew - Pilots	1						
Aztec Piper Air Speed - 150 Knots	Airborne Support (985) 851-6391	Houma, LA	Surveillance Aircraft	1	Houma, LA	352	1	0.25	2.05	3.30
			Spotter Personnel	2						
			Crew - Pilots	1						
Eurocopter EC-135 Helicopter Air Speed - 141 knots	PHI (800) 235-2452	Houma, LA	Surveillance Aircraft	1	Houma, LA	352	1	0.25	2.18	3.45
			Spotter Personnel	2						
			Crew - Pilots	1						
Sikorsky S-76 Helicopter Air Speed - 141 knots	PHI (800) 235-2452	Houma, LA	Surveillance Aircraft	1	Houma, LA	352	1	0.25	2.18	3.45
			Spotter Personnel	2						
			Crew - Pilots	1						

Table 9.D.6 Aerial Surveillance Activation List

Alaminos Canyon 857
Sample Offshore Aerial Dispersant Activation List

Aerial Dispersant System	Supplier & Phone	Airport/ City, State	Aerial Dispersant Package	Quantity	Staging Location	Distance to Site from Staging (Miles)	Response Times (Hours)				
							Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
NOTE: Planholder has access to additional dispersant assets. For a comprehensive list of assets, see Section 18. * - These components are additional operational requirements that must be procured in addition to the system(s) identified. ** The second flight times listed are to demonstrate subsequent sortie and application timeframes. *** The dispersants listed is for gallon capacity only not amount stored at each location.											
Twin Commander Air Speed - 300 MPH	CGA/Airborne Support (985) 851-6391	Houma, LA	Aero Commander	1	Houma, LA	352	1	0	1.17	0	2.20
			Spotter Personnel	2							
			Crew - Pilots	1							
BT-67 (DC-3 Turboprop) Aircraft Air Speed - 194 MPH	CGA/Airborne Support (985) 851-6391	Houma, LA	DC-3 Dispersant Aircraft	1	Houma, LA 1st Flight	352	2	0.5	1.82	0.5	4.85
			Dispersant - Gallons	2000							
			Spotter Aircraft	1							
			Spotter Personnel	2	Corpus Christi INTL., TX 2nd Flight	200	1.03	0.5	1.03	0.3	2.90
			Crew - Pilots	2							
DC-3 Aircraft Air Speed - 150 MPH	CGA/Airborne Support (985) 851-6391	Houma, LA	DC-3 Dispersant Aircraft	1	Houma, LA 1st Flight	352	2	0.5	2.35	0.5	5.35
			Dispersant - Gallons	1200							
			Spotter Aircraft	1							
			Spotter Personnel	2	Corpus Christi INTL., TX 2nd Flight	200	1.33	0.5	1.33	0.3	3.50
			Crew - Pilots	2							
DC-3 Aircraft Air Speed - 150 MPH	CGA/Airborne Support (985) 851-6391	Houma, LA	DC-3 Dispersant Aircraft	1	Houma, LA 1st Flight	352	2	0.5	2.35	0.5	5.35
			Dispersant - Gallons	1200							
			Spotter Aircraft	1							
			Spotter Personnel	2	Corpus Christi INTL., TX 2nd Flight	200	1.33	0.5	1.33	0.3	3.50
			Crew - Pilots	2							
C130-A Aircraft Air Speed - 342 MPH	MSRC (800) OIL-SPIL	Kiln, MS	C130-A Disp Aircraft	1	Stennis INTL., MS 1st Flight	443	4	0.0	1.29	0.5	5.80
			Dispersant - Gallons	4125							
			*Spotter Aircraft	1							
			*Spotter Personnel	2	Corpus Christi INTL., TX 2nd Flight	200	0.50	0.3	0.58	0.5	1.95
			Crew - Pilots	2							
BE-90 King Air Aircraft Air Speed - 213 MPH	MSRC (800) OIL-SPIL	Kiln, MS	BE-90 Dispersant Aircraft	1	Stennis INTL., MS 1st Flight	443	4	0.00	2.08	0.20	6.30
			Dispersant - Gallons	250							
			* Spotter Aircraft	1							
			*Spotter Personnel	2	Corpus Christi INTL., TX 2nd Flight	200	0.94	0.3	0.94	0.20	2.45
			Crew - Pilots	2							
C130-A Aircraft Air Speed - 342 MPH	MSRC (800) OIL-SPIL	Mesa, AZ	C130-A Disp. Aircraft	1	Corpus Christi INTL., TX 1st Flight	936	9	0.3	2.74	0.5	12.60
			Dispersant - Gallons	4125							
			*Spotter Aircraft	1							
			*Spotter Personnel	2	Corpus Christi INTL., TX 2nd Flight	200	0.50	0.3	0.58	0.5	1.95
			Crew - Pilots	2							

Table 9.D.7 Offshore Aerial Dispersant Activation List

Alaminos Canyon 857 Sample Offshore Boat Spray Dispersant Activation List											
							Response Times (Hours)				
Boat Spray Dispersant System	Supplier & Phone	Warehouse	Boat Spray Dispersant Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Staging ETA	Loadout Time	ETA to Site	Deploymen t Time	Total ETA
NOTE: Planholder has access to additional dispersant assets. For a comprehensive list of assets, see Section 18. * - These components are additional operational requirements that must be procured by OSROs in addition to the system(s) identified.											
Vessel Based Dispersant Spray System	CGA (888) 242-2007	Aransas Pass, TX	Dispersant Spray System Dispersant (Gallons) Personnel * Utility Boat	1 330 4 1	Aransas Pass, TX	188	4	0.5	19	1	24.5
USCG SMART Team	USCG	Mobile, AL	Personnel * Crew Boat	4 1	Aransas Pass, TX	188	12.25	1	13.5	0.5	27.25
Vessel Based Dispersant Spray System	CGA (888) 242-2007	Harvey, LA	Dispersant Spray System Dispersant (Gallons) Personnel * Utility Boat	1 330 4 1	Aransas Pass, TX	188	10.5	0.5	19	1	31

Table 9.D.8 Offshore Boat Spray Dispersant Activation List

Alaminos Canyon 857 Sample Control, Containment & Subsea Dispersant Package Activation List											
							Response Times (Days)				
Containment System	Supplier & Phone	Warehouse	Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
* - Response time may vary depending on Drill Ship's operations and location at the time of deployment.											
Site Assessment and Surveillance	RP	Port Fourchon, LA	Multi-Service Vessel ROV's	1 2	Port Fourchon, LA	355	0	1.5	25.5	0.5	27.5
Subsea Dispersant Application	RP / MWCC	Port Fourchon, LA Houston, TX	Multi-Service Vessel ROV's Coil Tubing Unit Dispersant Manifold Subsea Dispersant Injection System	1 2 1 200,000 gal 1 1	Port Fourchon, LA	355	1.5	1.5	25.5	2	30.5
Capping Stack	RP / MWCC	Port Fourchon, LA Houston, TX	Anchor Handling Tug Supply Vessel ROV's Hydraulic System Capping Stack	1 1 1 1	Port Fourchon, LA	355	2*	1.5	25.5	3	32*
"Top Hat" Unit	RP / MWCC	Port Fourchon, LA Houston, TX	Anchor Handling Tug Supply Vessel ROV's Multi-Purpose Supply Vessel Drill Ship (Processing Vessel) "Top Hat" Containment Chamber Shuttle Barge	1 2 1 1 1 1 1	Port Fourchon, LA	355	13*	1	25.5	3	43*

Table 9.D.9 Control, Containment, and Subsea Dispersant Package Activation List

Alaminos Canyon 857
Sample In-Situ Burn Equipment Activation List

NOTE: *Planholder has access to additional ISB assets. For a comprehensive list of those assets, see Section 19.*
Total ETA might be effected by weather, sea state, lock closure, 3rd party vessel availability.
** - These components are additional operational requirements that must be procured in addition to the system identified.*
*** - Teams will deploy in sections of 500' at any given time*

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
ISB Fire-Fighting Team	TBD	TBD	* Offshore Firefighting Vessels	2	Aransas Pass, TX	188	4	1	13.5	1	19.5
			* Cranes	2							
			* Roll-off Boxes	2							
			Personnel	8							
			* Air Monitoring Equipment	2							
SMART In-Situ Burn Monitoring Team	USCG	Mobile, AL	* Air Monitoring Equipment	1	Aransas Pass, TX	188	4	1	13.5	1	19.5
			* Offshore Vessel	1							
			Personnel	4							
Safety Monitoring Team	TBD	TBD	* Air Monitoring Equipment	1	Aransas Pass, TX	188	4	1	13.5	1	19.5
			* Offshore Vessel	1							
			Personnel	4							
Wildlife Monitoring Team	TBD	TBD	* Air Monitoring Equipment	1	Aransas Pass, TX	188	4	1	13.5	1	19.5
			* Offshore Vessel	1							
			Personnel	4							
Aerial Spotting Team (per 2 ISB Task Forces)	TBD	TBD	Fixed Wing Aircraft	1	Aransas Pass, TX	188	4	1	13.5	1	19.5
			Trained ISB Spotter	2							
			ISB Documenter	1							
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Houston, TX	**Fire Boom (ft)	16,000	Aransas Pass, TX	188	5.25	1	13.5	1	20.75
			Tow Line (ft)	600							
			* Appropriate Vessel	2							
			Personnel	2							
			Ignition Device	155							
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Galveston, TX	**Fire Boom (ft)	1,000	Aransas Pass, TX	188	6	1	13.5	1	21.5
			Tow Line (ft)	600							
			* Appropriate Vessel	2							
			Personnel	2							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Lake Charles, LA	**Fire Boom (ft)	2,000	Aransas Pass, TX	188	7.5	1	13.5	1	23
			Tow Line (ft)	600							
			* Appropriate Vessel	2							
			Personnel	2							
			Ignition Device	25							
Supply Team (Supply Vessel System)	MSRC (800) OIL-SPIL	Aransas Pass, TX	*Offshore Vessel 110' - 310'	1	Aransas Pass, TX	188	4	1	37.5	1	43.5
			Personnel	6							
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Portland, ME	**Fire Boom (ft)	1,000	Aransas Pass, TX	188	34	1	13.5	1	49.5
			Tow Line (ft)	600							
			* Appropriate Vessel	2							
			Personnel	2							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	CGA (888) 242-2007	Harvey, LA	Fire Boom (ft)	500	Aransas Pass, TX	188	0	24	19	6	49
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	3							
			Personnel	20							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	CGA (888) 242-2007	Harvey, LA	Fire Boom (ft)	500	Aransas Pass, TX	188	0	24	19	6	49
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	3							
			Personnel	20							
			Ignition Device	10							
								TOTAL FIRE BOOM AVAILABLE (FEET)		21,000	

Table 9.D.10 In-Situ Burn Equipment Activation List

Alaminos Canyon 857
Sample Shoreline Protection & Wildlife Support List

Supplier & Phone	Warehouse	Equipment Listing	Quantity	Staging Area	Response Times (Hours)			
					Staging ETA	Loadout Time	Deployment Time	Total ETA
Miller Env. Services (800) 929-7227	Corpus Christi, TX	Containment Boom - 10"	2,000'	Aransas Pass, TX	4	1	1	6
		Containment Boom - 18"	30,000'					
		Jon Boats - 14' to 16' w/25hp motor	4					
		Jon Boats - 16' to 18' w/Outboard motor	4					
		Air Boat - 14'	1					
		Response Boats - 24' to 26'	4					
		Portable Skimmers	6					
		Shallow Water Skimmers	2					
		Response Personnel	142					
Clean Harbors (800) 645-8265	Houston, TX	Containment Boom - 18" to 24"	4,500'	Aransas Pass, TX	5.25	1	1	8
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	3					
		Portable Skimmers	1					
		Response Personnel	14					
ES&H Environmental (877) 437-2634	Houston, TX	Containment Boom - 10"	500'	Aransas Pass, TX	5.25	1	1	8
		Containment Boom - 18"	13,000'					
		Containment Boom - 24"	5,000'					
		Jon Boat - 12' to 16'	2					
		Response Boats - 26' to 29'	2					
		Portable Skimmers	2					
		Wildlife Hazing Cannon	12					
Wildlife Ctr. of Texas (713) 861-9453	Houston, TX	Wildlife Specialist - Personnel	6 to 20	Aransas Pass, TX	5.25	1	1	8
Garner Environmental (800) 424-1716	Deer Park, TX	Containment Boom - 18"	16,000'	Aransas Pass, TX	5.75	1	1	8
		Response Boats - 12'	2					
		Response Boats - 16' to 20'	5					
		Respons Boats - 30'	2					
		Portable Skimmers	13					
Phoenix Pollution Control & Environmental Services (281) 838-3400	Baytown, TX	Containment Boom - 18"	13,000'	Aransas Pass, TX	5.75	1	1	8
		Containment Boom - 10"	1,150'					
		Response Boats - 16'	6					
		Response Boats - 20'	3					
		Response Boats - 24'	1					
		Response Boats - 35'	2					
		Portable Skimmers	24					
Garner Environmental (800) 424-1716	La Marque, TX	Containment Boom - 6"	9,500'	Aransas Pass, TX	5.75	1	1	8
		Response Boats - 16'	5					
		Response Boats - 24'	1					
		Portable Skimmers	7					
Miller Env. Services (800) 929-7227	Houston, TX	Containment Boom - 18"	12,000'	Aransas Pass, TX	5.25	1	1	8
		Shallow Water Skimmers	1					
		Response Boats - 28'	1					
		Responder Personnel	38					
SWS Environmental (877) 742-4215	Houston, TX	Containment Boom - 18"	19,000'	Aransas Pass, TX	5.25	1	1	8
		Response Boats - 16' to 25'	1					
		Response Boats - 25' to 42'	2					
		Portable Skimmers	2					
		Response Personnel	19					
OMI (800) 645-6671	Houston, TX	Containment Boom - 18" to 24"	4000'	Aransas Pass, TX	5.25	1	1	8
		Response Boats - 16'	3					
		Response Boats - 25' to 28'	1					
		Portable Skimmers	1					
USES Environmental (888) 279-9930	Houston, TX	Containment - 18"	10,000'	Aransas Pass, TX	5.25	1	1	8
		Response Boats - 16'	4					
		Response Boats - 26'	1					
		Portable Skimmers	1					
OMI (800) 645-6671	Port Arthur, TX	Containment Boom - 18" to 24"	4000'	Aransas Pass, TX	6.75	1	1	9
		Response Boats - 14' to 20'	6					
		Response Boats - 21' to 36'	2					
		Shallow Water Skimmers	1					

Table 9.D.11 Shoreline Protection and Wildlife Support List

Alaminos Canyon 857
Sample Shoreline Protection & Wildlife Support List

Supplier & Phone	Warehouse	Equipment Listing	Quantity	Staging Area	Response Times (Hours): Staging ETA	Loadout Time	Deployment Time	Total ETA
Clean Harbors (800) 645-8265	Port Arthur, TX	Containment Boom - 18" to 24"	3,000'	Aransas Pass, TX	6.75	1	1	9
		Response Boats - 21' to 36'	2					
		Portable Skimmers	2					
		Response Personnel	54					
AMPOL (800) 482-6765	Port Arthur, TX	Containment Boom - 18" to 24"	16,000'	Aransas Pass, TX	6.75	1	1	9
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	3					
Garner Environmental (800) 424-1716	Port Arthur, TX	Containment Boom - 6"	22,000'	Aransas Pass, TX	6.75	1	1	9
		Response Boats - 14' to 20'	8					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	3					
Miller Env. Services (800) 929-7227	Beaumont, TX	Containment Boom - 18'	14,000'	Aransas Pass, TX	6.75	1	1	9
		Response Boats - 18'	2					
		Response Boats - 24'	2					
		Shallow Water Skimmers	1					
		Response Personnel	47					
ES&H Environmental (877) 437-2634	Lake Charles, LA	Containment Boom - 10'	500'	Aransas Pass, TX	7.5	1	1	10
		Containment Boom - 18'	15,000'					
		Containment Boom - 24'	5,000'					
		Jon Boat - 12' to 16'	3					
		Response Boats - 18' to 21'	2					
		Response Boats - 26' to 29'	2					
		Portable Skimmers	13					
		Wildlife Hazing Cannon	40					
USES Environmental (888) 279-9930	Lake Charles, LA	Containment Boom - 10'	100'	Aransas Pass, TX	7.5	1	1	10
		Containment Boom - 18'	7,700'					
		Response Boats - 16'	3					
		Response Boats - 27'	1					
		Response Boats - 37'	1					
Miller Env. Services (800) 929-7227	Sulphur, LA	Containment Boom - 10'	600'	Aransas Pass, TX	7.5	1	1	10
		Containment Boom - 18'	14,000'					
		Jon Boats - 14' to 16'	2					
		Jon Boats - 16' w/25hp HP Outboard Motor	2					
		Air Boat - 18'	1					
		Work Boat - 18'	2					
		Response Boats - 24' - 28'	4					
		Portable Skimmers	5					
		Shallow Water Skimmers	1					
		Response Personnel	49					
Clean Harbors (800) 645-8265	New Iberia, LA	Containment Boom - 18" to 24"	33,800'	Aransas Pass, TX	9	1	1	11
		Containment Boom - 6" to 10"	500'					
		Response Boats - 21' to 36'	4					
AMPOL (800) 482-6765	New Iberia, LA	Containment Boom - 6" to 10"	4,150'	Aransas Pass, TX	9	1	1	11
		Containment Boom - 18" to 24"	34,050'					
		Response Boats - 14' to 20'	3					
		Response Boats - 21' to 36'	3					
		Portable Skimmers	27					
OMI (800) 645-6671	New Iberia, LA	Containment Boom - 18" to 24"	12,000'	Aransas Pass, TX	9	1	1	11
		Containment Boom - 6" to 10"	300'					
		Response Boats - 16'	3					
		Response Boats (Barge) - 25' to 33'	1					
		Response Boats - 25' to 28'	1					
		Portable Skimmers	8					
		Response Personnel	8					

Table 9.D.11 Shoreline Protection and Wildlife Support List (continued)

Alaminos Canyon 857
Sample Shoreline Protection & Wildlife Support List

Supplier & Phone	Warehouse	Equipment Listing	Quantity	Staging Area	Response Times (Hours)			
					Staging ETA	Loadout Time	Deployment Time	Total ETA
ES&H Environmental (877) 437-2634	Lafayette, LA	Containment Boom - 10"	500'	Aransas Pass, TX	8.5	1	1	11
		Containment Boom - 18"	13,000'					
		Jon Boat - 12' to 16'	3					
		Response Boats - 18' to 21'	1					
		Response Boats - 22' to 25'	1					
		Response Boats - 26' to 29'	1					
		Portable Skimmers	4					
		Wildlife Hazing Cannon	12					
OMI (800) 645-6671	Port Allen, LA	Containment Boom - 18" to 24"	2500'	Aransas Pass, TX	9	1	1	11
		Containment Boom - 6" to 10"	500'					
		Response Boats - 16'	2					
		Response Boats - 25 to 33'	1					
		Shallow Water Skimmers	1					
		Response Personnel	6					
OMI (800) 645-6671	Morgan City, LA	Containment Boom - 18" to 24"	2,500	Aransas Pass, TX	9.75	1	1	12
		Containment Boom - 6" to 10"	400'					
		Response Boats - 16'	2					
		Response Boats - 25' to 28'	1					
		Portable Skimmers	3					
		Response Personnel	3					
ES&H Environmental (877) 437-2634	Morgan City, LA	Containment Boom - 10"	2,000'	Aransas Pass, TX	9.75	1	1	12
		Containment Boom - 18"	500'					
		Jon Boat - 12' to 16'	3					
		Response Boats - 18' to 21'	2					
		Response Boats - 22' to 25'	1					
		Portable Skimmers	2					
		Wildlife Hazing Cannon	12					
USES Environmental (888) 534-2744	Geismar, LA	Containment Boom - 18"	1,000'	Aransas Pass, TX	9.5	1	1	12
		Response Boats - 16'	2					
		Portable Skimmers	1					
USES Environmental (888) 279-9930	Amelia, LA	Containment Boom - 18"	500'	Aransas Pass, TX	9.75	1	1	12
Clean Harbors (800) 645-8265	Baton Rouge, LA	Containment Boom - 18" to 24"	14,000'	Aransas Pass, TX	9.25	1	1	12
		Response Boats - 14' to 20'	1					
		Portable Skimmers	3					
		Response Personnel	13					
SWS Environmental (877) 742-4215	Baton Rouge, LA	Containment Boom - 18"	1,000'	Aransas Pass, TX	9.25	1	1	12
		Response Boats - 25' to 42'	2					
		Shallow Water Skimmers	1					
		Response Personnel	6					
Wildlife Ctr. of Texas (713) 861-9453	Baton Rouge, LA	Wildlife Specialist - Personnel	6 to 20	Aransas Pass, TX	9.25	1	1	12
AMPOL (800) 482-6765	Harvey, LA	Containment Boom - 18" to 24"	8,000'	Aransas Pass, TX	10.5	1	1	13
		Containment Boom - 6" to 10"	3,000'					
CGA (888) 242-2007	Harvey, LA	Wildlife Rehab Trailer	1	Aransas Pass, TX	10.5	1	1	13
		Wildlife Husbandry Trailer	1					
		Support Trailer	3					
		Bird Scare Cannons	120					
		Contract Truck (Third Party)	3					
		Personnel (Responder/Mechanic)	4					
ES&H Environmental (877) 437-2634	Houma, LA	Containment Boom - 10"	2,000'	Aransas Pass, TX	10.25	1	1	13
		Containment Boom - 18"	20,000'					
		Containment Boom - 24"	5,000'					
		Jon Boat - 12' to 16'	30					
		Response Boats - 22' to 25'	2					
		Response Boats - 26' to 29'	4					
		Portable Skimmers	23					
		Shallow Water Skimmers	2					
		Wildlife Hazing Cannon	57					

Table 9.D.11 Shoreline Protection and Wildlife Support List (continued)

Alaminos Canyon 857
Sample Shoreline Protection & Wildlife Support List

Supplier & Phone	Warehouse	Equipment Listing	Quantity	Staging Area	Response Times (Hours): Staging ETA	Response Times (Hours): Loadout Time	Response Times (Hours): Deployment Time	Response Times (Hours): Total ETA
OMI (985) 798-1005	Houma, LA	Containment Boom - 18" to 24"	2,000'	Aransas Pass, TX	10.25	1	1	13
		Containment Boom - 6" to 10"	500'					
		Response Boats - 16'	2					
		Response Boats - 25' to 28'	1					
		Response Boats - (Cabin Boat) 27' to 30'	1					
		Shallow Water Skimmers	3					
Lawson Environmental Service (985) 876-0420	Houma, LA	Containment Boom - 18"	30,000'	Aransas Pass, TX	10.25	1	1	13
		Containment Boom - 12"	2,000'					
		Containment Boom - 10"	9,500'					
		Response Boats - 14'	10					
		Response Boats - 16'	6					
		Response Boats - 20'	5					
		Response Boats - 24'	8					
		Response Boats - 26'	4					
		Response Boats - 28'	7					
		Response Boats - 32'	4					
		Portable Skimmers	6					
ES&H Environmental (877) 437-2634	Belle Chasse, LA	Containment Boom - 10"	1,500'	Aransas Pass, TX	10.75	1	1	13
		Containment Boom - 18"	15,500'					
		Containment Boom - 24"	5,000'					
		Jon Boat - 12' to 16'	4					
		Response Boats - 18' to 21'	1					
		Response Boats - 22' to 25'	1					
		Response Boats - 26' to 29'	3					
		Portable Skimmers	10					
		Wildlife Hazing Cannon	50					
OMI (800) 645-6671	Belle Chasse, LA	Containment Boom - 18" to 24"	4,500'	Aransas Pass, TX	10.75	1	1	13
		Containment Boom - 6" to 10"	500'					
		Response Boats - 20'	1					
		Response Boats - 25' to 28'	2					
		Portable Skimmers	12					
		Shallow Water Skimmers	1					
		Bird Scare Cannons	12					
		Response Personnel	24					
ES&H Environmental (877) 437-2634	Golden Meadow, LA	Containment Boom - 10"	1,000'	Aransas Pass, TX	11	1	1	13
		Containment Boom - 18"	13,000					
		Jon Boat - 12' to 16'	2					
		Response Boats - 18' to 21'	1					
		Response Boats - 22' to 25'	1					
		Response Boats - 26' to 29'	1					
		Portable Skimmers	5					
		Wildlife Hazing Cannon	12					
USES Environmental (888) 279-9930	Lafitte, LA	Containment Boom - 18"	1,000'	Aransas Pass, TX	11	1	1	13
		Response Boats - 18'	2					
USES Environmental (888) 279-9930	Marrero, LA	Containment Boom - 18"	600'	Aransas Pass, TX	10.5	1	1	13
USES Environmental (888) 279-9930	Meraux, LA	Containment Boom - 18"	6,000'	Aransas Pass, TX	10.5	1	1	13
		Containment Boom - 10"	1,000'					
		Response Boats - 16'	23					
		Response Boats - 18'	1					
		Response Boats - 24'	1					
		Response Boats - 26'	2					
		Response Boats - 28'	1					
		Portable Skimmers	2					
USES Environmental (888) 279-9930	Hahnville, LA	Containment Boom - 18"	500'	Aransas Pass, TX	10.25	1	1	13

Table 9.D.11 Shoreline Protection and Wildlife Support List (continued)

Alaminos Canyon 857
Sample Shoreline Protection & Wildlife Support List

Supplier & Phone	Warehouse	Equipment Listing	Quantity	Staging Area	Response Times (Hours) Staging ETA	Loadout Time	Deployment Time	Total ETA
OMI (800) 645-6671	Galliano, LA	Containment Boom - 18" to 24"	2,000'	Aransas Pass, TX	10.75	1	1	13
		Containment Boom - 6" to 10"	500'					
		Response Boats - 16'	1					
		Response Boats (Barge) - 25' to 33'	1					
		Response Boats - 25' to 28'	1					
		Portable Skimmers	3					
ES&H Environmental (877) 437-2634	Port Fourchon, LA	Containment Boom - 18"	1000'	Aransas Pass, TX	11.5	1	1	14
		Response Boats - 22' to 25'	1					
		Portable Skimmers	1					
USES Environmental (888) 279-9930	Biloxi, MS	Containment Boom - 18"	2,000'	Aransas Pass, TX	11.25	1	1	14
		Response Boats - 16'	1					
AMPOL (800) 482-6765	Venice, LA	Containment Boom - 18" to 24"	2,250'	Aransas Pass, TX	12.25	1	1	15
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	2					
ES&H Environmental (877) 437-2634	Venice, LA	Containment Boom - 10"	2,000'	Aransas Pass, TX	12.25	1	1	15
		Containment Boom - 18"	13,000'					
		Containment Boom - 24"	10,000					
		Jon Boat - 12' to 16'	4					
		Response Boats - 22' to 25'	1					
		Response Boats - 26' to 29'	2					
		Portable Skimmers	5					
		Wildlife Hazing Cannon	25					
OMI (800) 645-6671	Venice, LA	Containment Boom - 18" to 24"	1,500'	Aransas Pass, TX	12.25	1	1	15
		Response Boats - 16'	4					
		Response Boats (Barge) - 25' to 33'	1					
		Response Boats - 25' to 28'	2					
		Response Boats - (Cabin Boat) 27' to 30'	1					
		Shallow Water Skimmers	3					
		Portable Skimmers	2					
USES Environmental (888) 279-9930	Venice, LA	Containment Boom - 18"	10,000'	Aransas Pass, TX	12.25	1	1	15
		Response Boats - 16'	15					
		Response Boats - 26'	2					
		Response Boats - 30'	1					
		Portable Skimmers	2					
		Shallow Water Skimmers	1					
USES Environmental (888) 279-9930	Mobile, AL	Containment Boom - 10"	800'	Aransas Pass, TX	12.25	1	1	15
		Containment Boom - 18"	5,000'					
		Response Boats - 16'	1					
		Response Boats - 18'	1					
		Response Boats - 20'	1					
		Response Boats - 26'	1					
		Portable Skimmers	2					
SWS Environmental (877) 742-4215	Pensacola, FL	Containment Boom - 18"	2,500'	Aransas Pass, TX	13	1	1	15
		Response Boats - 16' to 25'	2					
		Shallow Water Skimmers	1					
		Response Personnel	2					
SWS Environmental (877) 742-4215	Memphis, TN	Containment Boom - 6"	100'	Aransas Pass, TX	14	1	1	16
		Containment Boom - 12"	800'					
		Containment Boom - 18"	800'					
		Response Boats - 25' to 42'	1					
		Shallow Water Skimmers	1					
		Response Personnel	9					

Table 9.D.11 Shoreline Protection and Wildlife Support List (continued)

Alaminos Canyon 857 Sample Shoreline Protection & Wildlife Support List								
					Response Times (Hours)			
Supplier & Phone	Warehouse	Equipment Listing	Quantity	Staging Area	Staging ETA	Loadout Time	Deployment Time	Total ETA
USES Environmental (888) 279-9930	Memphis, TN	Containment Boom - 6"	850'	Aransas Pass, TX	14	1	1	16
		Containment Boom - 12"	300'					
		Containment Boom - 18"	5,000'					
		Response Boats - 12'	3					
		Response Boats - 14'	5					
		Response Boats - 16'	2					
		Response Boats - 24'	1					
		Response Boats - 28'	1					
		Portable Skimmers	2					
SWS Environmental (877) 742-4215	Panama City, FL	Containment Boom - 18"	7,000'	Aransas Pass, TX	15	1	1	17
		Response Boats - 16' to 25'	3					
		Response Boats - 25' to 42'	1					
		Portable Skimmers	6					
		Response Personnel	10					
SWS Environmental (877) 742-4215	Jacksonville, FL	Containment Boom - 18"	1,500'	Aransas Pass, TX	17.5	1	1	20
		Response Boats - 16' to 25'	2					
		Shallow Water Skimmers	1					
		Response Personnel	8					
SWS Environmental (877) 742-4215	Tampa, FL	Containment Boom - 18"	2,000'	Aransas Pass, TX	19.75	1	1	22
		Response Boats - 16' to 25'	2					
		Response Boats - 25' to 42'	1					
		Shallow Water Skimmers	1					
		Response Personnel	10					
SWS Environmental (877) 742-4215	Tampa, FL	Containment Boom - 18"	2,000'	Aransas Pass, TX	19.75	1	1	22
		Response Boats - 16' to 25'	2					
		Response Boats - 25' to 42'	1					
		Portable Skimmers	1					
		Response Personnel	10					
SWS Environmental (877) 742-4215	St. Petersburg, FL	Containment Boom - 18"	10,800'	Aransas Pass, TX	19.25	1	1	22
		Response Boats - 16' to 25'	1					
		Response Boats - 25' to 42'	1					
		Portable Skimmers	1					
		Response Personnel	8					
SWS Environmental (877) 742-4215	Savannah, GA	Containment Boom - 18"	1,400'	Aransas Pass, TX	19.75	1	1	22
		Response Boats - 16' to 25'	3					
		Shallow Water Skimmers	1					
		Response Personnel	7					
SWS Environmental (877) 742-4215	Fort Lauderdale, FL	Containment Boom - 18"	1,000'	Aransas Pass, TX	21.5	1	1	24
		Response Boats - 16' to 25'	2					
		Response Boats - 25' to 42'	1					
		Shallow Water Skimmers	1					
		Response Personnel	8					
Tri-State Bird Rescue & Research, Inc. (800) 261-0980	Newark, DE	Wildlife Specialist - Personnel	6 to 12	Aransas Pass, TX	27	1	1	29

Table 9.D.11 Shoreline Protection and Wildlife Support List (continued)

SECTION 10: ENVIRONMENTAL MONITORING INFORMATION

A. Monitoring Systems

A rig based Acoustic Doppler Current Profiler (ADCP) is used to continuously monitor the current beneath the rig. Metocean conditions such as sea states, wind speed, ocean currents, etc. will also be continuously monitored. Shell will comply with NTL 2015-G04.

