

UNITED STATES GOVERNMENT  
MEMORANDUM

September 5, 2018

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

Control # - S-07901  
Type - Supplemental Exploration Plan  
Lease(s) - OCS-G32954 Block - 380 Alaminos Canyon Area  
OCS-G32964 Block - 424 Alaminos Canyon Area  
Operator - Shell Offshore Inc.  
Description - Subsea Wells  
Rig Type - E, F, G, EE, FF, GG, FFF, GGG, D, A, E, EE, AA, DD, EEE, AAA, DDD and E  
Not Found

Attached is a copy of the subject plan.

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

Leslie Wilson  
Plan Coordinator

Site Type/Name	Botm Lse/Area/Blk	Surface Location	Surf Lse/Area/Blk
WELL/A	G32964/AC/424	5139 FSL, 5968 FEL	G32964/AC/424
WELL/AA	G32964/AC/424	5239 FSL, 5968 FEL	G32964/AC/424
WELL/AAA	G32964/AC/424	5139 FSL, 6068 FEL	G32964/AC/424
WELL/D	G32964/AC/424	4268 FNL, 4997 FWL	G32964/AC/424
WELL/DD	G32964/AC/424	4168 FNL, 4997 FWL	G32964/AC/424
WELL/DDD	G32964/AC/424	4268 FNL, 4897 FWL	G32964/AC/424
WELL/E	G32964/AC/424	464 FNL, 5650 FEL	G32954/AC/380
WELL/E1	G32964/AC/424	464 FNL, 5650 FEL	G32964/AC/424
WELL/EE	G32964/AC/424	464 FNL, 5750 FEL	G32954/AC/380
WELL/EE1	G32964/AC/424	564 FNL, 5650 FEL	G32964/AC/424
WELL/EEE	G32964/AC/424	464 FNL, 5750 FEL	G32964/AC/424
WELL/F	G32954/AC/380	108 FSL, 7370 FEL	G32954/AC/380
WELL/FF	G32954/AC/380	208 FSL, 7370 FEL	G32954/AC/380
WELL/FFF	G32954/AC/380	108 FSL, 7470 FEL	G32954/AC/380





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United States of America  
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**Public Information Copy**

August 17, 2018

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: Amendment to Supplemental Exploration Plan S-7901  
Aliminos Canyon Blocks 380 & 424, OCS-G 32954 & G32964  
Offshore Texas

Dear Mrs. Picou:

In compliance with 30 CFR 550.211 and NTLs 2008-G04, 2009-G27 and 2015-N01, giving Exploration Plan guidelines, Shell Offshore Inc. (Shell) requests your approval of this amendment to subject Supplemental Exploration Plan for drilling of seventeen (17) subsea well bottom hole locations.

Anadarko submitted plan S-7901 and Shell is amending this EP for change of operator. 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 was provided by Anadarko in their plan.

Anadarko provided BOEM with the following report during their submittal in April 2018: *Geoscience Earth & Marine Services, Inc. (GEMS) Project Number 0817-2703*.

Should you require additional information, please contact Tracy Albert at 504.425.4652, [tracy.albert@shell.com](mailto:tracy.albert@shell.com), or myself at 504.425.7215.

Sincerely,

A handwritten signature in blue ink that reads "Sylvia A. Bellone".

Sylvia A. Bellone



## Cost Recovery Fee

6/4/2018

Pay.gov - Receipt



### Receipt

#### Your payment is complete

Pay.gov Tracking ID: 26A3B11B  
Agency Tracking ID: 75501176204  
Form Name: BOEM Exploration Plan  
Application Name: BOEM Exploration Plan - BF

#### Payment Information

Payment Type: Debit or credit card  
Payment Amount: \$18,365.00  
Transaction Date: 06/04/2018 10:12:28 AM EDT  
Payment Date: 06/04/2018  
Region: Gulf of Mexico  
Contact: Bridget O'Farrell 832-636-1694  
Company Name/No: Anadarko Petroleum Corporation, 00981  
Lease Number(s): 32954, 32964, , ,  
Area-Block: Alaminos Canyon AC, 380: Alaminos Canyon AC, 424: , : , : ,  
Surface Locations: 5

#### Account Information

Cardholder Name: Bridget O'Farrell  
Card Type: Visa  
Card Number: \*\*\*\*\*9234

#### Email Confirmation Receipt

Confirmation Receipts have been emailed to:  
Bridget.OFarrell-Villarreal@anadarko.com

AC 380 E & EE (AC 424 Surface), uses AC 424 E site clearance letter (within 500' radius)  
AC 380 F, FF, FFF (within 500' radius)  
AC 380 G, GG, GGG (within 500' radius)  
AC 424 A, AA, AAA (within 500' radius)  
AC 424 D, DD, DDD (within 500' radius)  
AC 424 E & EE, EEE (within 500' radius)





**SHELL OFFSHORE INC.**

**SUPPLEMENTAL EXPLORATION PLAN**

*For*

**ALAMINOS CANYON BLOCK 380/424  
OCS-G 32954/OCS-G 32964**

**PUBLIC INFORMATION COPY**

**AUGUST 2018**

**PREPARED BY:**

**Tracy W. Albert**  
***Regulatory Specialist***

**504.425.4652**

**[tracy.albert@shell.com](mailto:tracy.albert@shell.com)**



**REVISIONS TABLE:**

Date of Request	Plan Section	What was Corrected	Date Resubmitted
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**SUPPLEMENTAL EXPLORATION PLAN  
OFFSHORE LOUISIANA**

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## **SECTION 1: PLAN CONTENTS**

### **A. DESCRIPTION, OBJECTIVES & SCHEDULE**

Under this amended Supplemental Exploration Plan (EP/SEP), Shell Offshore Inc. (Shell) proposes to drill, complete and flow test the following wells in Alaminos Canyon 380/424. There are 6 surface locations in Alaminos Canyon 380, and 9 surface locations in Alaminos Canyon 424.

AC 380 E & EE (AC 424 Surface); AC 380 F, FF, FFF; AC 380 G, GG, GGG  
AC 424 A, AA, AAA; AC 424 D, DD, DDD; AC 424 E1 & EE, EEE

We had originally envisioned the AC 424 SHLs for the E and twins (E1, EE, and EEE) having bottom holes on 424, and two of them (E and EE) also having a shared BHL in 380. In other words, having names based on bottom hole be: AC 424 E1, EE, and EEE and AC 380 E and EE. (Five BHLs for six SHLs.)

The lease is 164 statute miles from the nearest shoreline, 318 statute miles from the onshore support base at Port Fourchon, Louisiana and 190 statute miles from the helicopter base at Galveston, Texas. Water depths at the well sites range from ~6,447' to ~7,251' (Attachment 1A).

The proposed rig is either a dynamically positioned (DP) semi-submersible (Atwood Condor or similar) or a Drill Ship (Noble Don Taylor or similar). Both are self-contained drilling vessels with accommodations for a crew which include quarters, galley and sanitation facilities. The drilling 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 1D through 1J).

### **C. RIG SAFETY AND POLLUTION FEATURES**

The rig (Atwood Condor or similar DP semi-submersible or Noble Don Taylor 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 can be discharged directly overboard. These are mostly located around the main deck and outboard in places where it is unlikely that hydrocarbons will be found.

Drains within 50 feet of a designated chemical storage area which uses the weather deck as a primary containment means shall be designated "normally plugged