B. Incidental Takes

Although marine mammals and other protected marine species may be seen in the area, Shell does not believe that its operations proposed under this EP will result in any incidental takes. Shell implements the mitigation measures and monitors for incidental takes of protected species according to the following notices to lessees and operators from the BOEM/BSEE:

NTL 2015-BSEE-G03 "Marine Trash and Debris Awareness and Elimination"
NTL 2016-BOEM-G01 "Vessel Strike Avoidance and Injured/Dead Protected Species Reporting"
NTL 2016-BOEM-G02 "Implementation of Seismic Survey Mitigation Measures & Protected Species Observer Program"

Additionally, the NMFS 2020 Endangered Species Act, Section 7 Consultation – Biological Opinion discusses the potential for entrapment or entanglement of listed marine species from proposed operations, and specifically references the use of areas commonly called "moon pools." Shell provides the following information regarding the use of moon pools on vessels supporting the proposed operations:

- The area that may be referred to as a "moon pool" on a DP semi-submersible rig is an open area under the rig and is not enclosed and poses no risk to marine life.

- The typical drillship MODUs that may be used to conduct the operations stated in this plan will be selected from our common fleet and the sizes of the moonpools range from approximately 82 x 41 ft to 111 x 36 ft.

- Regardless of which MODU will be used, all moon pool/open areas for these operations will be used for deploying casing and well heads, tools supporting drilling, blow-out preventers, and riser system components. The moon pool will not be used to deploy remote-operated vehicles (ROVs).

- Moon pools on MODUs intended to be used do not have doors. Some MODUs have wave breakers, but these will not be used during drilling operations. All MODUs have flexible lines, which are drape hoses, to support drilling operations, see image below. By definition, drape hoses have a U-shaped bend or 'drape' in the line that allows for relative movement between the inner barrel of the telescopic joint and the outer barrel of the telescopic joint as the MODU moves (ISO 13624-1:2009 Petroleum and Natural Gas Industries). The purpose of the flexible lines is to connect a choke, kill, or auxiliary line (e.g. hydraulic) terminal fitting on the telescopic joint to the appropriate piping on the drilling structure (API Specification 16Q). These drape hoses do not present a potential entanglement or entrapment threat to listed species.

Figure 1 Moon Pool on Transocean MODU

Specific to monitoring of the moon pool during operations, there is a minimum of one camera monitoring each moon pool 24/7. During operations there are generally two or more personnel monitoring the drilling unit and overseeing the moon pool.

At the time of this submission, the MODU contractor is not selected. Once this is determined, the following mitigations will be adhered to. Shell is committed to protecting marine life and will mitigate the potential for entrapment of endangered marine species in a moon pool area specific to these activities as follows:

1. The presence of Endangered Species Act listed marine species (listed species) in moon pools will be documented in MODU daily reports and logs. If a listed species is observed, rig/vessel personnel will follow actions listed in Bullet 3.

2. MODU personnel will take steps to avoid the presence or use of multiple flexible lines or ropes and/or nettings in the moon pool in a way that potentially may result in the entrapment or entanglement of a listed species. In the event critical operational and/or safety lines, ropes or nettings will be present, camera monitoring of the moon pool area as specified below will be in place. As stated above, drape hoses are not considered a type of flexible line that potentially may result in the entanglement or entrapment of listed species.

3. Cameras will monitor the moon pool area for the presence of listed species. Camera footage will be transmitted to the control room where personnel will monitor for presence of listed species. The occurrence of sea turtles or other listed species in a moon pool will be documented in operations daily report logs and personnel will alert our environmental lead on duty, who will immediately contact NMFS at nmfs.psoreview@noaa.gov and BSEE at 985-722-7902 and protectedspecies@bsee.gov for additional guidance on any operation restrictions, continued monitoring requirements, recovery assistance needs (if required), and incidental report information.

   a. If a listed species is observed in the moon pool prior to the start of operations, appropriate rig/vessel personnel will be notified by the control room before operations will be allowed to begin.

   b. If operations have not commenced and conditions within the moonpool are such that visibility is limited to visually detect a listed species, rig/vessel personnel will monitor the moon pool for 30 minutes prior to start of activities in the moon pool. If operations are ongoing and conditions within the moonpool are such that visibility is limited, rig/vessel personnel will continue to monitor the moon pool and adjust operations (e.g., deploy or retrieve equipment) when it is safe to do so to minimize any potential interaction with an undetected listed species.

   c. If any listed species is detected in the moon pool, personnel will assess whether ongoing operations have the potential to entangle or entrap the listed species:
      - If ongoing operations in the moon pool pose no potential threat of entrapment or entanglement to the listed species (e.g. drill pipe), operations will proceed and monitoring by rig/vessel operations personnel will continue.
      - If personnel determine that a potential threat exists, operations will pause until the threat is eliminated (e.g., the animal exits the moon pool on its own).
      - If pausing operations cannot eliminate the threat (e.g., the animal cannot or will not exit the moon pool within a reasonable time on its own volition) and/or the animal is dead, in distress, or injured, personnel will alert our environmental lead on duty, who will immediately contact NMFS at nmfs.psoreview@noaa.gov and BSEE at 985-722-7902 and protectedspecies@bsee.gov for additional guidance on any operation restrictions, continued monitoring requirements, recovery assistance needs (if required), and incidental report information.

C. Flower Garden Banks National Marine Sanctuary

The operations proposed in this EP will not be conducted within the Protective Zones of the Flower Garden Banks and Stetson Bank.

SECTION 11: LEASE STIPULATIONS INFORMATION

Alaminos Canyon Block 857 (G-17565)

The lease was acquired in Lease Sale #161 held on September 25, 1996 and are part of The Great White Unit (Contract No. 754308001).

This lease is located within Military Warning Area W-602. Shell will enter into an agreement with the W-602 Commander, who will be contacted, as needed, to coordinate and control electromagnetic emissions, possible evacuations of personnel, and shut-in operations during the proposed activities. Shell will notify the W-602, prior to conducting operations, of the person to be notified to implement the terms of this stipulation.

The W-602 is located at: 7791 Mercury Road, Tinker AFB, Oklahoma 73145-8704

Alaminos Canyon Block 901 (G-17571)

The lease was acquired in Lease Sale #161 held on September 25, 1996 and is part of The Great White Unit (Contract No. 754308001).

This lease is located within Military Warning Area W-602. Shell will enter into an agreement with the W-602 Commander, who will be contacted, as needed, to coordinate and control electromagnetic emissions, possible evacuations of personnel, and shut-in operations during the proposed activities. Shell will notify the W-602, prior to conducting operations, of the person to be notified to implement the terms of this stipulation.

The W-602 is located at: 7791 Mercury Road, Tinker AFB, Oklahoma 73145-8704

SECTION 12: ENVIRONMENTAL MITIGATION MEASURE INFORMATION

A. Impacts to Marine and coastal environments

The proposed action will implement mitigation measures required by laws and regulations, including all applicable Federal & State requirements concerning air emissions, discharges to water and solid waste disposal, as well as any additional permit requirements and Shell policies. Project activities will be conducted in accordance with the Regional OSRP. Section 18 of this plan discusses impacts and mitigation measures, including Coastal Habitats and Protected Areas.

B. Incidental Takes

We do not anticipate any incidental takes related to the proposed operations. Shell implements the mitigation measures and monitors for incidental takes of protected species according to the following notices to lessees and operators from the BOEM/BSEE:

NTL 2015-BSEE-G03	"Marine Trash and Debris Awareness and Elimination"
NTL 2016-BOEM-G01	"Vessel Strike Avoidance and Injured/Dead Protected Species Reporting"
NTL 2016-BOEM-G02	"Implementation of Seismic Survey Mitigation Measures & Protected Species Observer Program"

NMFS 2020 Endangered Species Act, Section 7 Consultation – Biological Opinion:

- Appendix A: No seismic survey activities will take place in this Plan.
- Appendix B: Shell will comply with GOM Marine and Trash Requirements in Appendix B 2020 NMFS BiOp and BOEM/BSEE Regulations.
- Appendix C: Shell will comply with GOM Vessel Strike Avoidance and Protected Species Reporting Requirements in Appendix C and BOEM/BSEE Regulations.
- Appendix J: There will be no explosive severance operations conducted in this Plan that may result in potential for entanglement or entrapment of endangered marine species. Shell intends to follow the monitoring and reporting procedures outlined in Section 12 and apply the measures in Appendix J, if appropriate, based on consultation with NMFS.

SECTION 13: RELATED FACILITIES AND OPERATIONS INFORMATION

A. Related OCS Facilities and Operations

This RDOCD covers the seafloor hardware required to produce the additional GD wells back to the Perdido Regional Host. No additional infrastructure is required. Section 1 has the Subsea Layout drawing for the equipment proposed in this plan.

No new pipelines to shore or pile-driving activities are associated with this Plan.

There is no moon pool located at the Perdido Regional Host.

This subsea tieback flows back to the Perdido Spar and was covered in the Initial DOCD (approved by the then MMS April 12, 2007, Control Number N-08809). This system remains as previously approved.

B. **Transportation System**

The identical Transportation System described in Section (13b) of the Initial DOCD (approved by the then MMS April 12, 2007, Control Number N-08809) pertains to this application. The followline new flowline/jumpers will be added to the existing system.

From (Facility/Area/Block)	To (Facility/Area/Block)	Diameter (Inches)	Length (Feet)	Max flow rate	Product
AC 857 Hub (WM12-2 manifold)	AC 857 manifold (WM 12-3)	6″ flowline	5,233′	21k BLPD	Crude Oil
AC 857 Wells	AC 857 manifolds (WM 12-3 or OL5)	10 6″ jumpers	290-1491′	7k BLPD	Crude Oil
AC 857 Hub (WM12-2 manifold)	AC 857 GB007 well (R-6831)	6″ jumper	428′	5k BLPD	Crude Oil
AC 857 Hub (WM12-2 manifold)	AC 857 Hub (WM 12-4 manifold)	6″ jumper	274′	26k BLPD	Crude Oil

Shut-in time for the lines is 60-minute CROC detection time, and then closeure of one or more valves within 2 minutes and 45 seconds after sensor activation.

SECTION 14: SUPPORT VESSELS AND AIRCRAFT INFORMATION

A. General

Type	Maximum Fuel Tank Storage Capacity (Gals)	Maximum No. In Area at Any Time	Trip Frequency or Duration
Crew Boats	8,000	1	Twice per week
Offshore Support Vessels	120,000	2	Twice per week
Helicopter	760	1	Once per day
Pipe Lay Vessel	1,070,950 gal	1	9 day duration
LCV	~530,000 gal	1	59 day duration
SV	~53,000 gal	2	~20 days duration
Multi Service Vessel	220,000 gals	1	9 days duration

B. Diesel Oil Supply Vessels

Size of Fuel Supply Vessel	Capacity of Fuel Supply Vessel	Frequency of Fuel Transfers	Route Fuel Supply Vessel Will Take
280′ length	100,000 gals.	1 week	6 miles from Port Fourchon to the mouth of Bayou Lafourche, then to AC 857

Vessels associated with this proposed activity will not transit the designated Bryde's whale area in the NMFS 2020 Endangered Species Act, Section 7 Consultation – Biological Opinion.

Additionally, vessels associated with the jumper installations proposed in this plan will be addressed in the BSEE pipeline permit.

C. Drilling Fluids Transportation

According to NTL 2008-G04, this information in only required when activities are proposed in the State of Florida.

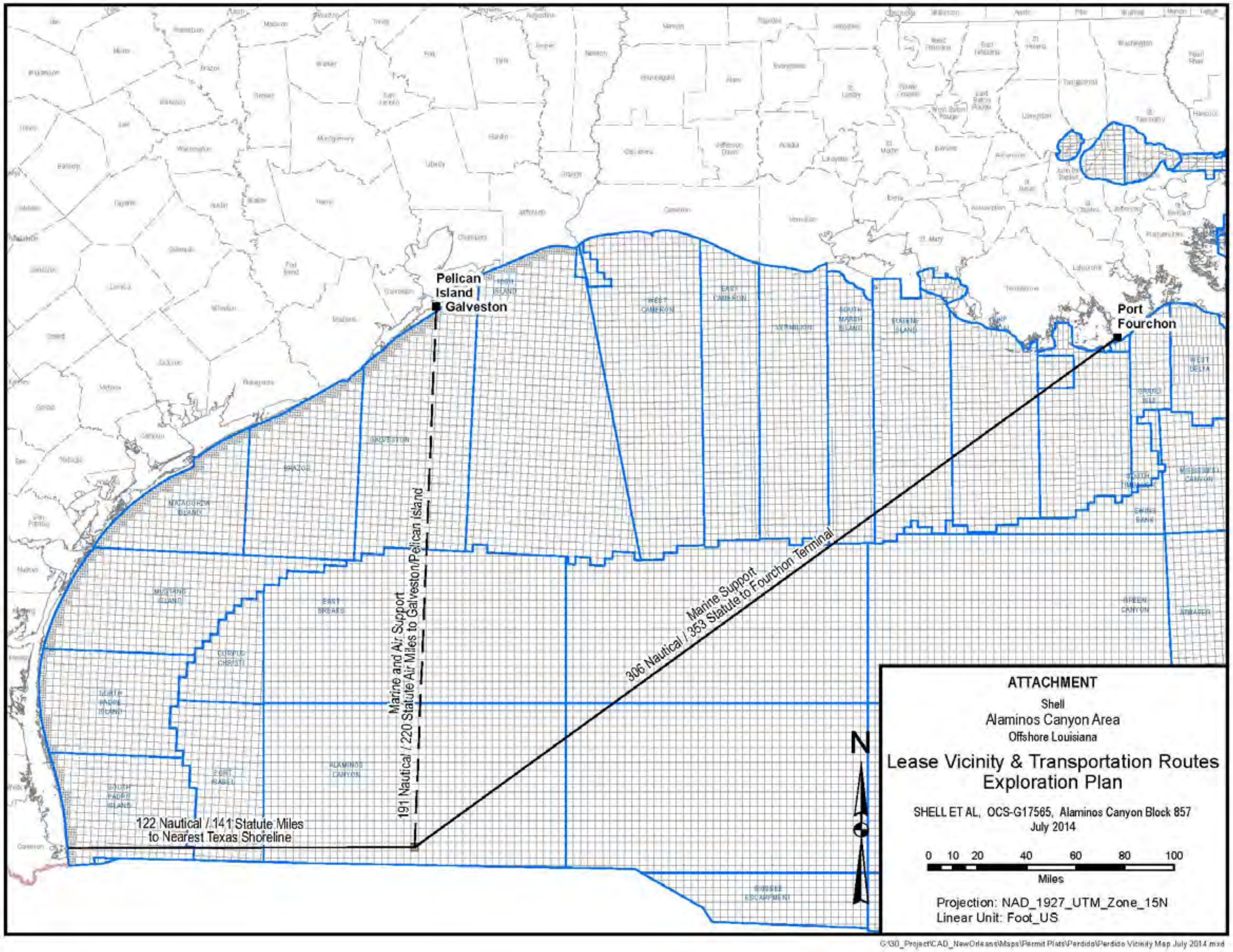
D. Solid and Liquid Wastes Transportation

See Section 7, Table 7B.

E. Vicinity Map

See Attachment 14A for Vicinity Map.

Attachment 14A – Vicinity Map



SECTION 15: ONSHORE SUPPORT FACILITIES INFORMATION

A. General

Name	Location	Existing/New/Modified
Fourchon	Port Fourchon, LA	Existing
Galveston Heliport	Galveston, TX	Existing
Haliburton	Galveston, TX	Exising

The onshore support bases for water and air transportation will be the existing terminals in Galveston, Texas and Fourchon, Louisiana. The Fourchon boat facility is operated by Shell and is located on Bayou Lafourche, south of Leeville, LA approximately 3 miles from the Gulf of Mexico. Marine support will be from Halliburton located at 1800 Seawolf Parkway in Galveston, TX or Martin Midstream at Pelican Island in Galveston, TX.

B. Support Base Construction or Expansion

Shell does not plan to construct a new onshore support base or expand an existing one to accommodate the production proposed in this DOCD.

C. Support Base Construction or Expansion Timetable

Since no onshore support base construction or expansion is planned for these activities, a timetable for land acquisition and construction or expansion is not applicable.

D. Waste Disposal

See Section 7, Tables 7A and 7B.

E. Air emissions

Not required by BOEM GoM.

F. Unusual solid and liquid wastes

Not required by BOEM GoM.

SECTION 16: SULPHUR OPERATIONS INFORMATION

Information regarding Sulphur Operations is not included in this EP as we are not proposing to conduct sulphur operations.

SECTION 17: COASTAL ZONE MANAGEMENT ACT (CZMA) INFORMATION

Coastal zone consistency has been provided from the State of Louisiana and the State of Texas in plan R-5144 in 2011.

CZM concurrence is not required for Supplemental plans in these states.

SECTION 18 : ENVIRONMENTAL IMPACT ANALYSIS (EIA)

Environmental Impact Analysis

SUPPLEMENTAL DEVELOPMENT OPERATIONS COORDINATION DOCUMENT

for

Alaminos Canyon Block 857 (OCS-G-17565)

Offshore Texas

May 2020

Prepared for:

Shell Offshore Inc.
P.O. Box 61933
New Orleans, Louisiana 70161
Telephone: (504) 425-6021

Prepared by:

CSA Ocean Sciences Inc.
8502 SW Kansas Avenue
Stuart, Florida 34997
Telephone: (772) 219-3000

Acronyms and Abbreviations

ABS	American Bureau of Shipping
AC	Alaminos Canyon
ac	acre
ADIOS	Automated Data Inquiry for Oil Spills
AQR	Air Quality Emissions Report
AUV	autonomous underwater vehicle
bbl	barrel
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BOP	blowout preventer
BOPD	barrels of oil per day (bbl/d)
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
dB	decibel
DOCD	Development Operations Coordination Document
DNV	Det Norske Veritas
DP	dynamically positioned
DPS	distinct population segment
EFH	Essential Fish Habitat
EIA	Environmental Impact Analysis
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAD	fish-attracting device
FR	Federal Register
GMFMC	Gulf of Mexico Fishery Management Council
H_2S	hydrogen sulfide
ha	hectare
HAPC	Habitat Area of Particular Concern
Hz	hertz
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
MODU	mobile offshore drilling unit
MWCC	Marine Well Containment Company
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NTL	Notice to Lessees and Operators
NWR	National Wildlife Refuge
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OSRA	Oil Spill Risk Analysis
OSRP	Oil Spill Response Plan
PAH	polycyclic aromatic hydrocarbon
PM	particulate matter
PEIS	Programmatic Environmental Impact Statement
Shell	Shell Offshore Inc.
SO_x	sulfur oxides
U.S.C	United States Code
USCG	U.S. Coast Guard
USDOI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
WCD	worst case discharge
WMA	Wildlife Management Area

Introduction

Project Summary

Shell Offshore Inc. (Shell) is submitting a Supplemental Development Operations Coordination Document (DOCD) for Alaminos Canyon (AC) Block 857 to install seafloor equipment (flexible flowlines, jumpers, flying leads, manifold, and umbilical), to produce, and to perform future well work of eight new wells. The drilling and completion of the wells were previously approved in the Supplemental Exploration Plan No. S-7953. The proposed well work and seafloor infrastructure will be in the area previously approved in DOCD Plan No. S-7322, Revised DOCD Plan Nos. R-5144, R-6668, and R-6831. This Environmental Impact Analysis (EIA) provides information on potential impacts on environmental resources that could be affected by Shell's proposed activities in the project area.

The project area is in the Western Planning Area, 141 miles (227 km) from the nearest shoreline (Texas), 363 miles (584 km) from the onshore support base at Port Fourchon, Louisiana, and 220 miles (354 km) from the helicopter base at Galveston, Texas. All miles in the EIA are statute miles. Water depth at the project area ranges from approximately 8,000 to 8,210 ft (2,438 to 2,502 m).

Well work, inclusive of some drilling activities, and installation of subsea equipment will be accomplished with a dynamically positioned (DP) mobile offshore drilling unit (MODU) or installation vessels, as detailed in DOCD Section 14. Well work activities and subsea installation activities are estimated to commence in 2020 and could take up to 200 days per year over a 26-year period from 2020 to 2045. There are no anchors associated with the proposed work in the plan.

Purpose of the Environmental Impact Analysis

The EIA was prepared pursuant to the requirements of the Outer Continental Shelf Lands Act (OCSLA), 43 United States Code (U.S.C.) §§ 1331-1356, and Bureau of Ocean Energy Management (BOEM) regulations, including 30 Code of Federal Regulations (CFR) 550. The EIA is a project- and site-specific analysis of Shell's planned activities under this DOCD.

The EIA presents data, analyses, and conclusions to support BOEM reviews as required by the National Environmental Policy Act (NEPA) and other relevant federal laws, including the Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA). The EIA addresses the impact-producing factors (IPFs), resources, and impacts associated with the proposed project activities. It identifies mitigation measures to be implemented in connection with the planned activities. Potential environmental impacts of a blowout scenario and worst-case discharge (WCD) are also analyzed.

Potential impacts have been analyzed at a broader level in the 2017 to 2022 Programmatic Environmental Impact Statement (PEIS) for the Outer Continental Shelf (OCS) Oil and Gas Leasing Program (BOEM, 2016a) and in multisale Environmental Impact Statements (EISs) for the Western and Central Gulf of Mexico Planning Areas (BOEM, 2012a, b, 2013, 2014a, 2015, 2016b, 2017a).

The most recent multisale EISs update environmental baseline information in light of the *Deepwater Horizon* incident at the Macondo well in 2010 and address potential impacts of a catastrophic spill (BOEM, 2012a, b, 2013, 2014a, 2015, 2016b, 2017a). Numerous technical studies have also been conducted to address the impacts of the incident. The findings of the post-*Deepwater Horizon* incident studies have been incorporated into this report and are supplemented by site-specific analyses, where applicable. The EIA relies on the analyses from these documents, technical studies, and post-*Deepwater Horizon* incident studies, where applicable, to provide BOEM and other regulatory agencies with the necessary information to evaluate Shell's DOCD and ensure that oil and gas exploration activities are performed in an environmentally sound manner, with minimal impacts on the environment.

OCS Regulatory Framework

The regulatory framework for OCS activities in the Gulf of Mexico is summarized by BOEM (2016a). Under the OCSLA, the U.S. Department of the Interior (USDOI) is responsible for the administration of mineral exploration and development of the OCS. Within the USDOI, BOEM and the Bureau of Safety and Environmental Enforcement (BSEE) are responsible for managing and regulating the development of OCS oil and gas resources in accordance with the provisions of the OCSLA. The BSEE offshore regulations are in 30 CFR Chapter II, Subchapter B. BOEM offshore regulations are in 30 CFR Chapter V, Subchapter B.

In implementing its responsibilities under the OCSLA and NEPA, BOEM consults numerous federal departments and agencies that have the authority to govern and maintain ocean resources pursuant to other federal laws. Among these are the U.S. Coast Guard (USCG), U.S. Environmental Protection Agency (USEPA), U.S. Fish and Wildlife Service (USFWS), and the National Oceanic and Atmospheric Administration (NOAA) through the National Marine Fisheries Service (NMFS). Federal laws establish consultation and coordination processes with federal, state, and local agencies (e.g., the ESA, MMPA, Coastal Zone Management Act of 1972, and the Magnuson-Stevens Fishery Conservation and Management Act).

In addition, Notices to Lessees and Operators (NTLs) are formal documents issued by BOEM and BSEE that provide clarification, description, or interpretation of a regulation or standard. **Table 1** lists and summarizes the NTLs applicable to the EIA.

Table 1. Notices to Lessees and Operators (NTLs) that are 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. Supersedes NTL 2012-JOINT-G01.
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 placards at prominent locations on offshore vessels and structures; and mandates a yearly marine trash and debris awareness training and certification process. Supersedes and replaces NTL 2012-G01.

Table 1. (Continued).

NTL	Title	Summary
BOEM 2015-N02	Elimination of Expiration Dates on Certain Notice to Lessees and Operators Pending Review and Reissuance	Eliminates the expiration dates on past or upcoming expiration dates from BOEM NTLs currently posted.
BOEM 2015-N01	Information Requirements for Exploration Plans, Development and Production Plans, and Development Operations Coordination Documents on the OCS for Worst Case Discharge Blowout Scenarios	Provides guidance regarding information required in worst-case discharge (WCD) descriptions and blowout scenarios. Supersedes NTL 2010-N06.
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	Provides clarification, guidance, and information for preparation of regional Oil Spill Response Plans. Recommends description of response strategy for WCD scenarios to ensure capability to respond to oil discharges is both efficient and effective.
2011-JOINT-G01	Revisions to the List of OCS Blocks Requiring Archaeological Resource Surveys and Reports	Provides new information on which OCS blocks require archaeological surveys and reports and line spacing required in each block. This NTL augments NTL 2005-G07.
2010-N10	Statement of Compliance with Applicable Regulations and Evaluation of Information Demonstrating Adequate Spill Response and Well Containment Resources	Informs operators using subsea blowout preventers (BOPs) or surface BOPs 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 *Federal Register* [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.
2009-N11	Air Quality Jurisdiction on the OCS	Clarifies jurisdiction for regulation of air quality in the Gulf of Mexico Outer Continental Shelf (OCS).

Table 1. (Continued).

NTL	Title	Summary
2008-G04	Information Requirements for Exploration Plans and Development Operations Coordination Documents	Provides guidance on the information requirements for OCS plans, including EIA requirements and information regarding compliance with the provisions of the ESA and MMPA.
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.

Oil Spill Prevention and Contingency Planning

Shell has an approved Gulf of Mexico Regional Oil Spill Response Plan (OSRP) as a fundamental component of the planned subsea equipment installation and well work inclusive of some drilling activities program that certifies Shell's capability to respond to a WCD (30 CFR 254.2) to the maximum extent practicable (see DOCD Section 9). The OSRP demonstrates Shell's capabilities to rapidly and effectively manage oil spills that may result from drilling operations; in this case, Shell's OSRP is applicable to the proposed well work and associated subsea installation. Despite the extremely low likelihood of a large oil spill occurring during the project, Shell has designed its response program based on a regional capability of responding to a range of spill volumes from small operational spills to a WCD from a well blowout. Shell's program is intended to meet the response planning requirements of the relevant coastal states and federal oil spill planning regulations. The OSRP includes information regarding Shell's regional oil spill organization and dedicated response assets, potential spill risks, and local environmental sensitivities. The OSRP presents specific information on the response program that includes a description of personnel and equipment mobilization, the incident management team organization, and the strategies and tactics that would be used to implement effective and sustained spill containment and recovery operations.

EIA Organization

The EIA is organized into **Sections A** through **I** corresponding to the information required by NTL 2008-G04 (as extended by NTL 2015-N02), which provides guidance regarding information required by 30 CFR Part 550 for EIAs. The main impact-related discussions are in **Section A** (Impact-Producing Factors) and **Section C** (Impact Analysis).

A. Impact-Producing Factors

Based on the description of Shell's proposed activities, a series of 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** was adapted from Form BOEM-0142 and 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 routine activities and accidental events could affect specific resources. An "X" indicates that an IPF could reasonably be expected to affect the resource, and a dash (--) indicates no impact or negligible impact is expected. Numbers in parentheses refer to table footnotes on the following page. 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.

- 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; and
- Accidents.

Table 2. Matrix of impact-producing factors and affected environmental resources. X = potential impact; dash (--) = no impact or negligible impact.

Environmental Resources	Impact-producing Factors									
	MODU Presence (incl. noise & lights)	Physical Disturbance to Seafloor	Air Pollutant Emissions	Effluent Discharges	Water Intake	Onshore Waste Disposal	Marine Debris	Support Vessel/Helicopter Traffic	Accidents	
									Small Fuel Spill	Large Oil Spill
Physical/Chemical Environment										
Air quality	--	--	X(5)	--	--	--	--	--	X(6)	X(6)
Water quality	--	--	--	X	--	--	--	--	X(6)	X(6)
Seafloor Habitats and Biota										
Soft bottom benthic communities	--	X	--	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)
Bryde's 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)
Oceanic whitetip shark (Threatened)	X	--	--	--	--	--	--	--	--	X(6)
Giant manta ray (Threatened)	X	--	--	--	--	--	--	--	--	X(6)
Gulf sturgeon (Threatened)	--	--	--	--	--	--	--	--	--	X(6)
Nassau grouper (Threatened)	--	--	--	--	--	--	--	--	--	X(6)
Smalltooth sawfish (Endangered)	--	--	--	--	--	--	--	--	--	X(6)
Beach mice (Endangered)	--	--	--	--	--	--	--	--	--	X(6)
Florida salt marsh vole (Endangered)	--	--	--	--	--	--	--	--	--	X(6)
Threatened coral species	--	--	--	--	--	--	--	--	--	X(6)
Coastal and Marine Birds										
Marine birds	X	--	--	--	--	--	--	X	X(6)	X(6)
Coastal 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										
Coastal habitats and protected areas	--	--	--	--	--	--	--	X	--	X(6)
Socioeconomic and Other Resources										
Recreational and commercial fishing	X	--	--	--	--	--	--	--	X(6)	X(6)
Public health and safety	--	--	--	--	--	--	--	--	--	X(6)
Employment and infrastructure	--	--	--	--	--	--	--	--	--	X(6)
Recreation and tourism	--	--	--	--	--	--	--	--	--	X(6)
Land use	--	--	--	--	--	--	--	--	--	X(6)
Other marine uses	--	--	--	--	--	--	--	--	--	X(6)

Numbers in parentheses refer to table footnotes on the following page.

Table 2 Footnotes and Applicability:

(1) *Activities that may affect a marine sanctuary or topographic feature. Specifically, if the well, platform 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.*
   - Not applicable. The lease is not within the given ranges (buffer zone) of any marine sanctuary, topographic feature, or no-activity zone. There are no submarine banks in the lease block.

(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 project area.

(3) *Activities within any Eastern Gulf OCS block and portions of Pensacola and Destin Dome area blocks in the Central Planning Area 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 project area.

(4) *Activities on blocks designated by BOEM as being in water depths 300 m or greater.*
   - No impacts on high-density deepwater benthic communities are anticipated. Geohazards assessments found that no features indicative of high-density chemosynthetic communities or coral communities were identified within 2,000 ft (610 m) of the proposed well work and associated subsea installation (Geoscience Earth & Marine Services, 2001, 2004, Fugro Geoservices Inc., 2015, Shell, 2017, Oceaneering, 2018).

(5) *Exploration or production activities where hydrogen sulfide (H_2S) concentrations greater than 500 ppm might be encountered.*
   - Development Operations Coordination Document (DOCD) Section 4 contains Shell's request for classification as an area absent of H_2S.

(6) *All activities that could result in an accidental spill of produced liquid hydrocarbons or diesel fuel that you determine would impact these environmental resources. If the proposed action is located a sufficient distance from a resource that no impact would occur, the Environmental Impact Analysis (EIA) can note that in a sentence or two.*
   - Accidental hydrocarbon spills could affect the resources marked (X) in the matrix, and 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 from routine activities. The project area is not on BOEM's list of archaeology survey blocks (BOEM, 2011), and water depths are well beyond the 60-m (197 ft) depth contour used by BOEM as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. As discussed in **Section C.6,** the shallow hazard assessment (Geoscience Earth & Marine Services, 2001, 2004, Fugro Geoservices Inc., 2015, Shell, 2017, Oceaneering, 2018) did not identify any archaeologically significant sonar contacts within 2,000 ft (610 m) of the proposed well work and associated subsea installation.

(8) *All activities that you determine might have an adverse effect on endangered or threatened marine mammals or sea turtles or their critical habitats.*
   - IPFs that may affect marine mammals or sea turtles include DP Mobile Drilling Unit (MODU) or installation vessel presence and emissions, 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.1 Vessel Presence (including noise and lights)

Well work, inclusive of some drilling activities, and installation of subsea equipment will be accomplished with a DP MODU or installation vessel. DP MODUs and installation vessels are self-propelled and maintain position using a global positioning system, specific computer software, and sensors in conjunction with a series of thrusters. Potential impacts to marine resources from the installation of subsea equipment include the physical presence of the support vessels in the ocean, increased light from working and safety lighting on the vessels, and noise audible above and below the water surface.

The physical presence of the vessels in the ocean can attract pelagic fishes and other marine life. The DP MODU or installation vessel would be a single, temporary structure that may concentrate small epipelagic fish species, resulting in the attraction of epipelagic predators. See **Section C.5.1** for further discussion.

The DP MODU or installation vessel will maintain exterior lighting for working at night and navigational and aviation safety in accordance with federal regulations. Artificial lighting may attract and directly or indirectly impact natural resources, particularly birds, as discussed in **Section C.4**.

MODUs can be expected to produce noise from station keeping, drilling, and maintenance operations. The noise levels produced by DP vessels largely depend on the level of thruster activity required to keep position and, therefore, vary based on environmental site conditions and operational requirements. Representative source levels for vessels in DP mode range from 184 to 190 decibels relative to one micropascal squared at 1 m squared (dB re 1 μPa^2 m^2) from the source, with a primary frequency below 600 Hertz (Hz) (Blackwell and Greene Jr., 2003, McKenna et al., 2012b, Kyhn et al., 2014). Drilling operations produce noise that includes strong tonal components at low frequencies (Minerals Management Service [MMS], 2000). When drilling, the drill string represents a long vertical sound source (McCauley, 1998). Sound pressure levels associated with drilling activities have a maximum broadband (10 Hz to 10 kilohertz [kHz]) energy of approximately 190 dB re 1 μPa^2 m^2 (Hildebrand, 2005). Based on available data, marine sound generated from MODUs during drilling and in the absence of thrusters can be expected to range between 154 and 176 dB re 1 μPa^2 m^2 (Nedwell et al., 2001). The use of thrusters, whether drilling or not, can elevate sound source levels from a drillship or semisubmersible to approximately 188 dB re 1 μPa^2 m^2 (Nedwell and Howell, 2004).

The response of marine mammals, sea turtles, and fishes to a perceived marine sound depends on a range of factors, including 1) the sound pressure level, frequency, duration, and novelty of the sound; 2) the physical and behavioral state of the animal at the time of perception; and 3) the ambient acoustic features of the environment (Hildebrand, 2004).

A.2 Physical Disturbance to the Seafloor

Well work, inclusive of some drilling activities, and installation of subsea equipment will be accomplished with a DP MODU or installation vessel; no vessel will use anchors. There will be minimal disturbance to the seafloor and soft bottom communities during positioning of the equipment. Physical disturbance of the seafloor will be limited to the proximal area where the wellbore penetrates the substrate, where mud and drill cuttings will be deposited, and where subsea equipment is placed on the substrate. Depending on the specific well configuration, the total disturbed area is estimated to be 0.62 acres (ac) (0.25 hectares [ha]) per well (BOEM, 2012a).

BOEM (2012a) estimated an area of seafloor disturbance between 1.2 ac (0.5 ha) and 2.5 ac (1.0 ha) per kilometer of pipeline or flowline installation. Due to the water depth in the project area, it is anticipated that the subsea equipment will not be buried by trenching, but will instead be placed on the seafloor, decreasing the area of impact. Using BOEM's (2012b) lower range value of 1.2 ac (0.5 ha) per km of flowline as an estimate for the proposed subsea installation, the estimated area disturbed by the flying leads and jumpers (estimated sum of total length 2.6 km; DOCD Section 6) is 3.1 ac (1.3 ha).

A.3 Air Pollutant Emissions

Estimates of air pollutant emissions are provided in DOCD Section 8. Offshore air pollutant emissions will result from operations of the DP MODU or installation vessel as well as service vessels and helicopters. These emissions occur mainly from combustion of diesel and aviation fuel (Jet-A). Primary air pollutants typically associated with OCS activities are suspended particulate matter (PM), sulfur oxides (SO_x), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and carbon monoxide (CO) (Reşitoğlu et al., 2015).

The project area is located westward of 87.5° W longitude; thus, air quality is under BOEM jurisdiction as explained in NTL 2009-N11. Anticipated emissions from the proposed project activities are calculated in the Air Quality Emissions Report (AQR) (see DOCD Section 8) prepared in accordance with BOEM requirements provided in 30 CFR 550 Subpart C. The AQR shows that the projected emissions associated with the proposed activities meet BOEM's exemption criteria. Based on calculated emissions and the location of the project area relative to shore, it can be concluded that project emissions will not significantly affect onshore air quality for any of the criteria pollutants. No further analysis or control measures are required.

A.4 Effluent Discharges

Effluent discharges from the DP MODUs or installation vessels are summarized in DOCD Section 7. Discharges from the DP MODUs or installation vessels are required to comply with the National Pollutant Discharge Elimination System (NPDES) General Permit for oil and gas activities (GMG290103). The support vessels' discharges are expected to be in accordance with USCG regulations.

Water-based drilling muds and cuttings will be released at the seafloor during the initial well intervals before the marine riser (which allows their return to the surface vessel) is set. Excess cement slurry and blowout preventer fluid will also be released at the seafloor.

A synthetic-based mud (SBM) system will be used for drilling activities after the marine riser is installed, which allows recirculation of the SBM fluids and cuttings. Unused or residual SBM will be collected by the vessel and transported to Port Fourchon, Louisiana, for recycling. Drill cuttings wetted with SBM will be discharged overboard via a downpipe below the water surface, after treatment that complies with the NPDES permit limits for synthetic fluid retained on cuttings. The estimated volume of drill cuttings to be discharged is provided in DOCD Section 7.

Other effluent discharges from the DP MODU or installation vessel and support vessels are expected to include non-contact cooling water, treated sanitary and domestic wastes, deck drainage, desalination unit brine, blowout preventer fluid, well treatment and completion fluids, excess cement, water-based subsea production control fluid, hydrate inhibitor, treated seawater, uncontaminated fire water, bilge water, and ballast water. The DP MODU or installation vessel, and support vessel discharges are expected to be in accordance with NPDES permit and/or USCG regulations, as applicable, and are therefore not expected to cause significant impacts on water quality.

A.5 Water Intake

Seawater will be drawn from several meters below the ocean surface for various services, including firewater and once-through non-contact cooling of machinery on the DP MODU or installation vessel (DOCD Table 7a).

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 NPDES General Permit No. GMG290103 specifies requirements for new facilities for which construction commenced after July 17, 2006, with a cooling water intake structure having a design intake capacity of greater than 2 million gallons of water per day, of which at least 25% is used for cooling purposes.

The DP MODU or installation vessel selected for this project will meet the described applicability for new facilities, and the vessels' water intakes are expected to be in compliance with the design, monitoring, and recordkeeping requirements of the NPDES permit.

A.6 Onshore Waste Disposal

Wastes generated during exploration activities are tabulated in DOCD Section 7. Used SBMs and additives will be transported to shore for recycling, reconditioning, or deep well injection at Halliburton Drilling Fluids, MiSwaco, Newpark Drilling Fluids, Ecoserv or R360 Environmental Solutions in Port Fourchon, Louisiana. Exploration and production wastes and cuttings wetted with SBMs will be transported to shore for deep well injection or landfarm at Ecoserv or R360 Environmental Solutions in Port Fourchon, Louisiana. Completion fluids will be transported to shore for recycling or deep well injection at Haliburton, Baker Hughes, Tetra, Superior, Ecoserv or R360 Environmental Solutions in Port Fourchon, Louisiana. Salvage hydrocarbons will be transported to shore for recycling or deep well injection at PSC Industrial Outsourcing, Inc. in Jeanerette, Louisiana. Produced sand will be transported to shore for disposal or deep well injection at Ecoserv or R360 Environmental Solutions in Port Fourchon, Louisiana.

Recyclable trash and debris will be generated during the proposed project and will be recycled at Omega Waste Management in West Patterson, Louisiana, Lamp Environmental in Hammond, Louisiana, or at a similarly permitted facility. Non-recyclable trash and debris will be transported to the Republic/BFI landfill in Sorrento, Louisiana; the parish landfill in Avondale, Louisiana; or to a similarly permitted facility. Used oil and glycol will be transported to Omega Waste Management in West Patterson, Louisiana. Non-hazardous waste will be transported to the Republic/BFI landfill in Sorrento, Louisiana; Lamp Environmental in Hammond, Louisiana; or to a similarly permitted facility. Non-hazardous oilfield waste will be transported to Ecoserv in Port Arthur, Texas. Universal waste items such as batteries, lamps, glass, and mercury contaminated waste will be sent to Lamp Environmental Services in Independence, Louisiana, for processing. Hazardous waste will be sent to Omega Waste Management in West Patterson, Louisiana; Lamp Environmental in Hammond, Louisiana; or to a similarly permitted facility. Wastes will be recycled or disposed according to applicable regulations at the respective onshore facilities.

A.7 Marine Debris

Trash and debris released into the marine environment can harm marine animals through entanglement and ingestion. Shell will adhere to the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) Annex V requirements, USEPA and USCG regulations, and BSEE regulations and NTLs regarding solid wastes. BSEE regulations at 30 CFR 250.300(a) and (b)(6) prohibit operators from deliberately discharging containers and other similar materials (e.g., trash and debris) into the marine environment, and 30 CFR 250.300(c) requires durable identification markings on equipment, tools and containers (especially drums), and other material. USCG and USEPA regulations require operators to become proactive in avoiding accidental loss of solid waste items 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. Additionally, the debris awareness training, instruction, and placards required by the Protected Species Lease Stipulation should minimize the amount of debris that is accidentally lost overboard by offshore personnel (NMFS [2020] Appendix B). Shell complies with 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 marine trash and debris awareness training and certification process.

A.8 Support Vessel and Helicopter Traffic

Shell will use existing shore-based facilities at Port Fourchon, Louisiana and Galveston, Texas, for onshore support for water and air transportation, respectively. No terminal expansion or construction is planned at either location.

The supply base at Port Fourchon is operated by Shell and located on Bayou Lafourche, approximately 3 miles (5 km) from the Gulf of Mexico. There will likely be at least one support vessel in the field at all times during well work inclusive of some drilling activities and subsea installation activities. NMFS (2020) has found that support vessel traffic has the potential to disturb protected species (e.g., marine mammals, sea turtles, and fishes) and creates a risk of vessel strikes. The probability of a vessel strike depends on the number, size, and speed of vessels as well as the distribution, abundance, and behavior of the species (Conn and Silber, 2013; Hazel et al., 2007; Jensen and Silber, 2004; Laist et al., 2001; Vanderlaan and Taggart, 2007; NMFS, 2020). 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. Supply vessels will normally move to the project area via the most direct route from the shorebase.

Helicopters transporting personnel and small supplies will normally take the most direct route of travel between the helicopter base in Galveston, Texas and the project 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) overpopulated areas and sensitive habitats such as wildlife refuges and park properties. Additional guidelines and regulations specify that helicopters maintain an altitude of 1,000 ft (305 m) within 328 ft (100m) of marine mammals (NMFS, 2020).

Vessel noise is one of the main contributors to overall noise in the sea (National Research Council, 2003a, Jasny et al., 2005). Offshore supply and service 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., 2012a). The vessel tonal noise typically dominates frequencies up to approximately 50 Hz, whereas broadband sounds may extend to 100 kHz. The primary sources of vessel noise are propeller cavitation, propeller singing (high-pitched, clear harmonic tone), and propulsion; other sources include auxiliary engine noise, flow noise from water dragging along the hull, and bubbles breaking in the vessel's wake while moving through the water (Richardson et al., 1995). The intensity of noise from service vessels is approximately related to ship size, weight, and speed. Large ships tend to be noisier than small ones and ships underway with a full load (or towing or pushing a load) produce more noise than unladed vessels. For any given vessel, relative noise tends to increase with increased speed, and propeller cavitation is usually the dominant underwater noise source. Broadband source levels for most small ships (a category that includes support vessels) are anticipated to be in the range of 150 to 180 dB re 1 $\mu Pa^2\ m^2$ (Richardson et al., 1995, Hildebrand, 2009, McKenna et al., 2012a).

Helicopters used for offshore oil and gas operational support are potential sources of noise to the marine environment. Helicopter noise is generated from their jet turbine engines, airframe, and rotors. The dominant tones for helicopters are generally below 500 Hz (Richardson et al., 1995). Richardson et al. (1995) reported received sound pressure levels in water of 109 decibels relative to 1 micropascal squared (dB re 1 μPa^2) from a Bell 212 helicopter flying at an altitude of 500 ft (152 m). Penetration of aircraft noise below the sea surface is greatest directly below the aircraft; at angles greater than 13 degrees from vertical, much of the sound is reflected from the sea surface and so does not penetrate into the water (Richardson et al., 1995). The duration of underwater sound from passing aircraft is much shorter in water than air. For example, a helicopter passing at an altitude of 500 ft (152 m) that is audible in air for 4 minutes may be detectable under water for only 38 seconds at 10 ft (3 m) depth and for 11 seconds at 59 ft (18 m) depth (Richardson et al., 1995). Additionally, the sound amplitude is greatest as the aircraft approaches or leaves a location.

A.9 Accidents

A.9.1 Types of Accidents Evaluated

The analysis in the EIA focuses on two types of potential accidents:

- a small fuel spill (<1,000 barrels [bbl]), which is the most likely type of spill during OCS activities; and
- an oil spill resulting from an uncontrolled blowout. A blowout resulting in a large oil spill (>1,000 bbl) is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures detailed in DOCD Section 2j.

The following subsections summarize assumptions about the sizes and fates of these spills as well as Shell's spill response plans. Impacts are analyzed in **Section C**.

Recent EISs (BOEM, 2014b, 2015, 2016b, 2017a) analyzed five other types of accidents, including loss of well control, pipeline failures, vessel collisions, chemical and drilling fluid spills, and hydrogen sulfide (H_2S) release. These types of accidents are discussed briefly in **Section A.9.4**.

A.9.2 Small Fuel Spill

Spill Size. According to the analysis by BOEM (2017a), 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 fuel spill in the project 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 project area and the short duration of a small spill, it is expected that the opportunity for impacts to occur would be very brief.

The water-soluble fractions of diesel are dominated by two- and three-ringed polycyclic aromatic hydrocarbons (PAHs), which are moderately volatile (National Research Council, 2003b). The constituents of these oils are light to intermediate in molecular weight and can be readily degraded by aerobic microbial oxidation. Diesel density is such that it 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, 2003b) and would not be expected to occur to any appreciable degree in offshore waters of the Gulf of Mexico. Diesel oil is readily and completely degraded by naturally occurring microbes (NOAA, 2006).

The fate of a small diesel fuel spill was estimated using NOAA's Automated Data Inquiry for Oil Spills (ADIOS) 2 model (NOAA, 2016a). This model uses the physical properties of oils 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 product spilled. It is estimated that more than 90% of a small diesel spill would evaporate or naturally disperse within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

The ADIOS 2 model results, coupled with spill trajectory information discussed in the next section for a large spill, indicate that a small fuel spill would not affect coastal or shoreline resources. The project area is 141 miles (227 km) from the nearest shoreline (Texas). Slicks from spills are expected to persist for relatively short periods of time ranging from minutes (<1 bbl) to hours (<10 bbl) to a few days (10 to 1,000 bbl) and rapidly spread out, evaporate, and disperse into the water column (BOEM, 2012a). Because of the distance of these potential spills on the OCS and their lack of persistence, it is unlikely that a small diesel spill would make landfall prior to dissipation (BOEM, 2012a).

Spill Response. In the unlikely event of a fuel spill, response equipment and trained personnel would be available to ensure that spill effects are localized and would result only in short-term, localized environmental consequences. DOCD Section 9b provides a detailed discussion of Shell's response to a spill.

A.9.3 Large Oil Spill

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures detailed in DOCD Section 2j. Blowouts are rare events and most do not result in oil spills (BOEM, 2016a).

Spill Size. Shell has calculated the WCD for this DOCD using the requirements prescribed by NTL 2015-N01 as 129,000 barrels of oil per day (BOPD) for the initial release and 78,700 BOPD for the 30-day average. The detailed analysis of this calculation can be found in DOCD Section 2j. The WCD scenario for this DOCD has a low probability of being realized. Some of the factors that are likely to reduce rates and volumes, which are not included in the WCD calculation, include, but are not limited to, obstructions or equipment in the wellbore, well bridging, and early intervention such as containment.

Shell has a robust system in place to prevent blowouts. Included in DOCD Sections 2j and 9b is Shell's response to NTL 2015-N01, which includes descriptions of measures to prevent a blowout, reduce the likelihood of a blowout, and conduct effective and early intervention in the event of a blowout. Shell will also comply with NTL 2010-N10 and the Final Drilling Safety Rule, which specify additional safety measures for OCS activities.

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

The results for Launch Area W011 (the launch area which includes the project area) are presented in **Table 3**. The 30-day OSRA model predicts <0.5% conditional probability of shoreline contact within the first 3 days following a spill. Within 10 days, there is a 1% probability of contact with six Texas counties. Within 30 days, shoreline segments of 11 Texas counties and one Louisiana parish have a probability of 1% to 10% of being contacted. Matagorda County, Texas, has the highest probability of shoreline contact, with a 10% chance within 30 days of a spill. Other parishes and counties ranging from Cameron County, Texas, to Cameron Parish, Louisiana, have a 1% to 8% probability of shoreline contact within 30 days of a spill. Counties whose conditional probability for shoreline contact is <0.5% for 3, 10, and 30 days are not shown in **Table 3**.

Table 3. Conditional probabilities of a spill in the project area contacting shoreline segments based on a 30-day Oil Spill Risk Analysis (OSRA) (From: Ji et al., 2004). Values are conditional probabilities that a hypothetical spill in the project area (represented by OSRA Launch Area W011) could contact shoreline segments within 3, 10, or 30 days.

Shoreline Segment	County or Parish, State	Conditional Probability of Contact[1] (%)		
		3 Days	10 Days	30 Days
C01	Cameron, Texas	--	1	5
C02	Willacy, Texas	--	--	2
C03	Kenedy, Texas	--	1	8
C04	Kleberg, Texas	--	1	6
C05	Nueces, Texas	--	--	4
C06	Aransas, Texas	--	1	5

Shoreline Segment	County or Parish, State	Conditional Probability of Contact[1] (%)		
		3 Days	10 Days	30 Days
C07	Calhoun, Texas	--	1	6
C08	Matagorda, Texas	--	1	10
C09	Brazoria, Texas	--	--	2
C10	Galveston, Texas	--	--	3
C12	Jefferson, Texas	--	--	1
C13	Cameron, Louisiana	--	--	1

[1] Conditional probability refers to the probability of contact within the stated time period, assuming that a spill has occurred. -- indicates less than 0.5% probability of contact.

The OSRA model does not evaluate the fate of a spill over time periods longer than 30 days, nor does it predict the fate of a release that continues over a period of weeks or months. Also as noted in Ji et al. (2004), the OSRA model does not take into account the chemical composition or biological weathering of oil spills, the spreading and splitting of oil spills, or spill response activities. The model does not assume a particular spill size but has generally been used by BOEM to evaluate contact probabilities for spills greater than 1,000 bbl. Thus, OSRA is a preliminary risk assessment model. In the event of an actual oil spill, trajectory modeling would be conducted using the location and estimated amount of spilled oil, as well as current and wind data.

Weathering. Following an oil spill, several physical, chemical, and biological processes, collectively called weathering, interact to change the properties of the oil, and thereby influence its potential effects on 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 PM, and stranding on shore or sedimentation to the seafloor (National Research Council, 2003b, International Tanker Owners Pollution Federation Limited, 2018).

Weathering decreases the concentration of oil and produces changes in its chemical composition, physical properties, and toxicity (BOEM, 2017a). The more toxic, light aromatic and aliphatic hydrocarbons in the oil are lost rapidly by evaporation and dissolution on the water surface. Evaporated hydrocarbons are degraded rapidly by sunlight. Biodegradation of oil on the water surface and in the water column by marine bacteria removes first the n-alkanes and then the light aromatics from the oil. Other petroleum components are biodegraded more slowly. Photo-oxidation attacks mainly the medium and high molecular weight PAHs in the oil on the water surface.

Spill Response. Shell is a founding member of the Marine Well Containment Company (MWCC) and has access to an integrated subsea well control and containment system that can be rapidly deployed through the MWCC. The MWCC is a non-profit organization that assists with the subsea containment system during a response. The near-term containment response capability will be specifically addressed in Shell's NTL 2010-N10 submission at the time an Application for Permit to Drill is submitted and will include equipment and services available to Shell through MWCC's development of near-term capability and other industry sources. Shell is a member of Clean Caribbean & Americas, Marine Preservation Association (which funds Marine Spill Response Corporation), Clean Gulf Associates, and Oil Spill Response Limited, organizations that are committed to providing the resources necessary to respond to a spill as outlined in Shell's OSRP.

The MWCC also 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), which enables water sampling and monitoring to water depths of 3,000 m. The two 8 ft × 20 ft containers have been certified for offshore use by Det Norske Veritas (DNV) and the American Bureau of Shipping (ABS). The LARS is a combined winch, A-frame, and 3,000-m long cable customized for instruments in the containers. The containers are designed to enable rapid mobilization of equipment to an incident site. The required equipment includes redundant systems to avoid downtime and supplies for sample handling and storage. Once deployed on a suitable vessel, the mobile containers then act as workspaces for scientists and operations personnel.

Mechanical recovery capabilities are addressed in the OSRP. The mechanical recovery response equipment that could be mobilized to the spill location in normal and adverse weather conditions is included in the Offshore On-Water Recovery Activation List in the OSRP.

Chemical dispersion capabilities are also readily available from resources identified in the OSRP. Available equipment for surface and subsea application of dispersants, response times, and support resources are identified in the OSRP.

Open water *in situ* burning may also be used as a response strategy, depending on the circumstances of the release. If appropriate conditions exist and approval from the Unified Command is received, one or multiple *in situ* burning task forces could be deployed offshore.

See DOCD Section 9b for a detailed description of spill response measures.

A.9.4 Other Accidents Not Analyzed in Detail

The lease sale EISs (BOEM, 2012a, 2015, 2016b, 2017a) discuss other types of accidents: loss of well control, pipeline failures, vessel collisions, chemical and drilling fluid spills, and H_2S release. These are briefly discussed in this section. No other site-specific issues have been identified for the EIA. The analysis in the lease sale EISs for these topics is incorporated by reference.

<u>Chemical Spill</u>. 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, 2017b). 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 chemical spills >50 bbl in volume occurred each year (BOEM, 2017a).

<u>Vessel Collisions</u>. BSEE data show that there were 168 OCS-related collisions between 2007 and 2017 (BSEE, 2017). Most collision mishaps are the result of service 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 boat collided with a drilling platform in the Main Pass project area, spilling 1,500 bbl. Diesel fuel is the product most frequently spilled, but oil, natural gas, corrosion inhibitor, hydraulic fluid, and lube oil have also been released as the result of vessel collisions. Human error accounted for approximately half of all reported vessel collisions from 2006 to 2009. As summarized by BOEM (2017b), vessel collisions occasionally occur during routine operations.

Some of these collisions have caused spills of diesel fuel or chemicals. Shell intends to comply with all USCG- and BOEM-mandated safety requirements to minimize the potential for vessel collisions.

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, 2012a). In addition to the potential release of gas, condensate, oil, sand, or water, the loss of well control can also suspend and disperse bottom sediments (BOEM, 2012a, 2017a). BOEM (2016a) noted that most OCS blowouts have resulted in the release of gas; ABSG Consulting Inc. (2018) reported that most loss of well control event spills were <1,000 bbl.

Shell has a robust system in place to prevent loss of well control. Included in this DOCD is Shell's response to NTL 2015-N01, which includes descriptions of measures to prevent a blowout, reduce the likelihood of a blowout, and conduct effective and early intervention in the event of a blowout. Shell will comply with NTL 2010-N10, as extended under NTL 2015-N02, as well as the Final Drilling Safety Rule, which specify additional safety measures for OCS activities. See DOCD Sections 2j and 9b for further information.

Drilling Fluid Spills. There is the potential for drilling fluids, specifically SBMs, to be spilled due to an accidental riser disconnect (BOEM, 2017a). SBMs are relatively nontoxic to the marine environment and have the potential to biodegrade (BOEM, 2014a). The majority of SBM releases are <50 bbl in size, but accidental riser disconnects may result in the release of medium (238 to 2,380 bbl) to large (>2,381 bbl) quantities of drilling fluids. In the event of an SBM spill, there could be short-term localized impacts on water quality and the potential for localized benthic impacts due to SBM deposition on the seafloor. Benthic impacts would be similar to those described in **Section C.2.1**. The potential for riser disconnect SBM spills will be minimized by adhering to the requirements of applicable regulations.

H_2S Release. Shell is requesting a classification of H_2S absent for AC 857. Based on the H_2S absent classification, no further discussion on H_2S impacts is warranted.

B. Affected Environment

The project area is in the Western Planning Area in the Gulf of Mexico, 141 miles (227 km) from the nearest shoreline, 363 miles (584 km) from the onshore support base at Port Fourchon, Louisiana, and 220 miles (354 km) from the helicopter base at Galveston, Texas. Water depth in the project area is approximately 8,000 to 8,210 ft (2,438 to 2,502 m).

No seafloor anomalies were identified within 2,000 ft (610 m) of the proposed well work and associated subsea installation that could indicate potential for chemosynthetic or high-density deepwater benthic communities (Geoscience Earth & Marine Services, 2001, 2004, Fugro Geoservices Inc., 2015, Shell, 2017, Oceaneering, 2018).

A detailed description of the regional affected environment is provided by BOEM (2016b, 2017a), 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. These regional descriptions are based on extensive literature reviews and are incorporated by reference. General background information is presented in the following sections, and brief descriptions of each potentially affected resource are presented in **Section C**, including site-specific or new information if available.

The local environment in the project area is not known to be unique with respect to physical/chemical, biological, or socioeconomic conditions found in this region of the Gulf of Mexico. The baseline environmental conditions in the project area are expected to be consistent with the regional description of the locations evaluated by BOEM (2016b, 2017a).

C. Impact Analysis

This section analyzes the potential direct and indirect impacts of routine activities and accidents; cumulative impacts are discussed in **Section C.9**.

Environmental impacts have been analyzed extensively in lease sale EISs for the Central and Western Gulf of Mexico Planning Areas (BOEM, 2012a, 2013, 2014a, 2015, 2016b, 2017a). Site-specific issues are addressed in this section as appropriate and are organized by the environmental resources identified in **Table 2** that addresses each potential IPF.

C.1 Physical/Chemical Environment

C.1.1 Air Quality

Due to the distance from shore-based pollution sources, offshore air quality 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, ambient air quality on coastal counties along the Gulf of Mexico is relatively good (BOEM, 2012a). As of April 2020, Mississippi, Alabama, and Florida Panhandle coastal counties are in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants (U.S. Environmental Protection Agency, 2020). St. Bernard Parish in Louisiana and Hillsborough County in Florida are nonattainment areas for sulfur dioxide based on the 2010 standard. One coastal metropolitan area in Texas (Houston-Galveston-Brazoria) is a nonattainment area for 8-hour ozone (2015 Standard). One coastal metropolitan area in Florida (Tampa) was reclassified in 2018 from a nonattainment area to maintenance status for lead based on the 2008 Standard (U.S. Environmental Protection Agency, 2020).

Winds in the region are driven by the clockwise circulation around the Bermuda High (BOEM, 2017a). The Gulf of Mexico is located to the southwest of this center of circulation, resulting in a prevailing southeasterly to southerly flow, which is conducive to transporting emissions toward shore. However, circulation is also affected by tropical cyclones (hurricanes) during summer and fall and by extratropical cyclones (cold fronts) during winter.

IPFs that could potentially affect air quality are air pollutant emissions associated with both types of accidents (a small fuel spill [<1,000 bbl] and a large oil spill [≥1,000 bbl]).

Impacts of Air Pollutant Emissions

Air pollutant emissions are the only routine IPF anticipated to affect air quality. Offshore air pollutant emissions will result from the operation of the DP MODU or installation vessel and service vessels, and helicopters, as described in **Section A.3**. These emissions occur mainly from combustion or burning of diesel and Jet-A aircraft fuel. Additionally, exhaust emissions from tanker and barge loadings and transfers would be anticipated, though these would be relatively small (BOEM, 2012a). Primary air pollutants typically associated with OCS activities are suspended PM, SO_x, NO_x, VOCs, and CO.

Due to the distance from shore, routine operations in the project area are not expected to impact air quality along the coast. As noted in the lease sale EISs BOEM (BOEM, 2012a, 2013, 2014a, 2015, 2016b, 2017a), emissions of air pollutants from routine activities in the project area are projected to have minimal impacts on onshore air quality because of the prevailing atmospheric conditions, emission heights, emission rates, and the distance of these emissions from the coastline.

AC 857 is located west of 87.5° W longitude; thus, air quality is under BOEM jurisdiction as explained in NTL 2009-N11. The BOEM implementing regulations are provided in 30 CFR 550 Subpart C. The Air Quality Emissions Report (see DOCD Section 8) prepared in accordance with BOEM requirements shows that the projected emissions from emission sources associated with the proposed activities meet the BOEM exemption criteria. Based on calculated emissions and the location of the project area relative to shore, it can be concluded that project emissions will not significantly affect onshore air quality for any of the criteria pollutants. No further analysis or control measures are required.

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. The BOEM coordinates with the USFWS if emissions from proposed projects may affect the Breton Class I area. The project area is approximately 414 miles (666 km) from the Breton Wilderness Area. Shell will comply with emissions requirements as directed by the BOEM. Based on the Class I Air Quality Related Values (AQRV) analysis results, it can be concluded that project emissions will not significantly affect onshore air quality for any of the criteria pollutants. No further analysis or control measures are required.

Greenhouse gas emissions contribute to climate change, with impacts on temperature, rainfall, frequency of severe weather, ocean acidification, and sea level rise (Intergovernmental Panel on Climate Change, 2014). Carbon dioxide (CO_2) and methane (CH_4) emissions from the project would constitute a very small incremental contribution to greenhouse gas emissions from all OCS activities. According to Programmatic and OCS lease sale EISs (BOEM, 2017a), estimated CO_2 emissions from OCS oil and gas sources are 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 of the climate change impacts evaluated in the Programmatic EIS (BOEM, 2016a).

Impacts of a Small Fuel Spill

Potential impacts of a small spill on air quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017a). The probability of a small spill would be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

A small fuel spill would likely affect air quality near the spill site by introducing VOCs into the atmosphere through evaporation. The ADIOS 2 model (see **Section A.9.2**) indicates that more than 90% of a small diesel spill would evaporate or disperse within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions. Given the open ocean location of the project area, the extent and duration of air quality impacts from a small spill would not be significant.

A small fuel spill would not affect coastal air quality because the spill would not be expected to make landfall or reach coastal waters prior to breaking up (see **Section A.9.2**).

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, 2017a).

A large oil spill would likely 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. Additional air quality impacts could occur if response measures approved by the Unified Command included *in situ* burning of the floating oil. *In situ* burning would generate a plume of black smoke offshore and result in emissions of NO_x, SO_x, CO, and PM, as well as greenhouse gases.

Due to the project area location, most air quality impacts would occur in offshore waters. Depending on the spill trajectory and the effectiveness of spill response measures, coastal air quality could also be affected. Based on the 30-day OSRA modeling predictions (**Table 3**), Matagorda County, Texas, is the coastal area most likely to be affected (1% probability within 10 days and 10% probability within 30 days). Within 30 days, shoreline segments of 11 Texas counties and one Louisiana parish have a 1% to 10% conditional probability of being contacted. A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on air quality are expected.

C.1.2 Water Quality

There are no site-specific baseline water quality data for the project area. Due to the lease location in deep, offshore waters, water quality is expected to be good, with low levels of contaminants. As noted by BOEM (2017a), deepwater areas in the northern Gulf of Mexico are relatively homogeneous with respect to temperature, salinity, and oxygen. Kennicutt (2000) noted that the deepwater region has little evidence of contaminants in the dissolved or particulate phases of the water column. IPFs that could potentially affect water quality are effluent discharges and two types of accidents (a small fuel spill and a large oil spill).

Impacts of Effluent Discharges

As described in **Section A.4**, NPDES General Permit GMG290103 establishes permit limits and monitoring requirements for effluent discharges from the DP MODU or installation vessel. NPDES permit limits and requirements will be met, and little or no impact on water quality is anticipated.

Water-based drilling muds and cuttings will be released at the seafloor during the initial well intervals before the marine riser, which allows their return to the surface vessel, is set. Excess cement slurry and blowout preventer fluid will also be released at the seafloor. Impacts will be limited to the immediate discharge area with little to no impact to regional water quality.

Cuttings wetted with SBMs will be discharged overboard in accordance with the NPDES permit. After discharge, SBM retained on cuttings would be expected to adhere to the cuttings particles and, consequently, would not produce much turbidity as the cuttings sink through the water column (Neff et al., 2000). Recent EISs have concluded that the discharge of treated SBM cuttings will not cause persistent impacts on water quality in the project area (BOEM, 2012a, 2013). NPDES permit limits and requirements are expected to be met, and little or no impact on water quality is anticipated.

Treated sanitary and domestic wastes will be discharged by the DP MODU or installation vessel, and support vessels and may have a transient effect on water quality in the immediate vicinity of these discharges. NPDES permit limits and USCG requirements are expected to be met, as applicable, and little or no impact on water quality is anticipated.

Deck drainage includes 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 DP MODU or installation vessel will flow overboard without treatment. However, rainwater that falls on the DP MODU or installation vessel deck and other areas such as chemical storage areas and places where equipment is exposed will be collected and oil and water separated to meet NPDES permit requirements. Negligible impact on water quality is anticipated.

Other discharges from the DP MODU or installation vessel will be in accordance with the NPDES permit. Discharges include desalination unit brine and non-contact cooling water, blowout preventer fluid, well treatment and completion fluids, excess cement, water-based subsea production control fluid, hydrate inhibitor, treated seawater, fire water, bilge water, and ballast water and are expected to dilute rapidly and have little or no impact on water quality. The DP MODU or installation vessel, and support vessel discharges are expected to be in compliance with NPDES permit and USCG regulations, as applicable, and therefore are not expected to cause significant impacts on water quality.

Impacts of a Small Fuel Spill

Potential impacts of a small spill on water quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017a). The probability of a small spill would be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area, the extent and duration of water quality impacts from a small spill would not be significant.

The water-soluble fractions of diesel are dominated by two- and three-ringed PAHs, which are moderately volatile (National Research Council, 2003b). The constituents of these oils are light to intermediate in molecular weight 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, 2017). It is possible for 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 solids loads (National Research Council, 2003b) 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 (see **Section A.9.2**). The sea surface area covered with a very thin layer of diesel fuel would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions. In addition to removal by evaporation, constituents of diesel oil are readily and completely degraded by naturally occurring microbes (NOAA, 2006). Given the open ocean location of the project area, the extent and duration of water quality impacts from a small spill would not be significant.

A small fuel spill would not affect coastal water quality because the spill would not be expected to make landfall or reach coastal waters due to response efforts that would be undertaken as well as natural degradation and dilution (see **Section A.9.2**).

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, 2017a). A large spill would likely affect water quality by producing a slick on the water surface and increasing the 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 of the spill as well as the effectiveness of the spill response measures. Most of the spilled oil would be expected to form a slick at the surface, although observations following the *Deepwater Horizon* incident indicate 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). Recent analyses of the entire set of samples associated with the *Deepwater Horizon* incident 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 *Deepwater Horizon* incident persisted for up to 2 months and were detectable up to 186 miles (300 km) from the wellsite at water depths of

3,280 to 3,937 ft (1,000 to 1,200 m). Dispersants were detectable in <9% of the samples (i.e., 353 of the 4,114 total water samples), and concentrations in the samples were significantly below the chronic screening level for dispersants (BOEM, 2012b).

Once oil enters the ocean, a variety of physical, chemical, and biological processes take place that degrade and disperse the oil. These processes include spreading, evaporation of the more volatile constituents, dissolution into the water column, emulsification of small droplets, agglomeration sinking, microbial modification, photochemical modification, and biological ingestion and excretion (National Research Council, 2003b). Marine water quality would be temporarily affected by the dissolved components and small oil droplets that do not rise to the surface or are mixed down by surface turbulence. Liu et al. (2017) observed that after the *Deepwater Horizon* incident, the hydrocarbon levels were reduced in the surface waters from May 2010 to August 2010 by either rapid weathering and/or physical dilution. A combination of dispersion by currents that dilutes the constituents and microbial degradation which removes the oil from the water column reduces concentrations to background levels. Most crude oil blends will emulsify quickly when spilled, creating a stable mousse that presents a more persistent cleanup and removal challenge (NOAA, 2017).

A large oil spill could result in a release of gaseous hydrocarbons that could affect water quality. During the *Deepwater Horizon* incident, large volumes of CH_4 were released, causing localized oxygen depletion as methanotrophic bacteria rapidly metabolized the hydrocarbons (Joye et al., 2011, Kessler et al., 2011). However, a broader study of the deepwater Gulf of Mexico found that although some stations showed slight depression of dissolved oxygen concentrations relative to climatological background values, the findings were not indicative of hypoxia (<2.0 mg L^{-1}) (Operational Science Advisory Team, 2010). Stations revisited around the Macondo wellhead in October 2010, approximately 6 months after the beginning of the event showed no measurable oxygen depressions (Operational Science Advisory Team, 2010).

Due to the project area location, 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 predictions (**Table 3**), the nearshore waters and embayments of Matagorda County, Texas, is the coastal area most likely to be affected, with a 1% probability of shoreline contact within 10 days and a 10% probability of shoreline contact within 30 days of a spill.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures detailed in DOCD Section 2j. In the event of a large spill, water quality could be temporarily affected, but no long-term significant impacts are expected. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on water quality are expected.

C.2 Seafloor Habitats and Biota

Water depth at the project area is approximately 8,000 to 8,210 ft (2,438 to 2,502 m). According to BOEM (2012a, 2013, 2014a, 2015, 2016b, 2017a), existing information for the deepwater Gulf of Mexico indicates that the seafloor is composed primarily of soft sediments; hard bottom communities are rare. Geoscience Earth & Marine Services (2001, 2004), Fugro Geoservices Inc. (2015), Shell (2017), and Oceaneering (2018) conducted shallow hazard assessment surveys of AC

857. No features or areas that could support significant, high-density benthic communities were found within 2,000 ft (610 m) of the proposed well work and associated subsea installation.

C.2.1 Soft Bottom Benthic Communities

There are no site-specific benthic community data from the project area. However, data from various gulf-wide studies have been conducted to regionally characterize the continental slope habitats and benthic ecology (Wei, 2006, Rowe and Kennicutt, 2009, Wei et al., 2010, Carvalho et al., 2013), which can be used to describe typical baseline benthic communities that occur at similar water depths elsewhere in the region. **Table 4** summarizes data from two nearby stations within the same faunal zone as the project area. Sediments at these two stations were similar, predominantly clay (60.4% and 61.3%) and silt (34.5% and 61.3%) at Stations AC1 and RW6, respectively (Rowe and Kennicutt, 2009).

Table 4. Baseline benthic community data from stations near to the project area in water depths similar to those sampled during the Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology Study (From: Wei, 2006, Rowe and Kennicutt, 2009).

Station	Location Relative to Lease Area	Water Depth (m)	Abundance		
			Meiofauna (individuals m^{-2})	Macroinfauna (individuals m^{-2})	Megafauna (individuals ha^{-1})
AC1	26 miles (42 km)	2,550	129,974	637	1,620
RW6	26 miles (42 km)	3,000	144,453	715	--

-- = data unavailable.

Densities of meiofauna (animals that pass through a 0.5-mm sieve but are retained on a 0.062-mm sieve) in sediments collected at water depths representative of the project area typically range from about 130,000 to 144,000 individuals m^{-2} (Rowe and Kennicutt, 2009). Nematodes, nauplii, and harpacticoid copepods were the three dominant groups in the meiofauna, accounting for about 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 surface waters (Wei, 2006). Densities decrease exponentially with water depth (Carvalho et al., 2013). Based on an equation presented by Wei (2006), macroinfaunal densities in the water depth of the project area are expected to range from approximately 1,066 to 1,117 individuals m^{-2}; however, actual densities are unknown and often highly variable.

Polychaetes are typically 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 of the northern Gulf of Mexico when compared to the eastern and western regions. Wei (2006) recognized four depth-dependent faunal zones (1 through 4), two of which (Zones 2 and 3) are divided horizontally. The project area is located outside of these delineated faunal zones, but is in close proximity to Zone 3W, which consists of stations on the mid Texas-Louisiana Slope ranging in depth from 1,875 to 3,008 m (6,152 to 9,869 ft). The most abundant species in this zone were the polychaetes *Levinsenia uncinata*, *Paraonella monilaris*, and *Tachytrypane* sp.; the bivalve *Heterodonta* sp.; and the isopod *Macrostylis* sp. (Wei, 2006, Wei et al., 2010).

Megafaunal density at a station in the vicinity of the proposed well work and seafloor infrastructure is approximately 1,620 individuals ha^{-1} (**Table 4**). Common megafauna included motile groups such as decapods, ophiuroids, holothurians, and demersal fishes, as well as sessile groups such as sponges and anemones (Rowe and Kennicutt, 2009).

Bacteria are the foundation of deep-sea chemosynthetic communities (Ross et al., 2012) and 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 project area typically is about 1 to 2 grams of carbon per square meter ($g\ C\ m^{-2}$) in the top 6 in. (15 cm) of sediments (Rowe and Kennicutt, 2009).

IPFs that could potentially affect benthic communities are physical disturbance, effluent discharges (drilling mud and cuttings), and a large oil spill resulting from a well blowout at the seafloor. A small fuel spill would not affect benthic communities because the diesel fuel would float and dissipate on the sea surface.

Impacts of Physical Disturbance to the Seafloor

In water depths such as those that are encountered in the project area, DP MODUs or installation vessel disturb the seafloor only around the wellbore (seafloor surface hole location) where the bottom template and blowout preventer are located. Depending upon the specific well configuration, this area is generally about 0.62 ac (0.25 ha) per well (BOEM, 2012a). The subsea installation is anticipated to disturb approximately 3.1 ac (1.3 ha) as described in **Section A.2**.

The areal extent of these impacts is relatively small compared to the lease block area itself. Soft bottom communities are ubiquitous along the northern Gulf of Mexico continental slope (Gallaway et al., 2003, Rowe and Kennicutt, 2009). Physical disturbance to the seafloor during this project will be localized and are likely to have no significant impact on soft bottom benthic communities on a regional basis.

Impacts of Effluent Discharges

Drilling mud and cuttings are the only effluents likely to affect these soft bottom benthic communities that could be present in vicinity of the wellsites. During initial well interval(s) before the marine riser is set, cuttings and seawater-based “spud mud” will be released at the seafloor. Excess cement slurry will also be released at the seafloor by casing installation during the riserless portion of the drilling operations. Cement slurry components typically include cement mix and some of the same chemicals used in WBM (Boehm et al., 2001). The main impacts will be burial and smothering of benthic organisms within several meters to tens of meters around the wellbore. Small amounts of water-based blowout preventer fluid will be released at the seafloor and are expected to be rapidly diluted and dispersed.

Benthic community effects of drilling discharges have been reviewed extensively by the National Research Council (1983), Neff (1987), Neff et al. (2005), and Hinwood et al. (1994). Due to the low toxicity of WBM and associated drill cuttings, the main mechanism of impact to benthic communities is increased sedimentation, possibly resulting in burial or smothering within several meters to tens of meters around the wellbore. Monitoring programs have shown that benthic impacts of drilling are minor and localized within a few hundred meters of the wellsite (National Research Council, 1983, Neff, 1987, Neff et al., 2005, Continental Shelf Associates, 2006). Soft bottom sediments disturbed by cuttings, drilling mud, cement slurry, and blowout preventer fluid will eventually be recolonized through larval settlement and migration from adjacent areas. Because some deep-sea biota grow and reproduce slowly, recovery may require several years.

Discharges of treated SBM associated cuttings from the DP MODU or installation vessel may affect benthic communities, primarily within several hundred meters of the wellsites. The fate and effects of SBM cuttings have been reviewed by Neff et al. (2000), and monitoring studies have been conducted in the Gulf of Mexico by Continental Shelf Associates (2004, 2006). In general, cuttings with adhering SBM tend to clump together and form thick cuttings piles close to the drillsites. Areas of SBM cuttings deposition may develop elevated organic carbon concentrations and anoxic conditions (Continental Shelf Associates, 2006). Where SBM cuttings accumulate and concentrations exceed approximately 1,000 mg kg^{-1}, benthic infaunal communities may be adversely affected due to both the toxicity of the base fluid and organic enrichment (with resulting anoxia) (Neff et al., 2000). Infaunal numbers may increase and diversity may decrease as opportunistic species that tolerate low oxygen and high H_2S predominate (Continental Shelf Associates, 2006). As the base synthetic fluid is biodegraded by microbes, the area will gradually recover to pre-drilling conditions. Disturbed sediments will be recolonized through larval settlement and migration from adjacent areas.

The areal extent of impacts from drilling discharges will be small; the typical effect radius is approximately 1,640 ft (500 m) around each wellsite. Soft bottom benthic communities are ubiquitous along the northern Gulf of Mexico continental slope (Gallaway, 1988, Gallaway et al., 2003, Rowe and Kennicutt, 2009); thus impacts from drilling discharges during this project will have no significant impact on soft bottom benthic communities on a regional basis.

Impacts of a Large Oil Spill

Potential impacts of a large oil spill on the benthic community are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017a). Impacts from a subsea blowout could include smothering and exposure to toxic hydrocarbons from oiled sediment settling to the seafloor. The most likely effects of a subsea blowout on benthic communities would be within a few hundred meters of the wellsites. BOEM (2012a) estimated that a severe subsurface blowout could suspend and disperse sediments within a 984 ft (300 m) radius. Although coarse sediments (sands) would probably settle at a rapid rate within 1,312 ft (400 m) from the blowout site, fine sediments (silts and clays) could be suspended for more than 30 days and dispersed over a much wider area. A previous study characterized surface sediments at the sampling stations in the vicinity of the proposed well work and subsea installation. Sediments at these two stations were similar, predominantly clay (60.4% and 61.3%) and silt (34.5% and 61.3%) at Stations AC1 and RW6, respectively (Rowe and Kennicutt, 2009).

Previous analyses by (BOEM, 2016b, 2017a) concluded that oil spills would be unlikely to affect benthic communities beyond the immediate vicinity of the wellhead (i.e., due to physical impacts of a blowout) because the oil would rise quickly to the sea surface directly over the spill location. During the *Deepwater Horizon* incident, the use of subsea dispersants at the wellhead caused the formation of subsurface plumes (NOAA, 2011b). While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could contact the seafloor and affect benthic communities beyond the 984 ft (300 m) radius (BOEM, 2012a), depending on its extent, trajectory, and persistence (Spier et al., 2013). This contact could result in smothering and/or toxicity to benthic organisms.

The subsurface plumes observed following the *Deepwater Horizon* incident 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 plumes apparently resulted from the use of subsea dispersants at the wellhead (NOAA, 2011b, Spier et al., 2013). Montagna et al. (2013) estimated that the most severe impacts to soft bottom benthic communities (e.g., reduction of faunal abundance and diversity) from the *Deepwater Horizon* incident extended 2 miles (3 km) from the wellhead in all directions, covering an area of approximately 9 miles^2 (24 km^2). Moderate impacts were observed up to 11 miles (17 km) to the southwest and 5 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 more than 772 miles^2 (2,000 km^2) of impacts to benthic habitats surrounding the *Deepwater Horizon* incident 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). Stout and Payne (2017) also noted that SBM released as a result of the blowout covered an area of 2.5 miles^2 (6.5 km^2).

Baguley et al. (2015) noted that while nematode abundance increased with proximity to the Macondo wellhead, copepod abundance, relative species abundance, and diversity decreased in response to the *Deepwater Horizon* incident. Washburn et al. (2017) noted that richness, diversity, and evenness were affected within a radius of 1 km of the wellhead. Reuscher et al. (2017) found that meiofauna and macrofauna community diversity was significantly lower in areas that were impacted by Macondo oil. Demopoulos et al. (2016) reported abnormally high variability in meiofaunal and macrofaunal density in areas near the Macondo wellhead, which supports the Valentine et al. (2014b) supposition that hydrocarbon deposition and impacts in the vicinity of the Macondo wellhead were patchy. While there are some indications of partial recovery of benthic fauna, as of 2015, full recovery has not occurred (Montagna et al., 2016, Reuscher et al., 2017, Washburn et al., 2017).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on soft bottom communities are expected.

C.2.2 High-Density Deepwater Benthic Communities

As defined in NTL 2009-G40, high-density deepwater benthic communities are features or areas that could support high-density chemosynthetic communities, high-density deepwater corals, or other associated high-density 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 (Cordes et al., 2008, Brooks et al., 2012, Demopoulos et al., 2017, Hourigan et al., 2017). These communities occur almost exclusively on exposed authigenic carbonate rock created by a biogeochemical (microbial) process, and on shipwrecks.

Monitoring programs on the Gulf of Mexico continental slope have shown that benthic impacts from drilling discharges typically are concentrated within approximately 1,640 ft (500 m) of the wellsite, although detectable deposits may extend beyond this distance (Continental Shelf Associates, 2004, Neff et al., 2005, Continental Shelf Associates, 2006). The nearest known high-density deepwater benthic communities include those in AC 645 and is located approximately 27 miles (43 km) from the project area (BOEM, nd).

High-resolution geophysical survey and re-processed three-dimensional seismic data, have been conducted in the project area as part of the assessment of archaeological resources and shallow hazards (Geoscience Earth & Marine Services, 2001, 2004, Fugro Geoservices Inc., 2015, Shell, 2017, Oceaneering, 2018). Based on these surveys, features or areas that could support high-density chemosynthetic or other benthic communities are not anticipated in the project area.

The only IPF identified for this project that could potentially affect high-density deepwater benthic communities is a large oil spill from a well blowout at the seafloor. Physical disturbance and effluent discharge are not likely to affect high-density deepwater benthic communities since these are generally limited to localized impacts. A small fuel spill would not affect benthic communities because the diesel fuel would float and dissipate on the sea surface.

Impacts of a Large Oil Spill

The geohazards assessment did not identify high-density deepwater benthic communities within 2,000 ft (610 m) of the proposed well work and associated subsea installation (Geoscience Earth & Marine Services, 2001, 2004, Fugro Geoservices Inc., 2015, Shell, 2017, Oceaneering, 2018).

BOEM (2012a, 2015, 2016c, 2017a) concluded that oil spills would be unlikely to affect benthic communities beyond the immediate vicinity of the wellhead (i.e., due to physical impacts of a blowout) because the oil would rise quickly to the sea surface directly over the spill location. However, subsea oil plumes resulting from a seafloor blowout could affect sensitive deepwater communities (BOEM, 2016b). During the *Deepwater Horizon* incident, 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). Chemical components of subsea dispersants used during the *Deepwater Horizon* incident persisted for up to 2 months and were detectable up to 186 miles (300 km) from the wellsite at a water depths of 3,280 to 3,937 ft (1,000 to 1,200 m) (Kujawinski et al., 2011). However, estimated dispersant concentrations in the subsea plume were below levels known to be toxic to marine life. 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, 2016a), depending on its extent, trajectory, and persistence (Spier et al., 2013). Potential impacts on sensitive resources would be an integral part of the decision and approval process for the use of dispersants.

Potential impacts of oil on high-density deepwater benthic communities are discussed by BOEM (2012a, 2015, 2016c, 2017a). Oil plumes that directly contact localized patches of sensitive benthic communities before degrading could potentially impact the resource. However, the potential impacts would be localized due to the directional movement of oil plumes by the water currents and because the sensitive habitats have a scattered, patchy distribution. The more likely result would be exposure to widely dispersed, biodegraded particles that “rain” down from a passing oil plume. While patches of habitat may be affected, the Gulf-wide ecosystem of live bottom communities would be expected to suffer no significant effects (BOEM, 2016b).

Although chemosynthetic communities live among hydrocarbon seeps, natural seepage occurs at a relatively constant low rate compared with the potential rates of oil release from a blowout. In addition, seep organisms 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. As discussed by BOEM (2017a), impacts could include loss of habitat and biodiversity; destruction of hard substrate; change in sediment characteristics; and reduction or loss of one or more commercial and recreational fishery habitats.

Sublethal effects are possible for deepwater coral communities that receive a lower level of oil impact. Effects to deepwater coral communities could be temporary (e.g., lack of feeding and loss of tissue mass) or long lasting and affect the resilience of coral colonies to natural disturbances (e.g., elevated water temperature and diseases) (BOEM, 2012a, 2015, 2016b, 2017a). The potential for a spill to affect deepwater corals was observed during an October 2010 survey of deepwater coral habitats in water depths of 4,600 ft (1,400 m) approximately 7 miles (11 km) southwest of the Macondo wellhead. Much of the soft coral observed in a location measuring approximately 50 ft × 130 ft (15 m × 40 m) was covered by a brown flocculent material (Bureau of Ocean Energy Management, Regulation, and Enforcement [BOEMRE], 2010) with signs of stress, including varying degrees of tissue loss and excess mucous production (White et al., 2012). Hopanoid petroleum biomarker analysis of the flocculent material indicated that it contained oil from the *Deepwater Horizon* incident. The injured and dead corals were in an area in which a subsea plume of oil had been documented during the spill in June 2010. The deepwater coral at this location showed signs of tissue damage that was not observed elsewhere during these surveys or in previous deepwater coral studies in the Gulf of Mexico. The team of researchers 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 floc in late 2010 (Hsing et al., 2013). Fisher et al. (2014a) reported two additional coral areas affected by the *Deepwater Horizon* incident; one 4 miles (6 km) south of the Macondo wellsite, and the other 14 miles (22 km) to the southeast. Prouty et al. (2016) found evidence that corals located northeast of the *Deepwater Horizon* incident were also affected. 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., 2014b).

Although no known deepwater coral communities are likely to be impacted by a subsurface plume, previously unidentified communities may be encountered if a large subsurface oil spill occurs. However, because of the scarcity of deepwater hard bottoms communities, their comparatively low surface area, and the distancing requirements set by BOEM in NTL 2009-G40, it is unlikely that a sensitive habitat would be located adjacent to a seafloor blowout or that concentrated oil would contact the site (BOEM, 2012a).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Potential impacts on sensitive resources would be an integral part of the decision and approval process for the use of dispersants. Therefore, no significant spill impacts on deepwater benthic communities are expected.

C.2.3 Designated Topographic Features

The blocks are 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 West Delta Block 147, located 116 miles (187 km) west-northwest of the project area. There are no IPFs associated with either routine operations or accidents that could cause impacts to designated topographic features due to the distance from the project area.

C.2.4 Pinnacle Trend Area Live Bottoms

The project area is not covered by the Live Bottom (Pinnacle Trend) Stipulation. As defined in NTL 2009-G39, the nearest pinnacle trend blocks are located about 444 miles (715 km) east-northeast of the project area in Main Pass Block 290.

There are no IPFs associated with either routine operations or accidents that could cause impacts to pinnacle trend area live bottoms due to the distance from the project area.

C.2.5 Eastern Gulf Live Bottoms

The project area is not covered by the Live Bottom (Low-Relief) Stipulation, which pertains to seagrass communities and low-relief hard-bottom reef within the Gulf of Mexico Eastern 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 Planning Area. The nearest block covered by the Live Bottom Stipulation, as defined in NTL 2009-G39, is Destin Dome Block 573, located approximately 487 miles (784 km) east-northeast of the project area.

There are no IPFs associated with either routine operations or accidents that could cause impacts to eastern Gulf of Mexico live bottom areas due to the distance from the project area.

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

This section discusses species listed as endangered or threatened under the ESA. In addition, it includes marine mammal species in the region that are protected under the MMPA.

Endangered, Threatened, or species of concern that may occur in the project area and/or along the northern Gulf Coast are listed in **Table 5**. The table also indicates the location of designated critical habitat 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. NMFS has jurisdiction over ESA-listed marine mammals (cetaceans) and fishes in the Gulf of Mexico, and USFWS has jurisdiction over ESA-listed birds and the West Indian manatee. These two agencies share federal jurisdiction over sea turtles, with NMFS having lead responsibility at sea and USFWS on nesting beaches.

Table 5. Federally listed Endangered and Threatened species potentially present in the project area and along the northern Gulf Coast.

Species	Scientific Name	Status	Potential Presence		Critical Habitat Designated in Gulf of Mexico
			Project Area	Coastal	
Marine Mammals					
Bryde's whale	*Balaenoptera edeni*	E	X	--	None
Sperm whale	*Physeter macrocephalus*	E	X	--	None
West Indian manatee	*Trichechus manatus*[1]	T	--	X	Florida (Peninsular)
Sea Turtles					
Loggerhead turtle	*Caretta caretta*	T,E[2]	X	X	Nesting beaches and nearshore reproductive habitat in Mississippi, Alabama, and Florida; *Sargassum* habitat including most of the central & 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
Whooping Crane	*Grus americana*	E	--	X	Coastal Texas (Aransas National Wildlife Refuge)
Fishes					
Oceanic whitetip shark	*Carcharhinus longimanus*	T	X	--	None
Giant manta ray	*Mobula birostris*	T	X	X	None
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	--	X	Coastal Louisiana, Mississippi, Alabama, and Florida
Nassau grouper	*Epinephelus striatus*	T	--	X	None
Smalltooth sawfish	*Pristis pectinata*	E	--	X	Southwest Florida
Invertebrates					
Elkhorn coral	*Acropora palmata*	T	--	X	Florida Keys and the Dry Tortugas
Staghorn coral	*Acropora cervicornis*	T	--	X	Florida Keys and the Dry Tortugas
Pillar coral	*Dendrogyra cylindrus*	T	--	X	None
Rough cactus coral	*Mycetophyllia ferox*	T	--	X	None
Lobed star coral	*Orbicella annularis*	T	--	X	None

Table 5. (Continued).

Species	Scientific Name	Status	Potential Presence		Critical Habitat Designated in Gulf of Mexico
			Project Area	Coastal	
Mountainous star coral	*Orbicella faveolata*	T	--	X	None
Boulder star coral	*Orbicella franksi*	T	--	X	None
Terrestrial Mammals					
Beach mice (Alabama, Choctawhatchee, Perdido Key, St. Andrew)	*Peromyscus polionotus*	E	--	X	Alabama and Florida (Panhandle) beaches
Florida salt marsh vole	*Microtus pennsylvanicus dukecampbelli*	E	--	X	None

-- = not present; E = Endangered; T = Threatened; X = potentially present.

[1]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.

[2]The Northwest Atlantic Ocean Distinct Population Segment (DPS) of loggerhead turtles is designated as Threatened (76 Federal Register [FR] 58868). The National Marine Fisheries Service and the U.S. Fish and Wildlife Service designated critical habitat for this DPS, including beaches and nearshore reproductive habitat in Mississippi, Alabama, and the Florida Panhandle as well as Sargassum spp. habitat throughout most of the central and western Gulf of Mexico (79 FR 39756 and 79 FR 39856).

Coastal Endangered or Threatened species that may occur along the U.S. Gulf Coast include the West Indian manatee (*Trichechus manatus*), Piping Plover (*Charadrius melodus*), Florida salt marsh vole (*Microtus pennsylvanicus dukecampbelli*), Whooping Crane (*Grus americana*), Gulf sturgeon (*Acipenser oxyrinchus desotoi*), smalltooth sawfish (*Pristis pectinate*), and four subspecies of beach mouse. Critical habitat has been designated for all of these species (except the Florida salt marsh vole) as indicated in Table 5 and discussed in individual sections. Two other coastal bird species (Bald Eagle [*Haliaeetus leucocephalus*] and Brown Pelican [*Pelecanus occidentalis*]) are no longer federally listed as Endangered or Threatened; these are discussed in Section C.4.2.

Five sea turtle species, the sperm whale (*Physeter macrocephalus*), and the oceanic whitetip shark (*Carcharhinus longimanus*) are the only Endangered or Threatened species likely to occur within the project area. The listed sea turtles include the leatherback turtle (*Dermochelys coriacea*), Kemp's ridley turtle (*Lepidochelys kempii*), hawksbill turtle (*Eretmochelys imbricata*), loggerhead turtle (*Caretta caretta*), and green turtle (*Chelonia mydas*) (Pritchard, 1997). Effective August 11, 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.3.5). No critical habitat has been designated in the Gulf of Mexico for the leatherback turtle, Kemp's ridley turtle, hawksbill turtle, or the green turtle. Listed marine mammal species include one odontocete (sperm whale) which is known to occur in the Gulf of Mexico (Würsig et al., 2000); no critical habitat has been designated for the sperm whale. The Bryde's whale (*Balaenoptera edeni*) exists in the Gulf of Mexico as a small, resident population. It is the only baleen whale known to be resident to the Gulf. The genetically distinct Northern Gulf of Mexico stock is severely restricted in range, being found only in the northeastern Gulf in the waters of the DeSoto Canyon (Waring et al., 2016) and are therefore not likely to occur within the project area. The giant manta ray (*Mobula birostris*) could occur in the project area but is most commonly observed in the Gulf of Mexico at the Flower Garden Banks. The Nassau grouper (*Epinephelus striatus*) has been observed in the Gulf of Mexico at the Flower Garden Banks but is most commonly observed in shallow tropical reefs of the Caribbean and is not expected to occur in the project area. The smalltooth sawfish is a coastal species limited to shallow areas off the west coast of Florida and is not expected to occur in the project area.

Five Endangered mysticete whales (blue whale [*Balaenoptera musculus*], fin whale [*Balaenoptera physalus*], humpback whale [*Megaptera novaeangliae*], North Atlantic right whale [*Eubalaena glacialis*], and sei whale [*Balaenoptera borealis*]) have been reported from 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 report (Hayes et al., 2019) nor in the most recent BOEM multisale EIS (BOEM, 2017a) as present in the Gulf of Mexico; therefore, they are not considered further in the EIA.

Seven Threatened coral species are known from the northern Gulf of Mexico: elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicronis*), lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), boulder star coral (*Orbicella franksi*), pillar coral (*Dendrogyra cylindrus*), and rough cactus coral (*Mycetophyllia ferox*). None of these species are expected to be present in the project area (see Section C.3.15).

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.

C.3.1 Sperm Whale (Endangered)

The only Endangered marine mammal likely to be present at or near the project area is the sperm whale. Resident populations of sperm whales occur within the Gulf of Mexico. 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 published by 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, the impacts from many of these threats are identified as either low or unknown (BOEM, 2012a).

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 there throughout the year (Davis et al., 2000). Results of a multi-year tracking study show female sperm whales typically concentrated along the upper continental slope between the 656- and 3,280-foot (200- and 1,000-meter) 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 and 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. Results of the Sperm Whale Seismic Study showed that sperm whales transit through the vicinity of the project area. Movements of satellite-tracked individuals suggest that this area of the Gulf of Mexico continental slope is within the home range of the Gulf of Mexico population (within the 95% utilization distribution) (Jochens et al., 2008).

IPFs that could potentially affect sperm whales include MODU presence, noise, and lights; support vessel and helicopter traffic; and both types of spill accidents: a small 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.

Though NMFS (2020) stated marine debris as an IPF, compliance with BSEE NTL 2015-G03 and NMFS (2020) Appendix B will minimize the potential for marine debris-related impacts on sperm whales. NMFS (2020) estimates that no more than three sperm whales will be nonlethally taken, with one sperm whale lethally taken through the ingestion of marine debris over 50 years of proposed action. Therefore, marine debris is likely to have negligible impacts on sperm whales and is not further discussed (See **Table 2**).

Impacts of Vessel Presence, Noise, and Lights

Some sounds produced by the DP MODU may be emitted at levels that could potentially disturb individual whales or mask the sounds animals would normally produce or hear. Noise associated with drilling rig operations 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 actively drilling MODU are maximum broadband (10 Hz to 10 kHz) energy of about 190 dB re 1 μPa^2 m^2 (Hildebrand, 2005).

NMFS (2018b) lists sperm whales in the same functional hearing group (i.e., mid frequency cetaceans) as most dolphins and other toothed whales, with an estimated hearing sensitivity from 150 Hz to 160 kHz. Therefore, vessel related noise is likely to be heard by sperm whales. Frequencies <150 Hz produced by the drilling operations are not likely to be perceived with any significance by mid-frequency cetaceans. The sperm whale may possess better low frequency hearing than some of the other odontocetes, although not as low as many baleen whale species that primarily produce sounds between 30 Hz and 5 kHz (Wartzok and Ketten, 1999). 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).

It is expected that, due to the relatively stationary nature of the MODU operations, sperm whales would move away from the proposed operations area, and noise levels that could cause auditory injury would be avoided. Noise associated with proposed vessel operations may cause behavioral (disturbance) effects to sperm whales. Observations of sperm whales near offshore oil and gas operations suggest an inconsistent response to anthropogenic marine sound (Jochens et al., 2008). 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 ability to avoid noise sources (National Research Council, 2003a).

NOAA Fisheries West Coast Region (2018) presents criteria that are used in the interim to determine behavioral disturbance thresholds for marine mammals and are applied equally across all functional hearing groups. Received mean-squared sound pressure levels of 120 dB re 1 μPa^2 from a non-impulsive source are considered high enough to elicit a behavioral reaction in some marine mammal species. The 120-dB isopleth may extend tens to hundreds of kilometers from the source depending on the propagation environment.

For mid frequency cetaceans exposed to a non-impulsive source (such as MODU operations), permanent threshold shifts are estimated to occur when the mammal has received a sound exposure level of 198 decibels relative to 1 micropascal squared seconds (dB re 1 μPa^2 s) over a 24-hour period (NMFS, 2016a). Similarly, temporary threshold shifts are estimated to occur when the mammal has received a sound exposure level of 178 dB re 1 μPa^2 s over a 24-hour period. Based on transmission loss calculations (see Urick, 1983), typical sources with DP thrusters are not expected to produce received mean-squared sound levels greater than 160 dB re 1 μPa^2 beyond 105 ft (32 m) from the source. Due to the short propagation distance of high sound pressure levels, the transient nature of sperm whales, and the stationary nature of the proposed activites, it is not expected that any sperm whales will receive exposure levels necessary for the onset of auditory threshold shifts.

The DP MODU or installation vessel will be located within a deepwater, open ocean environment. Sounds generated by drilling operations will be generally non-impulsive, with some variability in sound level. This analysis assumes that the continuous nature of sounds produced by the MODU will provide individual whales with cues relative to the direction and relative distance (sound intensity) of the sound source, and the fixed position of the MODU will allow for active avoidance of potential physical impacts. Drilling-related noise associated with this project will contribute to increases in the ambient noise environment of the Gulf of Mexico, but it is not expected to be in amplitudes sufficient enough to cause hearing effects to sperm whales.

DP MODU or installation vessel lighting and rig presence are not identified as IPFs for sperm whales (NMFS, 2007, BOEM, 2012a, 2013, 2014a, 2015, 2016b, 2017a).

Impacts of Support Vessel and Helicopter Traffic

NMFS has found that support vessel traffic has the potential to disturb sperm whales and creates 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 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. In addition, when sperm whales are sighted, vessel operators and crews are required to attempt to maintain a distance of 328 ft (100 m) or greater whenever possible (NTL BOEM 2016-G01 and NMFS, 2020). Vessel operators are required to reduce vessel speed to 10 knots or less, as safety permits, when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel (NTL BOEM-2016-G01). When sperm whales are sighted while a vessel is underway, the vessel should take action (e.g., attempt to remain parallel to the whale's course, avoid excessive speed or abrupt changes in direction until the whale has left the area) as necessary to avoid violating the relevant separation distance. However, if the sperm whale is sighted within this distance, the vessel should reduce speed and shift the engine to neutral and not re-engage until the whale is outside of the separation area. This does not apply to any vessel towing gear (NMFS [2020] Appendix C). Compliance with these mitigation measures will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing sperm whales.

NMFS (2020) analyzed the potential for vessel strikes and harassment of sperm whales in its Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico. 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 level of the population. With the implementation of the NMFS vessel strike protocols listed in Appendix C of NMFS (2020) in addition to the NTL BOEM--2016-G01, NMFS concluded that the likelihood of collisions between vessels and sperm whales would be reduced.

Helicopter traffic also has the potential to disturb sperm whales. Smultea et al. (2008a) documented responses of sperm whales offshore Hawaii to fixed wing aircraft flying at an altitude of 804 ft (245 m). A reaction to the initial pass of the aircraft was observed during 3 (12%) of 24 sightings. 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 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 (Smultea et al., 2008b).

Helicopters maintain altitudes above 700 ft (213 m) during transit to and from the offshore working area. In the event that a whale is seen during transit, the helicopter will not approach or circle the animal(s). 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 328 ft (100 m) of marine mammals (BOEM, 2016a, 2017a; NMFS, 2020). Although whales may respond to helicopters (Smultea et al., 2008), NMFS (2020) concluded that this altitude would minimize the potential for disturbing sperm whales. Therefore, no significant impacts are expected.

Impacts of a Small Fuel Spill

Potential spill impacts on marine mammals including sperm whales are discussed by NMFS (2020) and BOEM (2012a, 2015, 2016b, 2017a). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990) and by the Marine Mammal Commission (MMC) (2011). For 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 Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on sperm whales. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area and the duration of a small spill, the opportunity for impacts to occur would be very brief.

A small 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 of the spill, as well as the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

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 (Marine Mammal Commission [MMC], 2011). However, due to the limited areal extent and short duration of water quality impacts from a small 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 BOEM (2012a, 2015, 2016b, 2017a), and NMFS (2020). 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., 2018). 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, changing prey availability and foraging distribution and/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 the vicinity of the *Deepwater Horizon* incident in 2010. However, based on aerial surveys conducted in the aftermath of the spill, visibly oiled cetaceans (including several sperm whales) were identified within the footprint of the oil slick (Dias et al., 2017).

In the event of a large spill, the level of vessel and aircraft activity associated with spill response 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 (see **Table 1**) to reduce the potential for striking or disturbing these animals.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting sperm whales, it is expected that impacts resulting in the injury or death of individual sperm whales would be adverse but not likely significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on sperm whales are expected.

C.3.2 Bryde's Whale (Endangered)

The Bryde's whale (*Balaenoptera edeni*) is the only year-round resident baleen whale in the northern Gulf of Mexico. The Bryde's whale is sighted most frequently in the waters over DeSoto Canyon between the 328 ft (100 m) and 3,280 ft (1,000 m) isobaths (Rosel et al., 2016, Hayes et al., 2019). 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 of Mexico. Based on the available data, it is possible that Bryde's whales could occur in the project area though unlikely.

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 a proposed rule to list was published in 2016 (Hayes et al., 2019). On April 15, 2019, NMFS issued a final rule to list the Gulf of Mexico DPS of Bryde's whale as Endangered under the ESA. The listing was effective on May 15, 2019.

IPFs that could affect the Bryde's whales include vessel presence, noise, and lights; support vessel and helicopter traffic; and both types of spill accidents: a small fuel spill and a large oil spill. Effluent discharges are likely to have negligible impacts on Bryde's whales due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility and low abundance of Bryde's whales in the Gulf of Mexico.

Though NMFS (2020) stated marine debris as an IPF, compliance with BSEE NTL 2015-G03 and NMFS (2020) Appendix B will minimize the potential for marine debris-related impacts on Bryde's whales. NMFS (2020) estimated one sublethal take and no lethal takes of Bryde's whales from marine debris over 50 years of proposed action. Therefore, marine debris is likely to have negligible impacts on Bryde's whales and is not further discussed (See **Table 2**).

Impacts of Vessel Presence, Noise, and Lights

Some sounds produced by the MODUs may be emitted at levels that could potentially disturb individual whales or mask the sounds animals would normally produce or hear. Noise associated with drilling is relatively weak in intensity, and an individual animal's noise exposure would be transient. As discussed in **Section A.1**, frequencies generated by an actively drilling MODU are maximum broadband (10 Hz to 10 kHz) with a root-mean-square source level of approximately 177 to 190 dB re 1 µPa m (Hildebrand, 2005).

NMFS (2018b) lists Bryde's whales in the functional hearing group of low frequency cetaceans (baleen whales), with an estimated hearing sensitivity from 7 Hz to 35 kHz. Therefore, vessel related noise is likely to be heard by Bryde's whales. Frequencies <150 Hz produced by the drilling operations is more likely to be perceived by low-frequency cetaceans.

It is expected that, due to the relatively stationary nature of the MODU operations, Bryde's whales would move away from the proposed operations area, and noise levels that could cause auditory injury would be avoided. Noise associated with proposed vessel operations may cause behavioral (disturbance) effects to individual Bryde's whales. NOAA Fisheries West Coast Region (2018) presents criteria that are used in the interim to determine behavioral disturbance thresholds for marine mammals and are applied equally across all hearing groups. Received root-mean-square sound pressure level of 120 dB re 1 µPa from a non-impulsive source are considered high enough to elicit a behavioral reaction in some marine mammal species. The 120-dB isopleth may extend tens to hundreds of kilometers from the source depending on the propagation environment. However, exposure to a root-mean-square sound pressure level of 120 dB re 1 µPa does not equate to a behavioral response or a biological consequence; rather it represents the level at which onset of a behavioral response may occur.

For low frequency cetaceans, specifically the Bryde’s whale, permanent and temporary threshold shift onset from non-Impulsive sources is estimated to occur at sound exposure levles of 199 dB re 1 μPa^2 s and 179 re 1 μPa^2 s, repectively. MODU operatorions and DP thrusters are not expected to reach permanent or temporary theshold hold shift values, and based on open water transmission loss calculations (Urick, 1983), noise produced by typical sources with DP thrusters in use during drilling, are not expected to propagate root-mean-square sound pressure levels greater than 120 dB re 1 µPa beyond 700 m (2,290 ft) from the source.

The DP MODUs or installation vessels will be located within a deepwater, open ocean environment. Sounds generated by drilling operations will be generally non-impulsive, with some variability in sound level and frequency. This analysis assumes that the continuous nature of sounds produced by the MODU will provide individual whales with cues relative to the direction and relative distance (sound intensity) of the sound source, and the fixed position of the MODU will allow for active avoidance of potential physical impacts. Drilling-related noise associated with this project will contribute to increases in the ambient noise environment of the Gulf of Mexico, but it is not expected to be in amplitudes sufficient enough to cause hearing effects to Bryde’s whales and due to the low density of Bryde’s whales in the Gulf of Mexico, no significant impacts are expected.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb Bryde’s whales and creates a risk of vessel strikes. To reduce the potential for vessel strikes, BOEM has 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. When whales are sighted, vessel operators and crews are required to attempt to maintain a distance of 1,640 ft (500 m) or greater whenever possible (NTL BOEM-2016-G01; NMFS, 2020). Vessel operators are required to reduce vessel speed to 10 knots or less, as safety permits, when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel (NTL BOEM-2016-G01). When a Bryde’s whale is sighted while a vessel is underway, the vessel should take action (e.g., attempt to remain parallel to the whale’s course, avoid excessive speed or abrupt changes in direction until the whale has left the area) as necessary to avoid violating the relevant separation distance. However, if the whale is sighted within this distance, the vessel should reduce speed and shift the engine to neutral and not re-engage until the whale is outside of the separation area. This does not apply to any vessel towing gear (NMFS [2020] Appendix C). Compliance with these mitigation measures will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing Bryde’s whales.

Helicopter traffic also has the potential to disturb Bryde’s whales. Based on studies of cetacean responses to sound, the observed reactions to brief overflights by aircraft were short-term and limited to behavioral disturbances (Smultea et al., 2008). Helicopters maintain altitudes above 700 ft (213 m) during transit to and from the offshore working area. In the event that a whale is seen during transit, the helicopter will not approach or circle the animal(s). 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 1,640 ft (500 m) of marine mammals (BOEM, 2016a, 2017a; NMFS, 2020). Due to the brief potential for disturbance the low density of Bryde’s whales thought to reside in the Gulf of Mexico, no significant impacts are expected.

Impacts of a Small Fuel Spill

Potential spill impacts on marine mammals are discussed by NMFS (2020) and BOEM (2012a, 2015, 2016b, 2017a). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990) and by the MMC (2011). The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on Bryde's whales. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area and the duration of a small spill, the opportunity for impacts to occur would be very brief.

A small 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 of the spill as well as the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

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). However, due to the limited areal extent and short duration of water quality impacts from a small fuel spill, as well as the mobility of Bryde's whales and the unlikelihood of Bryde's whales in the project area, no significant impacts are expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine mammals are discussed by BOEM (2012a, 2015, 2016b, 2017a), and NMFS (2020). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990) and by the MMC (2011).

Potential impacts of a large oil spill on Bryde's whales 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 could 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., 2019). 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, changing prey availability and foraging distribution and/or patterns, changing reproductive behavior/productivity, and changing movement patterns or migration (MMC, 2011).

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

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting Bryde's whales, it is expected that impacts resulting in the injury or death of individual Bryde's whales would be adverse but not likely significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.3 West Indian Manatee (Endangered)

Most of the Gulf of Mexico West Indian manatee population is located in peninsular Florida (USFWS, 2001a). Critical habitat has been designated in southwest Florida in Manatee, Sarasota, Charlotte, Lee, Collier, and Monroe Counties. Manatees regularly migrate farther west of Florida in the warmer months (Wilson, 2003, Hieb et al., 2017) into Alabama and Louisiana coastal habitats, with some individuals traveling as far west as Texas (Fertl et al., 2005). There have been three verified reports of Florida manatee sightings on the OCS during seismic mitigation surveys in mean water depths of over 1,969 ft (600 m) (Barkaszi and Kelly, 2018). One of these sightings resulted in a shutdown of airgun operations. A species description is presented in the recovery plan for this species (USFWS, 2001a).

IPFs that could potentially affect manatees include support vessel and helicopter traffic and a large oil spill. A small fuel spill in the project area would be unlikely to affect manatees because the project area is approximately 141 miles (227 km) from the nearest shoreline (Texas). As explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up. Compliance with NTL BSEE 2015-G013 will minimize the potential for marine debris-related impacts on manatees. Consistent with the analysis by BOEM (2016a), impacts of routine project-related activities on the manatee would be negligible.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic associated with routine MODU or installation vessel operations has the potential to disturb manatees, and there is also a risk of vessel strikes, which are identified as a threat in the recovery plan for this species (USFWS, 2001a). Manatees are expected to be limited to inner shelf and coastal waters, and impacts are expected to be limited to transits of these vessels and helicopters through these waters. To reduce the potential for vessel strikes, BOEM has 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 strike avoidance measures described in NMFS (2020) for the marine mammal species managed by that agency may also provide some additional indirect protections to manatees. Compliance with NTL BOEM-2016-G01 will minimize the likelihood of vessel strikes, and no significant impacts on manatees are expected.

Depending 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 328 ft (100 m) of marine mammals (BOEM, 2012a,b; NMFS, 2020). This mitigation measure will minimize the potential for disturbing manatees, and no significant impacts are expected.

Impacts of a Large Oil Spill

The 30-day OSRA modeling results summarized in **Table 3,** predict that Texas shorelines between Cameron and Matagorda counties have a 1% conditional probability of shoreline contact within 10 days of a spill. Texas and Louisiana shorelines could be contacted within 30 days of spill (1% to 10% conditional probability). The coastal areas and embayments of Matagorda County, Texas are the most likely to be affected with 10% conditional probability of shoreline contact within 30 days of a spill. There is no critical habitat designated in these areas, and the number of manatees potentially present is a small fraction of the population in peninsular Florida.

In the event that manatees were 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 infection (BOEM, 2017a). Indirect impacts include stress from the activities and noise of response vessels and aircraft (BOEM, 2017a). 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, changing prey availability and foraging distribution and/or patterns, changing reproductive behavior/productivity, and changing movement patterns or migration (MMC, 2011).

In the event that a large spill reached coastal waters where manatees were present, the 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 (see **Table 1**) to reduce the potential for striking or disturbing these animals.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill enters areas inhabited by manatees, it is expected that impacts resulting in the injury or death of individual manatees could be significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on manatees are expected.

C.3.4 Non-Endangered Marine Mammals (Protected)

All marine mammal species are protected under the MMPA. In addition to the three Endangered species of marine mammals that were cited in **Sections C.3.1** to **C.3.3**, 20 additional species of marine mammals may be found in the Gulf of Mexico. These include the dwarf and pygmy sperm whales, four species of beaked whales, and 14 species of delphinid whales and dolphins (see DOCD Section 6h). The minke whale (*Balaenoptera acutorostrata*) is considered rare in the Gulf of Mexico, and is therefore not considered further in the EIA (BOEM, 2012a). The most common non-endangered cetaceans in the deepwater environment are odontocetes (toothed whales and dolphins) such as the pantropical spotted dolphin, spinner dolphin, and Clymene dolphin. A brief summary is presented in this section, and additional information on these groups is presented by BOEM (2017a).

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, Hayes et al., 2019). Either species could occur in the project area.

Beaked whales. Four species of beaked whales are known from the Gulf of Mexico. They are 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 species in the region. The 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 (*Ziphius* spp.) or grouped into an undifferentiated species complex (*Mesoplodon* spp.). In the northern Gulf of Mexico, they are broadly distributed in waters greater than 3,281 ft (1,000 m) over lower slope and abyssal landscapes (Davis et al., 2000). Any of these species could occur in the project area (Hayes et al., 2019).

Delphinids. Fourteen species of delphinids are known to occur in the Gulf of Mexico: Atlantic spotted dolphin (*Stenella frontalis*), bottlenose dolphin (*Tursiops truncatus*), Clymene dolphin (*Stenella clymene*), killer whale (*Orcinus orca*), false killer whale (*Pseudorca crassidens*), Fraser's dolphin (*Lagenodelphis hosei*), melon-headed whale (*Peponocephala electra*), pantropical spotted dolphin (*Stenella attenuata*), pygmy killer whale (*Feresa attenuata*), short-finned pilot whale (*Globicephala macrorhynchus*), Risso's dolphin (*Grampus griseus*), rough-toothed dolphin (*Steno bredanensis*), spinner dolphin (*Stenella longirostris*), and striped dolphin (*Stenella coeruleoalba*). 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. However, any of these species could occur in the project area (Waring et al. 2016; Hayes et al., 2019).

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 inhabits waters seaward from the 200-meter isobath and may occur within the project area. Inshore populations of coastal bottlenose dolphins in the northern Gulf of Mexico are separated by the NMFS into 31 geographically distinct population units, or stocks, for management purposes (Hayes et al., 2019).

Bottlenose dolphins in the Northern Gulf of Mexico are categorized into three stocks by NMFS (2016b): Bay, Sound, and Estuary; Continental Shelf; and Coastal and Oceanic. The Bay, Sound, and Estuary Stocks are considered to be strategic stocks. The strategic stock designation in this case was based primarily on the occurrence of an "unusual mortality event" of unprecedented size and duration (from April 2010 through July 2014) (NOAA, 2016) that affected these stocks. Carmichael et al. (2012) hypothesized that the unusual number of bottlenose dolphin strandings in the northern Gulf of Mexico during this time may have been associated with environmental perturbations, including sustained cold weather and the *Deepwater Horizon* incident in 2010 as well as large volumes of cold freshwater discharge in the early months of 2011. Carmichael et al. (2012) and Schwacke et al. (2014b) reported that 1 year after the *Deepwater Horizon* incident, many dolphins in Barataria Bay, Louisiana, showed evidence of disease conditions associated with petroleum exposure and toxicity. 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 "unusual mortality event" 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 *Deepwater Horizon* incident are proposed as a cause.

IPFs that could potentially affect non-endangered marine mammals include vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small fuel spill and a large oil spill). Effluent discharges are likely to have negligible impacts on marine mammals due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of marine mammals. Compliance with NTL BSEE 2015-G013 (see **Table 1**) will minimize the potential for marine debris-related impacts on marine mammals.

Impacts of Vessel Presence, Noise, and Lights

Noise from routine drilling activities has the potential to disturb marine mammals. Most odontocetes use higher frequency sounds than those produced by OCS drilling activities (Richardson et al., 1995). Three functional hearing groups are represented in the 20 non-endangered cetaceans found in the Gulf of Mexico (NMFS, 2018b). Eighteen of the 19 odontocete species are considered to be in the mid-frequency functional hearing group and two species (dwarf and pygmy sperm whales) are in the high frequency functional hearing group (NMFS, 2018b). Thruster and installation noise will affect each group differently depending on the frequency bandwiths produced by operations.

For mid frequency cetaceans exposed to a non-impulsive source (like drilling operations), permanent threshold shifts are estimated to occur when the mammal has received a sound exposure level of 198 dB re 1 μPa^2 s over a 24-hour period. Simlarly, temporary threshold shifts are estimated to occur when the mammal has received a sound exposure level of 178 dB re 1 μPa^2 s over a 24-hour period. Based on transmission loss calculations (Urick, 1983), open water propagation of noise produced by typical sources with intermittent use of DP thrusters during offshore operations, are not expected to produce received root-mean-square sound pressure levels greater than 160 dB re 1 µPa beyond 105 ft (32 m) from the source. Due to the short propagation distance of high root-mean-square 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. NOAA Fisheries West Coast Region (2018) presents criteria that are used in the interim to determine behavioral disturbance thresholds for marine mammals and are applied equally across all functional hearing groups. Received root-mean-square sound pressure levels of 120 dB re 1 μPa from a non-impulsive source are considered high enough to elicit a behavioral reaction in some marine mammal species. The 120 dB isopleth may extend tens to hundreds of kilometers from the source depending on the propagation environment.

Some odontocetes have shown increased feeding activity around lighted platforms at night (Todd et al., 2009). Even temporary MODUs or installation vessels present an attraction to pelagic food sources that may attract cetaceans (and sea turtles). Therefore, prey congregation could pose an attraction to protected species that would expose them to higher levels or longer durations of noise that might otherwise be avoided.

There are other OCS facilities and activities near the project area, and the region as a whole has a large number of similar sources. Due to the limited scope, timing, and geographic extent of drilling activities, this project would represent a small temporary contribution to the overall noise regime, and any short-term impacts are not expected to be biologically significant to marine mammal populations.

DP MODU or installation vessel lighting and presence are not identified as IPFs for marine mammals by BOEM (2016b, 2017a). Therefore, no significant impacts are expected from these IPF's.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb marine mammals, and there is also a risk of vessel strikes. Data concerning the frequency of vessel strikes are presented by BOEM (2017a). To reduce the potential for vessel strikes, BOEM has issued NTL BOEM-2016-G01 (see **Table 1**), 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 from whales and 148 ft (45 m) or greater from small cetaceans and sea turtles (NTL BOEM-2016-G01). 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. Although vessel strike avoidance measures described in NMFS (2020) are only applicable to ESA-listed species, complying with them may provide additional indirect protections to non-listed species as well. Use of these measures will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing marine mammals, and therefore no significant impacts are expected.

Helicopter 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 (BOEM, 2017a; NMFS, 2020). Maintaining this altitude will minimize the potential for disturbing marine mammals, and no significant impacts are expected.

Impacts of a Small Fuel Spill

Potential spill impacts on marine mammals are discussed by BOEM (2016b, 2017a), and oil impacts on marine mammals in general are discussed by Geraci and St. Aubin (1990). For the EIA, 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 Shell's preventative measures, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP is expected to mitigate and reduce the potential for impacts on marine mammals. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area and the duration of a small spill, the opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a thin slick on the water surface and introduce the 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.9.2** discusses the likely fate of a small fuel spill and indicates that over 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

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). However, due to the limited areal extent and short duration of water quality impacts from a small fuel spill, as well as the mobility of marine mammals, no significant impacts would be expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine mammals are discussed by BOEM (2016b, 2017a). For the EIA, 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). 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. Complications of the above may lead to dysfunction of immune and reproductive systems (DeGuise et al., 2017), physiological stress, declining physical condition, and death. Kellar et al. (2017) estimated reproductive success rates for two northern Gulf of Mexico stocks affected by oil were less than a third (19.4%) of those previously reported in other areas (64.7%) not impacted. Behavioral responses can include displacement of animals from prime habitat (McDonald et al., 2017a); disruption of social structure; changing prey availability and foraging distribution and/or patterns; changing reproductive behavior/productivity; and changing movement patterns or migration (MMC, 2011).

Data from the *Deepwater Horizon* incident, 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, Takeshita et al., 2017). 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 20 species of dolphins and whales that live in the northern Gulf of Mexico had demonstrable, quantifiable injuries. NMFS (2014a) documented 13 dolphins and whales live-stranded, and over 150 dolphins and whales dead during the oil spill response. Because of known low detection rates of carcasses (Williams et al., 2011), it is possible that the number of marine mammal deaths is underestimated. Also, necropsies to confirm the cause of death could not be conducted for many of these marine mammals, therefore some cause of deaths reported as unknown are likely attributable to oil interaction. Schwacke et al. (2014a) reported that 1 year after the spill, many dolphins in Barataria Bay, Louisiana, showed evidence of disease conditions associated with petroleum exposure and toxicity. Lane et al. (2015) noted a decline in pregnancy success rate among dolphins in the same region. BOEM (2012a) concluded that potential effects from a large spill could potentially contribute to more significant and longer-lasting impacts including mortality and longer-lasting chronic or sublethal effects than a small, but severe accidental spill.

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, 2017a). 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 or other 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.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell’s well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill, it is expected that impacts resulting in the injury or death of individual marine mammals could be significant at the population level depending on the level of oiling and the species affected. In the unlikely event of a spill, implementation of Shell’s OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.5 Sea Turtles (Endangered/Threatened)

As listed in DOCD Section 6h, five species of Endangered or Threatened sea turtles may be found near the project area. Endangered species are the leatherback, Kemp's ridley, and hawksbill turtles. As of May 6, 2016, the entire North Atlantic DPS of the green turtle is listed as Threatened (81 Federal Register [FR] 20057). The DPS of loggerhead turtle that occurs in the Gulf of Mexico is listed as Threatened, although other DPSs are Endangered. Of the sea turtle species that may be found in the project area, only the Kemp’s ridley relies on the Gulf of Mexico as its sole breeding ground. Species descriptions are presented by (BOEM, 2017a).

Critical habitat has been designated for the loggerhead turtle in the Gulf of Mexico as shown in **Figure 1**. Critical habitat in the northern Gulf of Mexico includes nesting beaches in Mississippi, Alabama, and the Florida Panhandle; nearshore reproductive habitat seaward from these beaches; and a large area of *Sargassum* habitat. The nearest designated nearshore reproductive critical habitat for loggerhead sea turtles is approximately 465 miles (748 km) from the project area.

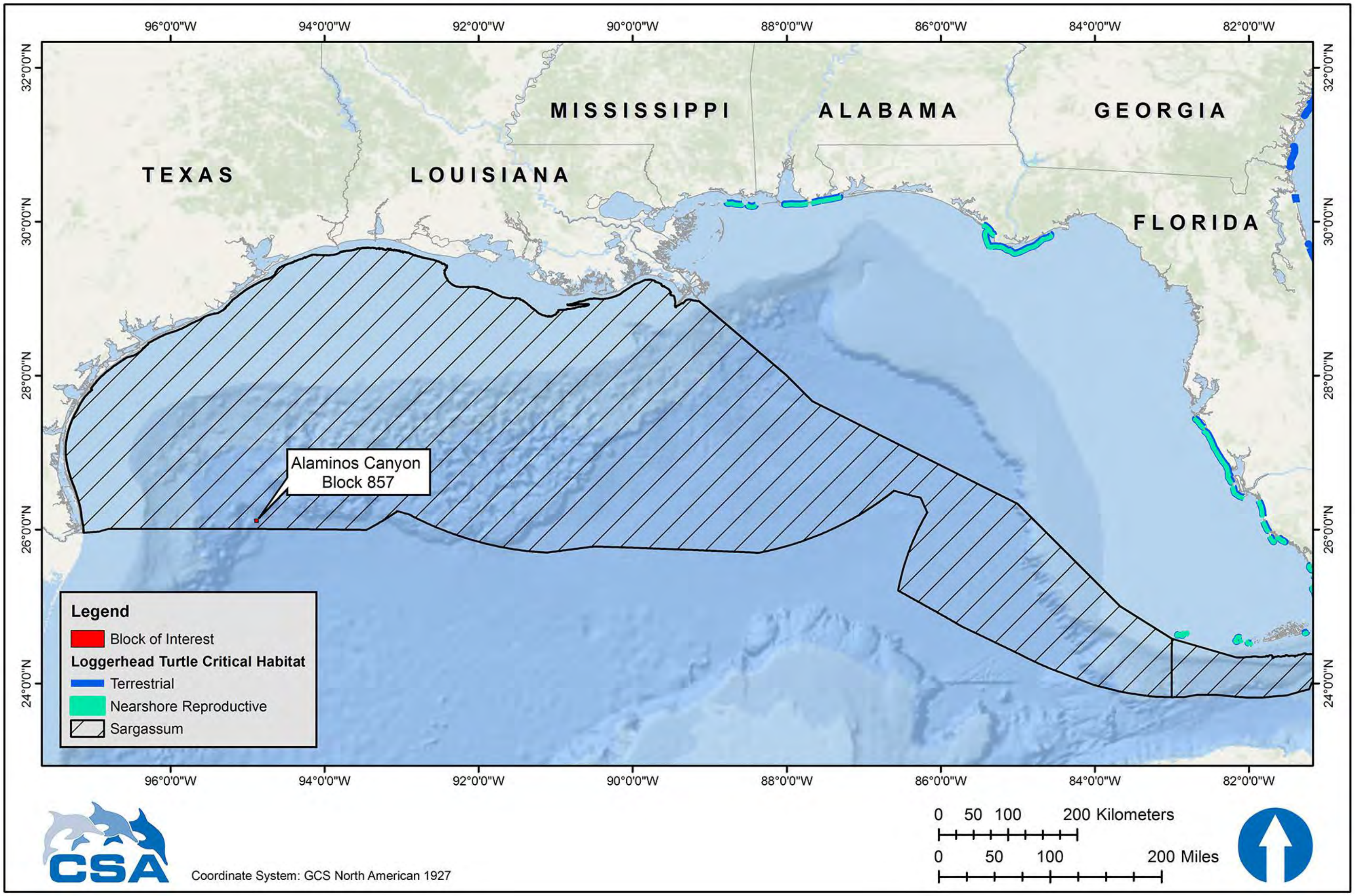


Figure 1. Location of loggerhead turtle designated critical habitat in relation to the project area.

Loggerhead turtles in the Gulf of Mexico are part of the Northwest Atlantic Ocean DPS (NMFS, 2014b). 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 genus of brown alga (Class Phaeophyceae) that has a pelagic existence. Rafts of *Sargassum* spp. serve as important foraging and developmental habitat for numerous fishes, and young sea turtles, including loggerhead turtles. NMFS also designated three other categories of critical habitat: 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).

Leatherbacks and loggerheads are the species most likely to be present near the project area as adults. Green, hawksbill, and Kemp's ridley turtles are typically inner shelf and nearshore species, unlikely to occur near the project area as adults. Hatchlings or juveniles of any of the sea turtles may be present in deepwater areas, including the project 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, Kemp's ridley, and loggerhead turtles forage primarily in shallow, benthic habitats. Leatherbacks are the most pelagic of the sea turtles, feeding primarily on jellyfish.

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

- Loggerhead turtles—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—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 Rancho Nuevo beach in Tamaulipas, Mexico (NMFS et al., 2011). A total of 190 Kemp's ridley turtle nests were counted on Texas beaches during the 2019 nesting season and a total of 250 Kemp's ridley turtle nests were counted on Texas beaches during the 2018 nesting season. These are a decrease from the 353 Kemp's ridley turtle nests counted in the 2017 nesting season (Turtle Island Restoration Network, 2019). 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 U.S.; and
- Hawksbill turtles—Hawksbill turtles typically do not nest anywhere near the project area, with most nesting in the region located in the Caribbean Sea and on beaches of the Yucatan Peninsula (U.S. Fish and Wildlife Service, 2016).

IPFs that could potentially affect sea turtles include vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small 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.

Though NMFS (2020) stated marine debris as an IPF, compliance with NTL BSEE 2015-G013 (See **Table 1**) and NMFS (2020) Appendix B will minimize the potential for marine debris-related impacts on sea turtles. NMFS (2020) estimated a small proportion of individual sea turtles would be adversely affected from exposure to marine debris. Therefore, marine debris is likely to have negligible impacts on sea turtles and is not further discussed (See **Table 2**).

Impacts of Vessel Presence, Noise, and Lights

Offshore drilling activities produce broadband sounds at frequencies and intensities that may be detected by sea turtles (Samuel et al., 2005, Popper et al., 2014). Potential impacts could include behavioral disruption and displacement from the area near the sound source. There is scarce information regarding hearing and acoustic thresholds for marine turtles. Sea turtles can hear low to mid-frequency sounds and they appear to hear best between 200 and 750 Hz and do not respond well to sounds above 1,000 Hz (Ketten and Bartol, 2005). 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). NMFS Biological Opinion (NMFS, 2015) lists the sea turtle underwater acoustic root mean square sound pressure level injury threshold as 207 dB re 1 μPa^2; Blackstock et al. (2018) identified the sea turtle underwater acoustic root mean square sound pressure level behavioral threshold as 175 dB re 1 μPa^2. No distinction is made between impulsive and non-impulsive sources for these thresholds.

Based on transmission loss calculations (Urick, 1983), open water propagation of noise produced by typical sources with DP thrusters in use during drilling, are not expected to produce mean-squared sound pressure levels greater than 160 dB re 1 μPa^2 beyond 105 ft (32 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 drilling and completion activities. Helicopters and support vessels may also affect sea turtles because of machinery noise or visual disturbances. Any impacts would likely be short-term behavioral changes such as diving and evasive swimming, disruption of activities, or departure from the area. Because of the limited scope and short duration of drilling 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, Simões et al., 2017). 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. Therefore, no significant impacts are expected.

NMFS (2020) stated sea turtles have the potential to be entangled or entrapped in moon pools, and though many sea turtles could exit the moon pool under their own volition, sublethal effects could occur. Based on the moon pool entrapment cases of sea turtles reported and successful rescues and releases that have occurred, NMFS (2020) estimated approximately about one sea turtle will be sub-lethally entrapped in moon pools every year. Therefore, no significant impacts are expected.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb sea turtles, and there is also a risk of vessel strikes. Data show that vessel traffic is one cause of sea turtle mortality in the Gulf of Mexico (Lutcavage et al., 1997; NMFS, 2020). 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 164 ft (50 m) or greater whenever possible (NMFS [2020] Appendix C). Compliance with these mitigation measures will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing sea turtles. Therefore, no significant impacts are expected.

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 (BOEM, 2012a; NMFS, 2020).

Impacts of a Small Fuel Spill

Potential spill impacts on sea turtles are discussed by NMFS (2020) and BOEM (2017a). For this DOCD, there are no unique site-specific issues with respect to spill impacts on sea turtles.

The probability of a spill will be minimized by Shell's preventative measures, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP is expected to mitigate and reduce the potential for impacts on sea turtles. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small 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 of the spill, as well as the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

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). However, due to the limited areal extent and short duration of water quality impacts from a small fuel spill, no significant impacts would be expected.

Effects of a small spill on *Sargassum* critical habitat for loggerhead turtles would be limited to the small area (1.2 to 12 ac [0.5 to 5 ha]) likely to be impacted by a small spill. A 12 ac (5 ha) impact would represent a negligible portion of the approximately 100,480,000 ac (40,662,810 ha) designated *Sargassum* critical habitat for loggerhead turtles in the northern Gulf of Mexico.

A small fuel spill in the project area would be unlikely to affect sea turtle nesting beaches because the project area is 141 miles (227 km) from the nearest shoreline (Texas) and 465 miles (748 km) from the nearest designated loggerhead nearshore reproductive critical habitat As explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up.

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, dispersants, and beach cleanup activities). 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, changing food availability and foraging distribution and/or patterns, changing reproductive behavior/productivity, and changing movement patterns or migration (MMC, 2011, NMFS, 2014b). In the unlikely event of a spill, implementation of Shell's OSRP is expected to mitigate and reduce the potential for these types of impacts on sea turtles. DOCD Section 9b provides detail on spill response measures.

Studies of oil effects on loggerheads in a controlled setting (Lutcavage et al., 1995, NOAA, 2010) 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, 2020).

Results of the *Deepwater Horizon* incident provide an indication of potential effects of a large oil spill on sea turtles. NOAA (2016b) estimated that between 4,900 and 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 *Deepwater Horizon* incident. Nearly 35,000 hatchling sea turtles (loggerheads, Kemp's ridleys, and green turtles) were also injured by response activities (NOAA, 2016b). Evidence from (McDonald et al., 2017b) suggests 402,000 turtles were exposed to oil in the aftermath of the *Deepwater Horizon* incident, including 54,800 which were likely to have been heavily oiled.

Spill response activities could also kill sea turtles and interfere with nesting. NOAA (2016b) concluded that after the *Deepwater Horizon* incident, 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. 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 or a reduction of 43.7% in 2010 (NOAA, 2016b, Lauritsen et al., 2017). Impacts from a large oil spill resulting in the death of individual listed sea turtles would be significant to local populations.

The 30-day OSRA modeling results summarized in **Table 3** predict Texas shorelines between Cameron and Matagorda counties have a 1% conditional probability of shoreline contact within 10 days of a spill. Texas and Louisiana shorelines that support sea turtle nesting could be contacted within 30 days of spill (1% to 10% conditional probability). The nearest nearshore reproductive critical habitat for loggerhead turtles is 465 miles (748 km) from the project area. Spilled oil reaching sea turtle nesting beaches could have effects on nesting sea turtles and egg development (NMFS, 2020). 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 normal bodily functions (NMFS, 2020).

The project area is within the loggerhead turtle critical habitat designated as *Sargassum* habitat (**Figure 1**), 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 (NMFS, 2014b). In the event of a large spill, parts of the *Sargassum* habitat would likely come into contact with spilled oil. Because *Sargassum* is a floating and pelagic species, it would only be affected by impacts that occur near the surface.

Due to the large area covered by the designated *Sargassum* habitat for loggerhead turtles, a large spill could result in the oiling of a substantial part of the *Sargassum* habitat in the northern Gulf of Mexico. For example, it is estimated that the *Deepwater Horizon* oil spill affected approximately one-third of the *Sargassum* habitat in the northern Gulf of Mexico (BOEM, 2016b). Because *Sargassum* is a floating and pelagic species, it would only be affected by impacts that occur near the surface.

The effects of oiling on *Sargassum* vary with 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) in areas of exposure. However, it is unlikely that the entire *Sargassum* critical habitat would be affected by a large spill. *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 sublethal affects, including reduced 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).

Impacts to sea turtles from a large oil spill and associated cleanup activities would depend on spill extent, duration, and season (relative to turtle nesting season); the amount of oil reaching the shore; the importance of specific beaches to sea turtle nesting; and the level of cleanup vessel and beach crew activity required. A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill, it is expected that impacts resulting in the injury or death of individual sea turtles would be adverse but not likely significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP would mitigate and reduce direct and indirect impacts to turtles from oil exposure and response activities and materials. DOCD Section 9b provides detail on spill response measures.

C.3.6 Piping Plover (Threatened)

The Piping Plover 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, 2019a). However, as a result of intensive conservation and management, populations of Piping Plover appear to have been increasing since 1991 throughout its range (Bird Life International, 2018). Critical overwintering habitat has been designated, including beaches in Texas, Louisiana, Mississippi, Alabama, and Florida (**Figure 2**). 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, 2010). A species description is presented by (BOEM, 2017a).

A large oil spill is the only IPF that could potentially affect Piping Plovers. There are no IPFs associated with routine project activities that could affect these birds. A small fuel spill in the project area would be unlikely to affect Piping Plovers because a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up (see explanation in **Section A.9.2**).

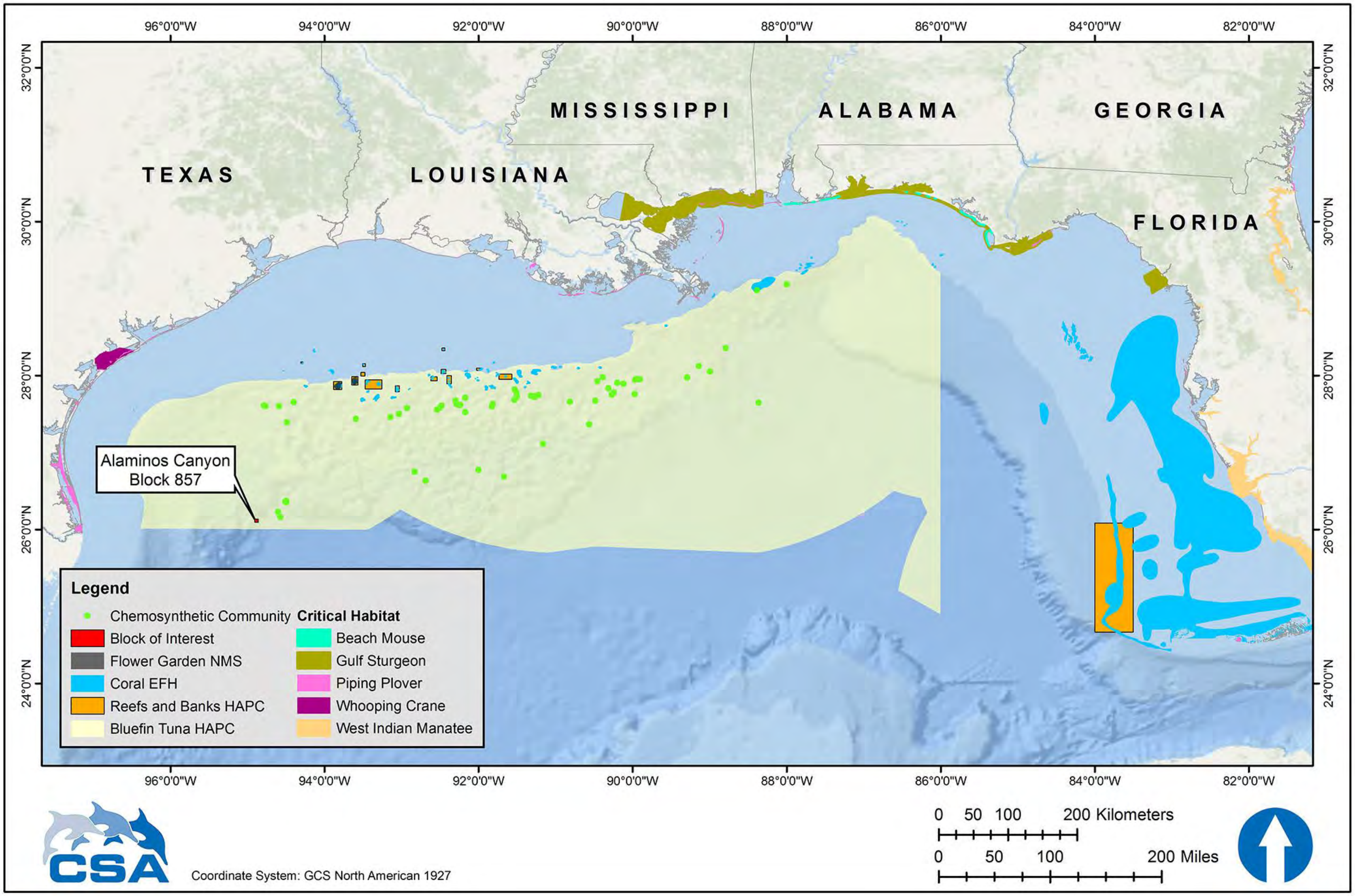


Figure 2. Location of selected environmental features in relation to the project area. (EFH = Essential Fish Habitat; HAPC = Habitat Area of Particular Concern)

Impacts of a Large Oil Spill

The project area is 139 miles (224 km) from the nearest shoreline designated as Piping Plover critical habitat. The OSRA results summarized in **Table 3** predict that Piping Plover critical habitat in Cameron County, Texas, has a 1% conditional probability of being contacted within 10 days of a spill and a 5% conditional probability of being contacted within 30 days of a spill.

Piping Plovers could become externally oiled while foraging on oiled shores or become exposed internally through ingestion of oiled intertidal sediments and prey (BOEM, 2017a). They congregate and feed along tidally exposed banks and shorelines, following the tide out and 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 the birds are most common along the coastal Gulf or if spills contacted critical habitat. Impacts could also occur from vehicular traffic on beaches and other activities associated with spill cleanup. Shell has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in the OSRP.

However, a large spill that contacts shorelines would not necessarily impact Piping Plovers. In the aftermath of the *Deepwater Horizon* incident, Gibson et al. (2017) completed thorough surveys of coastal Piping Plover habitat in coastal Louisiana, Mississippi, and Alabama and found that only 0.89% of all observed Piping Plovers were visibly oiled, leaving the authors to conclude that the *Deepwater Horizon* incident did not substantially affect Piping Plover populations.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting beaches inhabited by Piping Plovers, it is expected that impacts resulting in the injury or death of individual Piping Plovers could be significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on Piping Plovers are expected.

C.3.7 Whooping Crane (Endangered)

The Whooping Crane is a large omnivorous wading bird listed as an endangered species. Three wild populations live in North America (National Wildlife Federation, 2016b). One of these populations 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 an estimated population of 504 at Aransas NWR during the 2018 to 2019 winter (USFWS, 2019). Another reintroduced population summers in Wisconsin and migrates to the southeastern U.S. for the winter (Whooping Crane Eastern Partnership, 2019). 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). About 22,240 ac (9,000 ha) of salt flats in Aransas NWR and adjacent islands comprise the principal wintering grounds of the Whooping Crane. Aransas NWR is designated as critical habitat for the species (**Figure 2**). A species description is presented by BOEM (2012a).

A large oil spill is the only IPF that could potentially affect Whooping Cranes due to the distance from Aransas NWR.

Impacts of a Large Oil Spill

OSRA results summarized in **Table 3** predicts that there is a 1% and 5% probability (within 10 and 30 days, respectively) that an oil spill in the project area would reach a shoreline designated as critical habitat for the Whooping Crane in Calhoun or Aransas counties, Texas. The nearest Whooping Crane critical habitat is approximately 179 miles (288 km) from the project area.

In the event of oil exposure, 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 if the spill contacts their critical habitat in Aransas NWR, especially if spills occur during winter months when Whooping Cranes are most common along the Texas coast. Impacts could also occur from vehicular traffic on beaches and other activities associated with spill cleanup. Shell has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in the OSRP. Impacts leading to the death of individual Whooping Cranes would be significant at a species level.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting Whooping Crane habitat, it is expected that impacts resulting in the injury or death of individual Whooping Cranes could be significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on Whooping Cranes are expected.

C.3.8 Oceanic Whitetip Shark (Threatened)

The oceanic whitetip shark was listed as Threatened under the ESA in 2018 by NMFS (83 FR 4153). Oceanic whitetip sharks are found worldwide in offshore waters between approximately 30° N and 35° S latitude, and historically were one of the most widespread and abundant species of shark (Baum et al., 2015). However, based on reported oceanic whitetip shark catches in several major long-line fisheries, the global population appears to have suffered substantial declines (Camhi et al., 2008) and the species is now only occasionally reported in the Gulf of Mexico (Baum et al., 2015).

A comparison of historical shark catch rates in the Gulf of Mexico by Baum and Myers (2004) noted that most recent papers dismissed the oceanic whitetip shark as rare or absent in the Gulf of Mexico. NMFS (2018a) noted that there has been an 88% decline in abundance of the species in the Gulf of Mexico since the mid-1990s due to commercial fishing pressure.

IPFs that could affect the oceanic whitetip shark include vessel presence, noise, and lights, and a large oil spill. Though NMFS (2020) lists a small diesel fuel spill as an IPF, in the project area, a small diesel fuel spill would be unlikely to affect oceanic whitetip sharks due to rapid natural dispersion of diesel fuel and the low density of oceanic whitetip sharks potentially present in the project area. Therefore, no significant impacts are expected from small diesel fuel spills and they are not further discussed (**Table 2**).

Impacts of Vessel Presence, Noise, and Lights

Offshore drilling activities produce a broad array of sounds at frequencies and intensities that may be detected by elasmobranchs including the threatened oceanic whitetip shark. The general frequency range for elasmobranch hearing is approximately between 20 Hz and 1 kHz (Ladich and Fay, 2013), which includes frequencies exhibited by individual species such as the nurse shark (*Ginglymostoma cirratum*; 300 and 600 Hz) and the lemon shark (*Negaprion brevirostris*; 20 Hz to 1 kHz) (Casper and Mann, 2006). These frequencies overlap with sound pressure levels associated with drilling activities (typically 10 Hz to 10 kHz) (Hildebrand, 2005). Impacts from offshore drilling activities (i.e., non-impulsive sound) could include masking or behavioral change (Popper et al., 2014). However, because of the limited propagation distances of high sound pressure levels from the drilling rig, impacts would be limited in geographic scope and no population level impacts on oceanic whitetip sharks are expected.

Impacts of a Large Oil Spill

Information regarding the direct effects of oil on elasmobranchs, including the oceanic whitetip shark are largely unknown. However, in the event of a large oil spill, oceanic whitetip sharks could be affected by direct ingestion, ingestion of oiled prey, or the absorption of dissolved petroleum products through the gills. Because oceanic whitetip sharks may be found in surface waters, they could be more likely to be impacted by floating oil than other species which only reside at depth.

It is possible that a large oil spill could affect individual oceanic whitetip sharks and result in injuries or deaths. However, due to the low density of oceanic whitetip sharks thought to exist in the Gulf of Mexico, it is unlikely that a large spill would result in population-level effects.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.9 Giant Manta Ray (Threatened)

The giant manta ray was listed as Threatened under the ESA in 2018 by NMFS (83 FR 2916). The species is a slow-growing, migratory, and planktivorous, inhabiting tropical, subtropical, and temperate bodies of water worldwide (NOAA, 2018b).

Commercial fishing is the primary threat to giant manta rays (NOAA, 2018b). The species is targeted and caught as bycatch in several global fisheries throughout its range. Although protected in U.S. waters, protection of populations is difficult as they are highly migratory with sparsely distributed and fragmented populations throughout the world. Some estimated regional population sizes are small (between 100 to 1,500 individuals) (Marshall et al., 2018, NOAA, 2018b). Stewart et al. (2018) recently reported evidence that the Flower Garden Banks serves as nursery habitat for aggregations of juvenile manta rays. At least 74 unique individuals have been positively identified at the Flower Garden Banks based on unique underbelly coloration (Flower Garden Banks National Marine Sanctuary, 2018). Genetic and photographic evidence in the Flower Garden Banks over 25 years of monitoring showed that 95% of identified giant manta ray male individuals were smaller than mature size (Stewart et al., 2018).

IPFs that may affect giant manta rays include vessel presence, noise, and lights, and a large oil spill. Though NMFS (2020) lists a small diesel fuel spill as an IPF, in the project area a small diesel fuel spill would be unlikely to affect giant manta rays due to rapid natural dispersion of diesel fuel and the low density of giant manta rays potentially present in the project area. Therefore, no significant impacts are expected from small diesel fuel spills and they are not further discussed (See **Table 2**).

Impacts of Vessel Presence, Noise, and Lights

Offshore drilling activities produce a broad array of sounds at frequencies and intensities that may be detected by elasmobranchs including the giant manta ray. The general frequency range for elasmobranch hearing is approximately between 20 Hz and 1 kHz (Ladich and Fay, 2013). Studies indicate that the most sensitive hearing ranges for individual species were 300 and 600 Hz (yellow stingray [*Urobatis jamaicensis*]) and 100 to 300 Hz (little skate [*Erinacea raja*]) (Casper et al., 2003, Casper and Mann, 2006). These frequencies overlap with sound pressure levels associated with drilling activities (typically 10 Hz to 10 kHz) (Hildebrand, 2005). Impacts from offshore drilling activities (i.e., continuous sound) could include masking or behavioral change (Popper et al., 2014). However, because of the limited propagation distances of high sound pressure levels from the drilling rig, impacts would be limited in geographic scope and no population level impacts on giant manta rays are expected.

Impacts of a Large Oil Spill

A large oil spill in the project area could reach coral reefs at the Flower Garden Banks which is the only known location of giant manta ray aggregations in the Gulf of Mexico. Individuals may occur anywhere in the Gulf. In the unlikely event of a large oil spill impacting areas with giant manta rays, individual rays could be affected by direct ingestion of oil which could cover their gill filaments or gill rakers, or by ingestion of oiled plankton. Giant manta rays typically feed in shallow waters of less than 33 ft (10 m) depth (NOAA, 2018). Because of this shallow water feeding behavior, giant manta rays may be more likely to be impacted by floating oil than other species which only reside at depth.

In the event of a large oil spill, due to the distance between the project area and the Flower Garden Banks (approximately 146 miles [235 km]), it is unlikely that oil would impact the threatened giant manta ray nursery habitat. It is possible that a large oil spill could contact individual giant manta rays, but due to the low density of individuals thought to occur in the Gulf of Mexico, there would not likely be any population-level effects.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.10 Gulf Sturgeon (Threatened)

The Gulf sturgeon 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, migrating from the sea upstream into coastal rivers to spawn in freshwater. The historic range of the species extended from the Texas/Louisiana border to Tampa Bay, Florida (Pine and Martell, 2009). This range has contracted to encompass major rivers and inner shelf waters from the Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi to the Suwannee River, Florida (NOAA, 2018a). Populations have been depleted or even extirpated throughout the species' historical 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 2**). Species descriptions are presented by (BOEM, 2012a) and in the recovery plan for this species (USFWS et al., 1995).

A large oil spill is the only IPF that could potentially affect Gulf sturgeon. There are no IPFs associated with routine project activities that could affect this species. A small fuel spill in the project area would be unlikely to affect Gulf sturgeon, because a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up (see explanation in **Section A.9.2**). Vessel strikes to Gulf sturgeon would be unlikely based on the location of the support vessel base and that NMFS (2020) estimated one non-lethal Gulf sturgeon strike in the 50 years of proposed action. Due to the distance of the project area from the nearest Gulf Sturgeon critical habitat (448 miles [721 km]) and the support vessel base being in Port Fourchon, Louisiana, it is anticipated impacts from vessel strikes due to project activities will be negligible.

Impacts of a Large Oil Spill

Potential spill impacts on Gulf sturgeon are discussed by BOEM (2016b, 2017a), and NMFS (2020). For this DOCD, there are no unique site-specific issues with respect to this species.

The project area is approximately 448 miles (721 km) from the nearest Gulf sturgeon critical habitat. The 30-day OSRA modeling results (**Table 3**) predicts that a spill in the project area has a <0.5% conditional probability of contacting any coastal areas containing Gulf sturgeon critical habitat within 30 days.

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 would be vulnerable primarily during winter months (from October through April) when this species is foraging in estuarine and marine habitats (NMFS, 2020).

NOAA (2016b) estimated that 1,100 to 3,600 Gulf sturgeon were exposed to oil from the *Deepwater Horizon* 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).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting waterways inhabited by Gulf sturgeon, it is expected that impacts resulting in the injury or death of individual sturgeon would be adverse but not likely significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. Shell has extensive resources available to protect coastal and estuarine wildlife and habitats in the event of a spill reaching the shoreline, as detailed in the OSRP. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on Gulf sturgeon are expected.

C.3.11 Nassau Grouper (Threatened)

The Nassau grouper is a Threatened, long-lived reef fish typically associated with hard bottom structures such as natural and artificial reefs, rocks, and underwater ledges (NOAA, nd). Once one of the most common reef fish species in the coastal waters of the United States and Caribbean (Sadovy, 1997), the Nassau grouper has been subject to overfishing and is considered extinct in much of its historical range. Observations of current spawning aggregations compared with historical landings data suggest that the Nassau grouper population is substantially smaller than its historical size (NOAA, nd). The Nassau grouper was listed as threatened under the ESA in 2016 (81 FR 42268).

Nassau groupers are found mainly in the shallow tropical and subtropical waters of eastern Florida, the Florida Keys, Bermuda, the Yucatan Peninsula, and the Caribbean south to Brazil, as well as in the U.S. Virgin Island and Puerto Rico (NOAA, nd). There has been one confirmed sighting of Nassau grouper from the Flower Garden Banks in the Gulf of Mexico at a water depth of 118 ft (36 m) (Foley et al., 2007). Three additional unconfirmed reports (i.e., lacking photographic evidence) of Nassau grouper have also been documented from mooring buoys and the coral cap region of the West Flower Garden flats (Foley et al., 2007).

There are no IPFs associated with routine project activities that could affect Nassau grouper. A small fuel spill would not affect Nassau grouper because the fuel would float and dissipate on the sea surface and would not be expected to reach the Flower Garden Banks or Florida Keys. A large oil spill is the only relevant IPF.

Impacts of a Large Oil Spill

Based on the 30-day OSRA modeling results (**Table 3**), a large oil spill would be unlikely (<0.5% probability) to reach Nassau grouper habitat in the Florida Keys (Monroe County, Florida). A spill would be unlikely to contact the Flower Garden Banks based on the distance between the project area and the Flower Garden Banks (approximately 146 miles [235 km]), and the difference in water depth between the project area (8,000 to 8,210 ft [2,438 to 2,502 m]) and the Banks (approximately 17 to 145 m [56 to 476 ft]). While on the surface, oil would not be expected to contact subsurface fish. Natural or chemical dispersion of oil could cause a subsurface plume which would have the possibility of contacting Nassau groupers.

If a subsurface plume were to occur, impacts to Nassau groupers on the Flower Garden Banks would be unlikely due to the low density of Nassau grouper present on the Banks, the distance between the project area and the Flower Garden Banks (approximately 146 miles [235 km]), and the shallow location of the coral cap of the Banks. 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. (2014a) observed the spatial distribution of excess hopane, a crude oil tracer from the *Deepwater Horizon* incident 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. It is possible that a large oil spill could contact individual Nassau grouper fish, but due to the low density of individuals thought to occur in the Gulf of Mexico, there would not likely be any population-level effects.

In the unlikely event that an oil slick contacts Nassau grouper habitat, oil droplets or oiled sediment particles could come into contact with Nassau grouper present on the reefs. Individual fish could be affected by direct ingestion of oil which could cover their gill filaments or gill rakers, result in ingestion of oiled prey, or the absorption of dissolved petroleum products through the gills.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell’s well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell’s OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.12 Smalltooth Sawfish (Endangered)

The smalltooth sawfish, named due to their flat, saw-like rostrum, is an elasmobranch ray which lives in shallow coastal tropical seas and estuaries where they feed on fish and invertebrates such as shrimp and crabs (NOAA Fisheries, nd). Once found along most of the northern Gulf of Mexico coast from Texas to Florida, their current range in Gulf of Mexico is restricted to areas primarily in southwest Florida (Brame et al., 2019) where several areas of critical habitat have been designated. A species description is presented in the recovery plan for this species (NMFS, 2009b).

Listed as Endangered under the ESA in 2003, population numbers have drastically declined over the past century primarily due to accidental bycatch (Seitz and Poulakis, 2006). Although there are no reliable estimates for smalltooth sawfish population numbers throughout its range (NMFS, 2018c), data from 1989 to 2004 indicated a slight increasing trend in population numbers in Everglades National Park during that time period (Carlson et al., 2007). More recent data resulted in a similar conclusion, with indications that populations were stable or slightly increasing in southwest Florida (Carlson and Osborne, 2012).

There are no IPFs associated with routine project activities that could affect smalltooth sawfish. A small fuel spill would not affect smalltooth sawfish because the fuel would float and dissipate on the sea surface and would not be expected to reach smalltooth sawfish habitat in coastal areas (see **Section A.9.2**). A large oil spill is the only relevant IPF.

Impacts of a Large Oil Spill

The project area is approximately 782 miles (1,295 km) from the nearest smalltooth sawfish critical habitat in Charlotte County, Florida. Based on the 30-day OSRA modeling (**Table 3**), coastal areas containing smalltooth sawfish critical habitat are unlikely to be affected within 30 days of a spill (<0.5% conditional probability).

Information regarding the direct effects of oil on elasmobranchs, including the smalltooth sawfish are largely unknown. A recent study by Cave and Kajiura (2018) reported that when exposed the crude oil, the Atlantic stingray experienced impaired olfactory function which could lead to decreased fitness. In the event of oil reaching smalltooth sawfish habitats, the smalltooth sawfish could be affected by direct ingestion, ingestion of oiled prey, or the absorption of dissolved petroleum products through the gills. Based on the shallow, coastal habitats preferred by smalltooth sawfish, individuals in areas subject to coastal oiling could be more likely to be impacted than other species that reside at depth.

C.3.13 Beach Mice (Endangered)

Four subspecies of Endangered beach mouse occur on the barrier islands of Alabama and the Florida Panhandle: the Alabama (*Peromyscus polionotus ammobates*), Choctawhatchee (*Peromyscus polionotus allophrys*), Perdido Key (*Peromyscus polionotus trissyllepsis*), and St. Andrew beach mouse (*Peromyscus polionotus peninsularis*). Critical habitat has been designated for all four subspecies and is shown combined in Figure 2. One additional species of beach mouse in habiting dunes on the western Florida Panhandle, the Santa Rosa beach mouse (*Peromyscus polionotus leucocephalus*), is not listed under the ESA. Species descriptions are presented by (BOEM, 2017a).

A large oil spill is the only IPF that could potentially affect subspecies of beach mouse. There are no IPFs associated with routine project activities that could affect these animals due to the distance from shore and the lack of onshore support activities near their habitat.

Impacts of a Large Oil Spill

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

The project area is approximately 502 miles (808 km) from the nearest beach mouse critical habitat. The OSRA results summarized in **Table 3** predicts that a spill in the project area has <0.5% conditional probability of contacting any coastal areas containing beach mouse critical habitat within 30 days.

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, 2017a).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting beach mice habitat, it is expected that impacts resulting in the death of individual beach mice would be adverse and potentially significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on beach mice are expected.

C.3.14 Florida Salt Marsh Vole (Endangered)

The Florida salt marsh vole (*Microtus pennsylvanicus dukecampbelli*) is a small, dark brown or black rodent found only in saltgrass (*Distichlis spicata*) meadows in the Big Bend region of Florida that was listed as Endangered under the ESA in 1991. Only two populations of Florida salt marsh vole are known to exist: one near Cedar Key in Levy County, Florida and one in the Lower Suwanee National Wildlife Refuge in Dixie County, Florida (Florida Fish and Wildlife Conservation Commission, nd). No critical habitat has been established for the Florida salt marsh vole in part due to concerns over illegal trapping or trespassing if the location of the populations were publicly disclosed (U.S. Fish and Wildlife Service, 2001b).

A large oil spill is the only IPF that potentially may affect the Florida salt marsh vole. There are no IPFs associated with routine project activities that could affect these animals due to the distance from the project area to their habitat and the lack of any onshore support activities near their habitat. A small fuel spill in the project area would not affect the Florida salt marsh vole because a small fuel spill would not be expected to reach their habitat prior to dissipating (see **Section A.9.2**).

Impacts of a Large Oil Spill

Florida salt marsh vole habitat in Levy and Dixie counties, Florida is approximately 746 miles (1,201 km) from the project area. The 30-day OSRA modeling (**Table 3**) predicts that a spill in the project area has <0.5% or less conditional probability of contacting any coastal areas containing Florida salt marsh voles within 30 days.

In the event of oil contacting beaches containing these animals, Florida salt marsh voles 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. Impacts associated with an extensive oiling of coastal habitat containing Florida salt marsh voles from a large oil spill are expected to be significant. Due to the extremely low population numbers, extensive oiling of Florida salt marsh vole habitat could result in the extinction of the species.

However, any such impacts are unlikely due to the distance from the project area to Florida salt marsh vole habitat and response actions that would occur in the event of a spill.

C.3.15 Threatened Coral Species

Seven Threatened coral species are known from the northern Gulf of Mexico: elkhorn coral, staghorn coral, lobed star coral, mountainous star coral, boulder star coral, pillar coral, and rough cactus coral. Elkhorn coral, lobed star coral, mountainous star coral, and boulder star coral have been reported from the coral cap region of the Flower Garden Banks (NOAA, 2014), but are unlikely to be present as regular residents in the northern Gulf of Mexico because they typically inhabit coral reefs in shallow, clear tropical, or subtropical waters. Staghorn coral, pillar coral, and rough cactus coral are not known to inhabit reefs of the Flower Garden Banks, but are present on reefs in the Florida Keys and Dry Tortugas (Florida Fish and Wildlife Conservation Commission, 2018). 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, Florida Keys, or Dry Tortugas. Critical habitat has been designated for elkhorn coral and staghorn coral in the Florida Keys (Monroe County, Florida) and Dry Tortugas, but none has been designated for the other Threatened coral species included here.

There are no IPFs associated with routine project activities that could affect Threatened corals in the northern Gulf of Mexico. A small 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 (potential impacts listed in Table 2) and is discussed below.

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 30-day OSRA modeling (**Table 3**) predicts the conditional probability of oil contacting the Florida Keys is less than 0.5%. The nearest coral Habitat Area of Particular Concern (HAPC) is approximately 37 miles (60 km) northwest of the project area. 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 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. (2014b) observed the spatial distribution of excess hopane, a crude oil tracer from *Deepwater Horizon* incident sediment core samples, to be in the deeper waters and not transported up the shelf, thus confirming 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 project 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,b, Clapp et al., 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 and 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 coastal birds, see **Section C.4.2**.

Seabirds of the northern Gulf of Mexico were surveyed from ships during the GulfCet II program (Davis et al., 2000). Davis et al. (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) (Davis et al., 2000). The GulfCet II study did not estimate bird densities; however, seabird densities over the open ocean have been estimated to be 1.6 birds km^{-2} (Haney et al., 2014).

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., 2000), 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 (Davis et al., 2000).

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

IPFs that could potentially affect marine and pelagic birds include vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small fuel spill and a large oil spill). Effluent discharges permitted under the NPDES general permit 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-G013 will minimize the potential for marine debris-related impacts on birds.

Impacts of 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 platform collisions appear to be similar. In some cases, migrants simply do not see a part of the platform until it is too late to avoid it. In other cases, navigation may be disrupted by noise or lighting (Russell, 2005, Ronconi et al., 2015). However, offshore structures may in some cases serve as suitable stopover habitats for trans-Gulf migrant species, particularly in spring (Russell, 2005, Ronconi et al., 2015).

Overall, potential negative impacts to birds from DP MODU or installation vessel lighting, potential collisions, or other adverse effects are highly localized, relatively short term and temporary in nature, and may be expected to affect only individual birds during migration periods. Therefore, these potential impacts may be adverse, but are not expected to affect birds at the population or species level and are not significant (BOEM, 2012a).

Impacts of Support Vessel and Helicopter Traffic

Support vessels and helicopters are unlikely to significantly disturb pelagic birds in open, offshore waters. Schwemmer et al. (2011) showed that several sea birds showed behavioral responses and altered distribution patterns in response to ship traffic, which could potentially cause loss of foraging time and resting habitat. However, 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 Fuel Spill

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

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on marine and pelagic birds. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area and the short duration of a small spill, the potential exposure for pelagic marine birds would be brief.

A small 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.9.2** discusses the likely fate of a small fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), 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 VOCs. Because of the limited areal extent and short duration of water quality impacts from a small 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 marine and pelagic birds would be expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine birds are discussed by BOEM (2016b, 2017a). 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 (>200 m water depth). Haney et al. (2014) estimated that seabird densities over the open ocean are approximately 1.6 birds km^{-2}. The number of marine birds that could be affected in open, offshore waters would depend on the extent and persistence of the oil slick.

Data following the *Deepwater Horizon* incident provide relevant information about the species of marine birds that may be affected in the event of a large oil spill. Birds that were 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 individuals 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 *Deepwater Horizon* incident 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 for 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).

However, a blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. It is expected that impacts to marine birds from a large oil spill resulting in the death of individual birds would be adverse but likely not significant at population levels. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on marine and pelagic birds are expected.

C.4.2 Coastal Birds

Threatened and Endangered bird species (Piping Plover and Whooping Crane) are discussed in **Section C.3**. 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 nest on beaches, flats, dunes, bars, barrier islands, and similar coastal and nearshore habitats include the Sandwich Tern, Wilson's Plover, Black Skimmer, Forster's Tern, Gull-Billed Tern, Laughing Gull, Least Tern, and Royal Tern (USFWS, 2010). Additional information is presented by BOEM (2012a, 2017a).

The Brown Pelican was delisted from federal Endangered status in 2009 (USFWS, 2016) and was delisted from state species of special concern status by the State of Florida in 2017 (Florida Fish and Wildlife Conservation Commission, 2016). However, this species remains listed as endangered by both Louisiana and Mississippi (Mississippi Natural Heritage Program, 2018). 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., 2000) indicate that Brown Pelicans do not occur over deep offshore waters (Fritts and Reynolds, 1981, Peake, 1996). Nearly half the southeastern population of Brown Pelicans lives in the northern Gulf Coast, generally nesting on protected islands (USFWS, 2010).

The Bald Eagle was delisted from its federal Threatened status in 2007. However, this species is listed as endangered in Louisiana (Louisiana Department of Wildlife and Fisheries, 2017) and Mississippi (Mississippi Natural Heritage Program, 2018). The Bald Eagle is also listed as threatened in Texas (Texas Parks and Wildlife Department, 2017) and still receives federal 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 (Buehler, 2000).

IPFs that could potentially affect coastal birds include support vessel and helicopter traffic and a large oil spill. As explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up. Compliance with NTL BSEE 2015-G013 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, Louisiana and Galveston, Texas, 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 some foraging and resting birds. Flushing distances vary among species and individuals (Rodgers and Schwikert, 2002, Schwemmer et al., 2011). 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 this project, and some species such as gulls are attracted to boats. Support vessels will not approach nesting or breeding areas on the shoreline, so nesting birds, eggs, and chicks will not be disturbed. 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, duration, and geographic extent of installation activities, any short-term impacts are not expected to be significant to coastal bird populations.

Helicopter traffic can cause some disturbance to birds on shore 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 over other human disturbances for some species (Bélanger and Bédard, 1989). However, Federal Aviation Administration 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 in Efroymson et al. (2000). With these guidelines in effect, it is likely that individual birds would experience, at most, only short-term behavioral disruption. The potential impacts are not expected to be significant to bird populations or species in the project area.

Impacts of Large Oil Spill

Coastal birds can be exposed to oil as they float on the water surface, dive during foraging, or wade in oiled coastal waters. The Brown Pelican and Bald Eagle could be impacted by the ingestion of contaminated fish or birds (BOEM, 2012a, 2016b). In the event of a large oil spill reaching coastal habitats, cleanup personnel and equipment could create short-term disturbances to coastal birds. Indirect effects could occur from restoration efforts, resulting in habitat loss, alteration, or fragmentation (BOEM, 2017a). The OSRA results summarized in **Table 3** predict coastal areas would not likely be affected within 3 days (<0.5% conditional probability); however, coastal areas of Texas, between Cameron and Matagorda Counties, could be affected within 10 days (1% conditional probability). Within 30 days, shoreline segments of 11 Texas counties and 1 Louisiana parish have a 1% to 10% conditional probability of being contacted.

Studies concerning the *Deepwater Horizon* incident provide additional information regarding impacts on shorebirds and coastal nesting birds that may be affected in the event that a large oil spill reaches coastal habitats. 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). A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. However, if oil from a large spill reaches coastal bird habitats, significant injuries or mortalities to coastal birds are possible and could be significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on shorebirds and coastal nesting birds are expected.

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, whose surface waters 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 numerical abundance was dominated by relatively few families and species.

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

Impacts of Vessel Presence, Noise, and Lights

The DP MODU or installation vessel, as a floating structure in the deepwater environment, will act as a fish-attracting 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 (Holland, 1990, Higashi, 1994, Relini et al., 1994). Positive fish associations with offshore rigs and platforms in the Gulf of Mexico are well documented (Gallaway and Lewbel, 1982, Wilson et al., 2003, Wilson et al., 2006). The FAD effect could possibly enhance the feeding of epipelagic predators by attracting and concentrating smaller fish species. MODU noise could potentially cause acoustic 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 mean-squared sound pressure levels of 170 dB re 1 μPa^2 accumulated over a 48-hour period for onset of recoverable injury and 158 dB re 1 μPa^2 accumulated over a 12-hour period for onset temporary auditory threshold shifts. However, no consistent behavioral thresholds for fish have been established (Popper 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). Because the DP MODU or installation vessel is a single, temporary structure, impacts on fish populations, whether beneficial or adverse, are considered minor.

Few data exist regarding the impacts of noise on pelagic larvae and eggs. Generally, it is understood 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 (such as MODU operations) are expected to be far 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 drilling, are not expected to produce received levels greater than 160 dB re 1 μPa beyond 105 ft (32 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

Discharges of treated SBM-associated cuttings will produce temporary, localized increases in suspended solids in the water column around the MODU. In general, turbid water can be expected to extend between a few hundred meters and several kilometers down current from the discharge point (National Research Council, 1983, Neff, 1987). Effluents discharged during the course of normal subsea equipment installation activities are not expected to have a significant impact on water column biota. NPDES permit limits regulate the discharges.

Water-based drilling muds and cuttings will be released at the seafloor during the initial well intervals before the marine riser is set, which allows their return to the surface vessel. Excess cement slurry and blowout preventer fluid will also be released at the seafloor. Impacts will be limited to the immediate area of the discharge, with little to no impact to fisheries resources.

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 will dilute rapidly to undetectable levels within tens to hundreds of meters from the source. 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 will 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 desalination unit brine and non-contact cooling water, blowout preventer fluid, well treatment and completion fluids, excess cement, water-based subsea production control fluid, hydrate inhibitor, treated seawater, fire water, bilge water, and ballast water, are expected to dilute rapidly and have little or no impact on water column biota. The DP MODU or installation vessel, and support vessel discharges are expected to be in accordance with NPDES permit and USCG regulations, as applicable, and therefore are not expected to cause significant impacts on water quality.

Impacts of Water Intakes

Seawater will be drawn from several meters below the ocean surface for various services including firewater and once-through non-contact cooling of machinery on the DP MODU or installation vessel (DOCD Table 7a). 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 general NPDES Permit No. GMG290103 specifies requirements for new facilities for which construction commenced after July 17, 2006 with a cooling water intake structure having a design intake capacity of greater than two million gallons of water per day, of which at least 25% is used for cooling purposes.

If the DP MODU or installation vessel selected for this project meets the described applicability for new facilities, the vessels' water intakes are expected to be in compliance with the design, monitoring, and recordkeeping requirements of the NPDES permit.

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 except for a few fast-swimming larvae of certain taxonomic groups. Those organisms entrained may be stressed or killed, primarily through changes in water temperature during the route from cooling intake structure to discharge structure and mechanical damage (turbulence in pumps and condensers). Because of the limited scope and short duration of drilling activities, any short-term impacts of entrainment are not expected to be biologically significant to plankton or ichthyoplankton populations (BOEM, 2017a).

Impacts of a Small Fuel Spill

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

The probability of a spill will be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on pelagic communities, including ichthyoplankton. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small 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.9.2** discusses the likely fate of a small fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

A small fuel spill could have localized impacts on phytoplankton, zooplankton, ichthyoplankton, and nekton. Due to the limited areal extent and short duration of water quality impacts, a small 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, 2017a). 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. Eggs and larvae of fishes in the upper layers of the water column are especially vulnerable to oiling; certain toxic fractions of spilled oil may be lethal to these life stages. Impacts would be potentially 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 concentrations of ichthyoplankton on the continental shelf peak (BOEM, 2014a, 2015, 2016b).

Oil spill impacts to phytoplankton include changes in community structure and increases in biomass, which have been attributed to the effects of oil contamination and of decreased predation due to zooplankton mortality (Abbriano et al., 2011, Ozhan et al., 2014). Ozhan et al. (2014) reported that the formation of oil films on the water surface can limit gas exchange through the air-sea interface and can reduce light penetration into the water column which will limit phytoplankton photosynthesis. Determining the impact of a diesel spill on phytoplankton is a complex issue as some phytoplankton species are more tolerant of oil exposure than others while some species are more tolerant under low concentrations and some under high concentrations (Ozhan et al., 2014). Phytoplankton populations can change quickly on small temporal and spatial scales making it difficult to predict how a phytoplankton community as a whole will respond to an oil spill.

Mortality of zooplankton has been shown to be positively correlated with oil concentrations (Lennuk et al., 2015). Spills that are not immediately lethal can have short- or long-term impacts on biomass and community composition, behavior, reproduction, feeding, growth and development, immune response and respiration (Harvell et al., 1999, Wootton et al., 2003, Auffret et al., 2004, Hannam et al., 2010, Bellas et al., 2013, Blackburn et al., 2014). Zooplankton are especially vulnerable to acute oil pollution, showing increased mortality and sublethal changes in physiological activities (e.g., egg production; Moore and Dwyer, 1974, Linden, 1976, Lee et al., 1978, Suchanek, 1993). Zooplankton may also accumulate PAHs through diffusion from surrounding waters, direct ingestion of micro-droplets (e.g., Berrojalbiz et al., 2009, Lee et al., 2012, Lee, 2013), and by ingestion of droplets that are attached to phytoplankton (Almeda et al., 2013). Bioaccumulation of hydrocarbons can lead to additional impacts among those higher trophic level consumers that rely on zooplankton as a food source (Almeda et al., 2013, Blackburn et al., 2014).

Planktonic communities have a high capacity for recovery from the effects of oil spill pollution due to their short life cycle and high reproductive capacity (Abbriano et al., 2011). Planktonic communities drift with water currents and recolonize from adjacent areas. Because of these attributes, plankton usually recover relatively rapidly to normal population levels following hydrocarbon spill events. Research in the aftermath of the *Deepwater Horizon* incident found that phytoplankton population recovered within weeks to months and zooplankton populations may have only been minimally affected (Abbriano et al., 2011).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. It is expected that impacts to pelagic communities and ichthyoplankton from a large oil spill would be adverse but not significant at population levels. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on pelagic communities and ichthyoplankton are expected.

C.5.2 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined as those 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 on the Texas-Louisiana OCS, the nearest of which is located 117 miles (188 km) west-northwest of the project area.

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

- Blue marlin (juveniles, adults)
- Bluefin tuna (spawning, eggs, larvae)
- Oceanic whitetip shark (all)
- Sailfish (juveniles, adults)
- Skipjack tuna (spawning)
- Swordfish (larvae, juveniles, adults)
- White marlin (juveniles)
- 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*) (Theo and Block, 2010), and NMFS (2009c) has designated an HAPC for this species. The HAPC covers much of the deepwater Gulf of Mexico, including the project area (**Figure 2**). The areal extent of the HAPC is approximately 115,830 miles^2 (300,000 km^2). The prevailing understanding 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, 2009c). The Atlantic bluefin tuna has also been designated as a species of concern (NMFS, 2011).

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 WPA/CPA 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 in the Gulf of Mexico by the Gulf of Mexico Fishery Management Council (2005, 2010), including the Florida Middle Grounds, Madison-Swanson Marine Reserve, Tortugas North and South Ecological Reserves, Pulley Ridge, and several individual reefs and banks of the northwestern Gulf of Mexico (**Figure 2**). The nearest of these is West Flower Garden Bank, located 130 miles (209 km) north-northeast of the project area.

Routine IPFs that could potentially affect EFH and fisheries resources include vessel presence, noise, and lights; effluent discharges; and water intakes. In addition, two types of accidents (a small fuel spill and a large oil spill) may potentially affect EFH and fisheries resources.

Impacts of Vessel Presence, Noise, and Lights

The DP MODU or installation vessel, as a floating structure in the deepwater environment, will act as a FAD. In oceanic waters, the FAD effect would be most pronounced for epipelagic fishes such as tunas, dolphin, billfishes, and jacks that are commonly attracted to fixed and drifting surface structures (Holland, 1990, Higashi, 1994, Relini et al., 1994). This FAD effect would possibly enhance feeding of epipelagic predators by attracting and concentrating smaller fish species. MODU noise could potentially cause masking in 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, Nedelec et al., 2017). Any impacts on EFH for highly migratory pelagic fishes are not expected to be significant.

Impacts of Effluent Discharges

Other effluent discharges affecting EFH by diminishing ambient water quality include treated sanitary and domestic wastes, deck drainage, and miscellaneous discharges such as desalination unit brine and non-contact cooling water, blowout preventer fluid, well treatment and completion fluids, excess cement, water-based subsea production control fluid, hydrate inhibitor, treated seawater, fire water, bilge water, and ballast water. Impacts on EFH from effluent discharges are anticipated to be similar to those described in **Section C.5.1** for pelagic communities. No significant impacts on EFH for highly migratory pelagic fishes are expected from these discharges.

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, timing, and geographic extent of the well work inclusive of some drilling activities and subsea installation activities, any short-term impacts on EFH for highly migratory pelagic fishes are not expected to be biologically significant.

Impacts of a Small Fuel Spill

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

The probability of a spill will be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on EFH. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small 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.9.2** discusses the likely fate of a small fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

A small 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 project area. A spill would also produce short-term impact on surface and near-surface water quality in the HAPC for spawning Atlantic 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. Therefore, no significant spill impacts on EFH for highly migratory pelagic fishes are expected.

A small fuel spill would not affect EFH for corals and coral reefs; the nearest coral EFH is located 117 miles (188 km) west-northwest of the project area. A small fuel spill would float and dissipate on the sea surface and would not contact these features. Therefore, no significant spill impacts on EFH for corals and coral reefs are expected.

Impacts of a Large Oil Spill

Potential spill impacts on EFH are discussed by BOEM (2016b, 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 the subsurface as well. Given the extent of EFH designations in the Gulf of Mexico (Gulf of Mexico Fishery Management Council, 2005, NMFS, 2009c), some impact on EFH would be unavoidable.

A large spill could affect the EFH for many managed species, including shrimps, 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, ichthyoplankton, and nekton. In coastal waters, sediments could be oiled and result in persistent degradation of the seafloor habitat for managed demersal fish and shellfish species.

The project area is within the HAPC for spawning Atlantic bluefin tuna (NMFS, 2009c). 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 and their offspring. Potential impacts would depend in part on the timing of a spill, as this species migrates to the Gulf of Mexico to spawn in April, May, and June (NMFS, 2009c).

The nearest feature designated as EFH for corals is located 117 miles (188 km) west-northwest of the project area. An accidental spill would be unlikely to reach or affect this feature. Near-bottom currents in the region are expected to flow along the isobaths (Nowlin et al., 2001, Valentine et al., 2014b) and typically would not carry a plume up onto the continental shelf edge.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting EFH for managed species, it is expected that impacts could be significant but would likely be temporary and short-term. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.6 Archaeological Resources

C.6.1 Shipwreck Sites

In BOEM (2012a), information was presented that altered the impact conclusion for archaeological resources which came to light as a result of BOEM-sponsored studies and industry surveys. Evidence of damage to significant cultural resources (i.e., historic shipwrecks) has been shown to have occurred because of an incomplete knowledge of seafloor conditions in project areas 656 ft (>200 m) water depth that have been exempted from high-resolution surveys. Since significant historic shipwrecks have recently been discovered outside the previously designated high-probability areas (some of which show evidence of impacts from permitted activities prior to their discovery), a survey is now required for exploration and development projects.

The project area is not on the list of archaeological survey blocks determined to have a high potential for containing archaeological properties (BOEM, 2011). The shallow hazard assessment (Geoscience Earth & Marine Services, 2001, 2004, Fugro Geoservices Inc., 2015, Shell, 2017, Oceaneering, 2018) identified five sonar contacts within 1,000 ft (305 m) of the proposed well work and subsea installation. These contacts were identified as modern debris or natural in origin and are not archaeologically significant. No archaeological impacts are expected from routine activities in the project area.

Because no historic shipwreck sites are present in the project area (see DOCD Section 6), there are no routine IPFs that are likely to affect these resources. A small fuel spill would not affect shipwrecks in adjoining blocks because the oil would float and dissipate on the sea surface. The only IPF considered would be the impact from a large oil spill that could contact shipwrecks in other blocks.

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 project area, this impact would not be relevant.

Beyond the seafloor blowout radius, there is the potential for impacts from oil, dispersants, and depleted oxygen levels (BOEM, 2017a). These impacts could include chemical contamination, alteration of the rates of microbial activity (BOEM, 2017a), and reduced biodiversity as shipwreck-associated sediment microbiomes (Hamdan et al., 2018). During the *Deepwater Horizon* incident, 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 dispersants at the wellhead (NOAA, 2011b). While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could contact shipwreck sites beyond the 984-foot (300-meter) radius estimated by BOEM (2012a), depending on its extent, trajectory, and persistence (Spier et al., 2013). If oil from a subsea spill should contact wooden shipwrecks on the seafloor, it could adversely affect their condition or preservation.

Although there are no known historic shipwrecks in the project area, an archaeological review did detect five sonar contacts within 1,000 ft (305 m) of the proposed well work and subsea infrastructure (Geoscience Earth & Marine Services, 2001, 2004, Fugro Geoservices Inc., 2015, Shell, 2017, Oceaneering, 2018). These contacts were identified as modern debris or natural in origin and are not archaeologically significant. No archaeological impacts are expected from routine activities in the project area.

A spill entering shallow coastal waters could conceivably contaminate undiscovered or known historic shipwreck sites. The 30-day OSRA modeling results summarized in **Table 3** predicts that shoreline contact is unlikely within 3 days of a spill (<0.5% conditional probability). Within 10 days, there is a 1% probability of contact with six Texas counties (from Cameron to Matagorda counties). Within 30 days, shoreline segments of 11 Texas counties and one Louisiana parish have a 1% to 10% conditional probability of being contacted. Matagorda County, Texas, has the highest probability of shoreline contact (10%) within 30 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). Undiscovered shipwreck sites on or nearshore could also be impacted by foot or vehicle traffic during response and clean-up efforts in the aftermath of a spill.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on historic shipwrecks are expected.

C.6.2 Prehistoric Archaeological Sites

With a water depth of approximately 8,000 to 8,210 ft (2,438 to 2,502 m), the project area is well beyond the 197 ft (60 m) depth contour used by the BOEM as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. Because prehistoric archaeological sites are not found in the project area, the only relevant IPF is a large oil spill that would reach coastal waters within the 197 ft (60 m) depth contour.

Impacts of a Large Oil Spill

Because prehistoric archaeological sites are not found in the project area, it is highly unlikely that any such resources would be affected by the physical effects of a subsea blowout. BOEM (2012a) estimates 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 (2012a). The 30-day OSRA modeling results summarized in **Table 3,** shoreline contact is unlikely within the first 3 days following a spill (<0.5% conditional probability). Within 10 days, there is a 1% probability of contact with six Texas counties (from Cameron to Matagorda counties). Within 30 days, shoreline segments of 11 Texas counties and one Louisiana parish have a 1% to 10% probability of being contacted. Matagorda County, Texas, has the highest probability of shoreline contact (10%) within 30 days of a spill. A spill reaching a prehistoric site along these shorelines could coat fragile artifacts or site features and compromise the potential for radiocarbon dating organic materials in a site (although other dating methods are available and it is possible to decontaminate an oiled sample for radiocarbon dating). Coastal prehistoric sites could also be damaged by spill cleanup operations (e.g., by destroying fragile artifacts and disturbing the provenance of artifacts and site features). BOEM (2017a) notes that some unavoidable direct and indirect impacts on coastal historic resources could occur, resulting in the loss of information.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on archaeological resources are expected.

C.7 Coastal Habitats and Protected Areas

Coastal habitats in the northern Gulf of Mexico that may be affected by oil and gas activities are described in previous EISs (BOEM, 2012a, 2013, 2014a, 2015, 2016b, 2017a) and in a literature review by Collard and Way (1997). Sensitive coastal habitats are also tabulated in the OSRP. Coastal habitats inshore of the project area include coastal and barrier island beaches and dunes, wetlands, oyster reefs, and submerged seagrass beds. Generally, most of the northern Gulf of Mexico is fringed by coastal and barrier island beaches, with wetlands and/or submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries.

Due to the distance from shore, there are no IPFs associated with routine activities occurring in the project area that are likely to affect beaches and dunes, wetlands, seagrass beds, coastal wildlife refuges, wilderness areas, or any other managed or protected coastal area. The support bases are not located in a wildlife refuge or a wilderness area. Potential impacts of support vessel traffic are briefly addressed in this section.

A large oil spill is the only accidental impact analyzed. A small fuel spill in the project area would be unlikely to affect coastal habitats due to the project area's distance from the nearest shoreline. As explained in **Section A.9.2**, a small fuel spill in the project area would be unlikely to affect coastal habitats, because it would not be expected to make landfall or reach coastal waters prior to natural dispersion.

Impacts of Support Vessel Traffic

For OCS activities in general, support operations, including the crew boat and supply boats, may have a minor incremental impact on coastal habitats. Over time with a large number of vessel trips, vessel wakes can erode shorelines along inlets, channels, and harbors. Support operations, including the crew boat and supply boats as detailed in DOCD Section 14, may have a minor incremental impact on coastal habitats, seagrass beds, wetlands, or protected areas. Impacts 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 (2017a, 2017b).

Impacts of a Large Oil Spill

Potential spill impacts on coastal habitats are discussed by BOEM (2016b, 2017a). Coastal habitats inshore of the project area include coastal and barrier island beaches, wetlands, oyster reefs, and submerged seagrass beds. For this DOCD, there are no unique site-specific issues with respect to coastal habitats.

The 30-day OSRA modeling results summarized in **Table 3** predict that shoreline contact is unlikely within the first 3 days following a spill (<0.5% conditional probability). Within 10 days, there is a 1% probability of contact with six Texas counties (from Cameron to Matagorda counties). Within 30 days, shoreline segments of 11 Texas counties and one Louisiana parish have a 1% to 10% probability of being contacted. Matagorda County, Texas, has the highest probability of shoreline contact (10%) within 30 days of a spill.

NWRs and other protected areas such as Wildlife Management Areas (WMAs) along the coast are discussed in the lease sale EIS BOEM (2017a) and Shell's OSRP. Coastal wildlife refuges, wilderness areas, and state and national parks within the geographic range of the potential shoreline contacts within 30 days of a large oil spill are listed in **Table 6**.

Table 6. 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 of a hypothetical spill from Launch Point 11 based on the 30-day Oil Spill Risk Analysis (OSRA) model.

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
Cameron, Texas	Boca Chica State Park
	Brazos Island State Park
	Laguna Atascosa National Wildlife Refuge
	Laguna Madre Gulf Ecological Management Site
	Las Palomas Wildlife Management Area
	Lower Rio Grande Valley National Wildlife Refuge
Willacy, Texas	Laguna Atascosa National Wildlife Refuge
	Laguna Madre Gulf Ecological Management Site
	Padre Island National Seashore
Kenedy, Texas	Laguna Madre Gulf Ecological Management Site
	Padre Island National Seashore
Kleberg, Texas	Laguna Madre Gulf Ecological Management Site
	Padre Island National Seashore
Nueces, Texas	I.B. Magee Beach Park
	Laguna Madre Gulf Ecological Management Site
	Mission-Aransas National Estuarine Research Reserve
	Mustang Island State Park
	Port Aransas Nature Preserve
	Roberts Point Park
Aransas, Texas	Aransas National Wildlife Refuge
	Goose Island State Park
	Lydia Ann Island Audubon Sanctuary
	Rattlesnake Island, Ayres Island, and Roddy Island Audubon Sanctuary
	Redfish Bay State Scientific Area
	Mission-Aransas National Estuarine Research Reserve

Table 6. (Continued).

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
Calhoun, Texas	Aransas National Wildlife Refuge
	Chester Island Bird Sanctuary
	Guadalupe Delta Wildlife Management Area
	Matagorda Island Wildlife Management Area
	Welder Flats Wildlife Management Area
Matagorda, Texas	Big Boggy National Wildlife Refuge
	Matagorda Bay Nature Park
	San Bernard National Wildlife Refuge
	West Moring Dock Park
Brazoria, Texas	Brazoria National Wildlife Refuge
	Christmas Bay Coastal Preserve
	Justin Hurst Wildlife Management Area
	San Bernard National Wildlife Refuge
Galveston, Texas	Anahuac National Wildlife Refuge
	Bolivar Flats Shorebird Sanctuary
	Fort Travis Seashore Park
	Galveston Island State Park
	Horseshoe Marsh Bird Sanctuary
	Mundy Marsh Bird Sanctuary
	R.A. Apffel Park
	Seawolf Park
Jefferson, Texas	McFaddin National Wildlife Refuge
	Sea Rim State Park
	Texas Point National Wildlife Refuge
Cameron Parish, Louisiana	Sabine National Wildlife Refuge
	Rockefeller State Wildlife Refuge and Game Preserve
	Peveto Woods Sanctuary

The 30-day OSRA modeling results in **Table 3** include only shoreline segments with contact probabilities greater than 0.5% within 30 days; other coastal areas could be affected at lower contact probabilities within 30 days, or beyond 30 days from the spill. Additional NWRs and managed wildlife areas occur along the Gulf Coast. These areas include habitats such as barrier beach and dune systems, wetlands, and submerged seagrass beds that support diverse wildlife, including endangered or threatened species.

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 at the time of the spill (BOEM, 2017a). Oil that makes it to beaches may be 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 impacted because of the inherent toxicity of hydrocarbon and non-hydrocarbon components of the spilled substances (Mendelssohn et al., 2012, Lin et al., 2016). 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 *Deepwater Horizon* spill, Silliman et al. (2012) reported that previously healthy marshes largely recovered to a pre-oiling state within 18 months. At 103 salt marsh locations that spanned 267 miles (430 km) of shoreline in Louisiana, Mississippi, and Alabama, Silliman et al. (2016) determined a threshold for oil impacts on marsh edge erosion with higher erosion rates occurring for approximately 1 to 2 years after the *Deepwater Horizon* spill at sites with the highest amounts of plant stem oiling (90% to 100%). Thus, displaying a large-scale ecosystem loss. In addition to the direct impacts of oil, cleanup activities in marshes may accelerate rates of erosion and retard recovery rates (BOEM, 2017a). Impacts associated with an extensive oiling of coastal wetland habitat are expected to be significant.

In addition to the direct impacts of oil, cleanup activities in marshes may accelerate rates of erosion and retard recovery rates (BOEM, 2017a). 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 are expected to be significant.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on coastal habitats are expected.

C.8 Socioeconomic and Other Resources

C.8.1 Recreational and Commercial Fishing

Potential impacts to recreational and commercial fishing are analyzed by BOEM (2017a). The major species sought by commercial fishermen in federal waters of the Gulf of Mexico include shrimp, menhaden, red snapper, tunas, and groupers (BOEM, 2017a). However, most of the fishing effort for these species is on the continental shelf in shallow waters. 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, Beerkircher et al., 2009). Pelagic longlining has occurred historically in the project area, primarily during spring and summer.

It is unlikely that any commercial fishing activity other than longlining will occur at 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) (Stiles et al., 2007). Tilefishes (primarily *Lopholatilus 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, Keithly and Roberts, 2017). In deeper water, the main attraction to recreational fishers would be petroleum platforms in offshore waters of Texas and Louisiana. Due to distance from shore, it is unlikely that recreational fishing activity is occurring in the project area.

The only routine IPF that could potentially affect fisheries (commercial and recreational) is vessel presence (including noise and lights). Two types of potential accidents are also addressed in this section (a small fuel spill and a large oil spill).

Impacts of Vessel Presence

There is a slight possibility of pelagic longlines becoming entangled in the DP MODU or installation 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.

No adverse impacts on fishing activities 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 Fuel Spill

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area, the duration of a small spill and opportunity for impacts to occur would be very brief.

Pelagic longlining activities in the project area, if any, could be interrupted in the event of a small fuel spill. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions. Fishing activities could be interrupted due to the activities of response vessels operating in the project area. A small fuel spill would not affect coastal water quality because the spill would not be expected to make landfall or reach coastal waters prior to breaking up (see **Section A.9.2**).

Impacts of a Large Oil Spill

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

Table 6. (Continued).

Pelagic longlining activities in the project 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 from the *Deepwater Horizon* incident 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 Exclusive Economic Zone. 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, 2017a), 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. However, most species of commercially valuable fish in the Gulf of Mexico have planktonic eggs or larvae which may be affected by a large oil spill in deep water (BOEM, 2017a). 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, 2017b). Loss of consumer confidence and public health concerns can lead to the potential for economic loss since it is likely to result in seafood being withdrawn from the market. A loss of consumer confidence may also lead to price reductions or outright rejection of seafood products by commercial buyers and consumers. Quantifying financial loss due to loss in market confidence can be difficult, because it depends on reliable data being available to demonstrate both that sales have been lost and that prices have fallen as a direct consequence of the spill (ITOPF, 2014). An analysis of the effects of the *Deepwater Horizon* incident on the seafood industry in the Gulf of Mexico estimated that the spill reduced total seafood sales by $51.7 to $952.9 million, with an estimated loss of 740 to 9,315 seafood related jobs (Carroll et al., 2016).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of a large spill, impacts to recreational and commercial fishing are expected to be adverse, but likely temporary. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on fishing activities are expected.

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 fuel spill that is dissipated within a few days would have little or no impact on public health and safety, as the spill response would be completed entirely offshore. A large oil spill is the only IPF that has the potential to affect public health and safety.

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 the OSRP, and, in addition, the DP MODU or installation vessel maintains a Shipboard Oil Pollution Emergency Plan as required under MARPOL 73/78.

Table 6. (Continued).

Depending on the spill rate and duration, the physical/chemical characteristics of the oil, the 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, through skin contact or inhalation of VOCs. Crude oil is a highly flammable material, and any smoke or vapors from a crude oil fire can cause irritation. Exposure to large quantities of crude oil may pose a health hazard.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on public health and safety are expected.

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 installation activities with support from existing shore-based 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, existing offshore and coastal infrastructure (including major sources of supplies, services, energy, and water). A small 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. A large oil spill is the only IPF that has the potential to affect employment and infrastructure.

Impacts of a Large Oil Spill

Potential socioeconomic impacts of an oil spill are discussed by BOEM (2016b, 2017a). For this DOCD, there are no unique site-specific issues with respect to employment and coastal infrastructure. A large spill could cause several types of economic impacts: extensive fishery closures could put fishermen out of work; temporary employment could increase as part of the response effort; adverse publicity could reduce employment in coastal recreation and tourism industries; and OCS drilling activities, including service and support operations that are an important part of local economies, could be suspended.

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, 2017a). Net employment impacts from a spill would not be expected to exceed 1% of baseline employment in any given year (BOEM, 2017a).

The project area is 141 miles (227 km) from the nearest shoreline. Based on the 30-day OSRA modeling predictions (**Table 3**), shoreline contact is unlikely within the first 3 days following a spill (<0.5% conditional probability). Within 10 days, there is a 1% probability of contact with six Texas counties (from Cameron to Matagorda counties). Within 30 days, shoreline segments of 11 Texas counties and one Louisiana parish have a 1% to 10% probability of being contacted. Matagorda County, Texas, has the highest probability of shoreline contact (10%) within 30 days of a spill.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on employment and infrastructure are expected.

Table 6. (Continued).

C.8.4 Recreation and Tourism

For this DOCD, there are no unique site-specific issues with respect to this activity. There are no known recreational uses of the project area. Recreational resources and tourism in coastal areas would not be affected by routine activities due to the distance from shore. Compliance with NTL BSEE-2015-G013 (See **Table 1**) will minimize the chance of trash or debris being lost overboard from the DP MODU or installation vessel and subsequently washing up on beaches. There are no known recreational or tourism activities occurring in the project area, and as explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up. Therefore, a small fuel spill in the project area would be unlikely to affect recreation and tourism. A large oil spill is the only IPF that has the potential to affect recreation and tourism.

Impacts of a Large Oil Spill

Potential impacts of an oil spill on recreation and tourism are discussed by BOEM (2017a). 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. Loss of tourist confidence and public health concerns can then lead to the potential for economic loss. Media coverage of oil contamination, or word-of-mouth, can have implications on public perception of the incident.

However, quantifying financial loss due to loss in confidence can be difficult because it depends on implementation of an effective response plan as well as a strategy to restore any loss of appeal to tourists that the area may have suffered.

Based on the 30-day OSRA modeling results summarized in **Table 3** predict that shoreline contact is unlikely within the first 3 days following a spill (<0.5% conditional probability). Within 10 days, there is a 1% probability of contact with six Texas counties (from Cameron to Matagorda counties). Within 30 days, shoreline segments of 11 Texas counties and one Louisiana parish have a 1% to 10% probability of being contacted. Matagorda County, Texas, has the highest probability of shoreline contact (10%) within 30 days of a spill.

According to BOEM (2017a), 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 to affect large to affect 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, 2017a).

Impacts of the *Deepwater Horizon* incident 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 *Deepwater Horizon* incident 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).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts.

Table 6. (Continued).

DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on recreation and tourism are expected.

C.8.5 Land Use

Land use along the northern Gulf coast is discussed by BOEM (2016b, 2017a). There are no routine IPFs potentially affecting 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 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 accident IPF. A small fuel spill would not have 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 *Deepwater Horizon* incident, 25 temporary staging areas were established in Louisiana, Mississippi, Alabama, and Florida for spill response and cleanup efforts (BOEM, 2012a). In the event of a large spill in the project area, similar temporary staging areas could be needed. These areas would eventually return to their original use as the response is demobilized.

An 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) state 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 *Deepwater Horizon* incident and response, USEPA reported that existing landfills receiving oil spill waste had sufficient capacity to handle waste volumes; the wastes that were disposed of in landfills represented less than 7% of the total daily waste normally accepted at these landfills (USEPA, 2016).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on land use are expected.

C.8.6 Other Marine Uses

The project area is not located within any USCG-designated fairway or shipping lane. The project area is in Military Warning Area W-602. Shell will comply with BOEM requirements and lease stipulations to avoid impacts on uses of the area by military vessels and aircraft.

The shallow hazard assessment (Geoscience Earth & Marine Services, 2001, 2004, Fugro Geoservices Inc., 2015, Shell, 2017, Oceaneering, 2018) identified existing wells, pipelines, and umbilical within 1,000 ft (305 m) of the proposed well work and subsea installations. A large oil spill is the only relevant IPF. A small fuel spill would not have impacts on other marine uses because the spill and response activities would be mainly within the project area, and the duration would be brief.

Impacts of a Large Oil Spill

An accidental spill would be unlikely to significantly affect shipping or other marine uses. The lease block is not located within any USCG-designated fairway, shipping lane, or Military Warning Area. In the event of a large spill requiring numerous response vessels, coordination would be required to manage the vessel traffic for safe operations. Shell will comply with BOEM requirements and lease stipulations to avoid impacts on uses of the area by military vessels and aircraft.

Table 6. (Continued).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Therefore, no significant spill impacts on other marine uses are expected.

C.9 Cumulative Impacts

For purposes of NEPA, 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 and/or time period, substantial impacts may result.

Prior Studies. Prior to the lease sales, BOEM and its predecessors prepared multisale EISs to analyze the environmental impact of activities that might occur in the multisale area. BOEM and its predecessors also analyzed the cumulative impacts of OCS exploration activities similar to those planned in this DOCD in several documents. The level and types of activities planned in Shell's DOCD are within the range of activities described and evaluated by BOEM (2012a, b, 2013, 2014a, 2015, 2016a, b, 2017a). Past, present, and reasonably foreseeable activities were identified in the cumulative effects scenario of these documents, which are incorporated by reference. The proposed action will 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. Shell does not anticipate other projects in the vicinity of the project area beyond the types of projects analyzed in the lease sale and Supplemental EISs (BOEM, 2012a, 2013, 2014a, 2015, 2016b, 2017a).

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 impact 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 EISs considered exploration, delineation, and development 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 Shell'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, in conjunction with the other reasonably foreseeable activities expected to occur in the Gulf of Mexico. Thus, for all impacts, the incremental contribution of Shell's proposed actions to the cumulative impacts analysis in these prior analyses is not significant.

C.9.1 Cumulative Impacts to Physical/Chemical Resources

The work planned in this DOCD is limited in geographic scope and duration, and the impacts on the physical/chemical environment will be correspondingly limited.

Air Quality. Emissions from pollutants into the atmosphere from activities are not projected to have significant effects on onshore air quality because of the distance from shore, the prevailing atmospheric conditions, emission rates and heights, and resulting pollutant concentrations. As BOEM found in the multisale EISs, the incremental contribution of activities similar to Shell's proposed activities to the cumulative impacts is not significant and will not cause or contribute to a violation of NAAQS (BOEM, 2012a, 2013, 2014a, 2015, 2016b, 2017a). In addition, the cumulative contribution to visibility impairment is also very small. As mentioned in previous sections, projected emissions meet the BOEM exemption criteria.

Table 6. (Continued).

Climate Change. CO_2 and CH_4 emissions from the project would constitute a negligible contribution to greenhouse gas emissions from all OCS activities. According to BOEM (2013), greenhouse gas emissions from all OCS oil and gas activities make up a very small portion of national CO_2 emissions and BOEM does not believe that emissions directly attributable to OCS activities are a significant contributor to global greenhouse gas levels. Greenhouse gas emissions identified in this DOCD 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 of the climate change impacts evaluated in the previous EISs.

Water Quality. Shell's project may result in some minor water quality impacts due to the NPDES-permitted discharge of water based drilling fluids and associated cuttings, cuttings wetted with SBM, treated sanitary and domestic wastes, non-contact cooling water, deck drainage, desalination unit brine, blowout preventer fluid, well treatment and completion fluids, excess cement, water-based subsea production control fluid, hydrate inhibitor, treated seawater, uncontaminated fire water, bilge water and ballast water. These effects are expected to be minor (localized to the area within a few hundred meters of the DP MODU), and temporary (lasting only hours longer than the disturbance or discharge). Any cumulative effects to water quality are expected to be negligible.

Archaeological Resources. The lease block is not on the list of archaeology survey blocks (BOEM, 2011). The shallow hazards assessments (Geoscience Earth & Marine Services, 2001, 2004, Fugro Geoservices Inc., 2015, Shell, 2017, Oceaneering, 2018) did not identify any known shipwrecks or other archaeological artifacts on this lease block. The project area is well beyond the 60-m (197-ft) depth contour used by the BOEM as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. Therefore, Shell's operations will have no cumulative impacts on historic shipwrecks or prehistoric archaeological resources.

New Information. New information included in the most recent Programmatic, Supplemental, and Final EISs (BOEM, 2012a, 2013, 2014a, 2015, 2016a, 2016b, 2017a) has been incorporated into the EIA, where applicable.

C.9.2 Cumulative Impacts to Biological Resources

The work planned in this DOCD is limited in geographic scope and duration, and the impacts on biological resources will be correspondingly limited.

Seafloor Habitats and Biota. Effects on seafloor habitats and biota from discharges of drilling mud and cuttings and bottom disturbance associated with installation activities are expected to be minor and limited to a small area. As described previously, the geophysical surveys did not identify any features that could support high-density deepwater benthic communities in the project area (Geoscience Earth & Marine Services, 2001, 2004, Fugro Geoservices Inc., 2015, Shell, 2017, Oceaneering, 2018).

Areas that may support high-density deepwater benthic communities will be avoided as required by NTL 2009-G40. Soft bottom communities are ubiquitous along the northern Gulf of Mexico continental slope, and the extent of benthic impacts during this project is insignificant regionally. As noted in the multisale EISs, the incremental contributions of activities similar to Shell's proposed activities to the cumulative impacts is not determined to be significant (BOEM, 2012a, b, 2013, 2014a, 2015, 2016b, 2017a).

Threatened, Endangered, and Protected Species. Threatened, Endangered, and protected species that could occur in the project area include the sperm whale, Bryde's whale, oceanic whitetip shark, giant manta ray, and five species of sea turtles. Potential impact sources include vessel presence including noise and lights, marine debris, and support vessel and aircraft traffic. Potential effects for these species would be limited and temporary and would be reduced by Shell's compliance with

Table 6. (Continued).

BOEM-required mitigation measures, including NTLs BSEE-2015-G013 and BOEM-2016-G01 and NMFS (2020) Appendix B and C. No significant cumulative impacts are expected.

Coastal and Marine Birds. Birds may be exposed to contaminants, including air pollutants and routine discharges but significant impacts are unlikely due to rapid dispersion. Shell's compliance with NTL BSEE-2015-G013 will minimize the likelihood of debris-related impacts on birds. Support vessel and helicopter traffic may disturb some foraging and resting birds; however, it is likely that individual birds would experience, at most, only short-term behavioral disruption.

Due to the limited scope, timing, and geographic extent of installation activities, collisions or other adverse effects are unlikely, and no significant cumulative impacts are expected.

Fisheries Resources. Exploration and production structures occur in the vicinity of the project area. The additional effect of the proposed installation activity would be negligible.

Coastal Habitats. Due to the distance from shore, routine activities are not expected to have any impacts on beaches and dunes, wetlands, seagrass beds, coastal wildlife refuges, wilderness areas, or any other managed or protected coastal area. The support bases at Port Fourchon, Louisiana and Galveston, Texas, are not in wildlife refuge or wilderness areas. Support operations, including the crew boat and supply boats, may have a minor incremental impact on coastal habitats. Over time with a large number of vessel trips, vessel wakes can erode shorelines along inlets, channels, and harbors. Impacts will be minimized by following the speed and wake restrictions in harbors and channels.

New Information. New information included in the most recent Programmatic, Supplemental, and Final EISs (BOEM, 2012a, b, 2013, 2014a, 2015, 2016a, 2016b, 2017a) has been incorporated into the EIA, where applicable.

C.9.3 Cumulative Impacts to Socioeconomic Resources

The work planned in this DOCD is limited in geographic scope and duration, and the impacts on socioeconomic resources will be correspondingly limited.

The multisale and Supplemental and Final EISs analyzed the cumulative impacts of oil and gas exploration and development in the project area, in combination with other impact-producing activities, on commercial fishing, recreational fishing, recreational resources, historical and archaeological resources, land use and coastal infrastructure, demographics, and environmental justice (BOEM, 2012a, 2013, 2014a, 2015, 2016b, 2017a). BOEM also analyzed the economic impact of oil and gas activities on the Gulf States, finding only minor impacts in most of Texas, Mississippi, Alabama, and Florida, more significant impacts in parts of Texas, and substantial impacts on Louisiana.

Shell's proposed activities will have negligible cumulative impacts on socioeconomic resources. There are no IPFs associated with routine operations that are expected to affect public health and safety, employment and infrastructure, recreation and tourism, land use, or other marine uses. Due to the distance from shore, it is unlikely that any recreational fishing activity is occurring in the project area, and it is unlikely that any commercial fishing activity other than longlining occurs at or near the project area. The project will have negligible impacts on fishing activities.

New Information. New information included in the most recent Programmatic, Supplemental, and Final EISs (BOEM, 2012a, b, 2013, 2014a, 2015, 2016a, 2016b, 2017a) has been incorporated into the EIA, where applicable.

D. Environmental Hazards

D.1 Geologic Hazards

Based on the results of high-resolution geophysical surveys and re-processed three-dimensional seismic data, the proposed subsea equipment installation appear suitable for the planned activities (Geoscience Earth & Marine Services, 2001, 2004, Fugro Geoservices Inc., 2015, Shell, 2017, Oceaneering, 2018).

See DOCD Section 6a for supporting geological and geophysical information.

Table 6. (Continued).

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 DP MODU or installation vessel. High winds and limited visibility during a severe storm could disrupt communication and support activities (vessel and helicopter traffic) and make it necessary to suspend some activities on the DP MODU or installation vessel for safety reasons until the storm or weather event passes. In the event of a hurricane, procedures in Shell's Hurricane Evacuation Plan would be followed.

D.3 Currents and Waves

A rig-based acoustic Doppler current profiler will be used to continuously monitor the current beneath the rig. Metocean conditions such as sea states, wind speed, ocean currents, etc., will also be continuously monitored. Under most circumstances, physical oceanographic conditions are not expected to have any effect on the proposed activities. Strong currents (caused by Loop Current eddies and intrusions) and large waves were considered in the design criteria for the DP MODU or installation vessel. High waves during a severe storm could disrupt support activities (i.e., vessel and helicopter traffic) and make it necessary to suspend some activities on the DP MODU or installation vessel for safety reasons until the storm or weather event passes.

E. Alternatives

No formal alternatives were evaluated in this DOCD. However, various technical and operational options, including the location of the proposed well work and subsea installation and the selection of a DP MODU or installation vessel, were considered by Shell in developing the proposed action. There are no other reasonable alternatives to accomplish the goals of this project.

F. Mitigation Measures

The proposed action includes numerous mitigation measures required by laws, regulations, and BOEM lease stipulations and NTLs. The project will comply with applicable federal, state, and local requirements concerning air pollutant emissions, discharges to water, and solid waste disposal. Project activities will be conducted under Shell's OSRP and will include the measures described in DOCD Section 2f.

G. Consultation

No persons beyond those cited as Preparers (**Section H, Preparers**) or agencies were consulted regarding potential impacts associated with the proposed activities during the preparation of the EIA.

H. Preparers

The EIA was prepared for Shell Offshore Inc. by its contractor, CSA Ocean Sciences Inc. Contributors included the following:

- Kathleen Gifford (Project Scientist, CSA Ocean Sciences Inc.);
- John Tiggelaar (Project Scientist, CSA Ocean Sciences Inc.);
- Tracy Albert (Regulatory Specialist, Shell Exploration & Production Co.);
- Sylvia Bellone (Regulatory Specialist, Shell Exploration & Production Co.);

Table 6. (Continued).

- Joshua O'Brien (Senior Environmental Engineer, Shell Exploration & Production Co.);
- Stacey Frickey Maysonave (Geophysical Technician, Shell Exploration & Production Co.);
- Jeremy Piefer (BOM/FEDM, Shell Exploration & Production Co.);
- Michael Teoh (Well/Drilling Engineer, Shell Exploration & Production Co.);
- Matthew Schmitz (Project Lead, Shell Exploration & Production Co.);
- Charles Bopp (Geoscientist, Shell Exploration & Production Co.);
- Christine Hahn (Petrophysical Engineer, Shell Exploration & Production Co.);
- Rahul Kaveeshwar (Subsea Engineer, Shell Exploration & Production Co.);
- Tim Langford (Shell Exploration & Production Co.); and
- Brian Diunizio (GIS Specialist, CSA Ocean Sciences Inc.).

Table 6. (Continued).

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SECTION 19: ADMINISTRATIVE INFORMATION

A. Exempted Information Description (Public Information Copies Only)

The following attachments were excluded from the public information copies of this plan:

Section 1B OCS Plan Information form – Bottom hole locations & proposed total depth
Section 2J Blowout Scenario – confidential information for NTL 2015 N01 calculation
Section 3A Geologic Description
Section 3B Structure Contour Maps
Section 3C Interpreted 2D or 3D seismic line(s)
Section 3D Cross Section(s)
Section 3E Stratigraphic Column with Time vs. depth table

B. Bibliography

CSA Environmental Impact Analysis

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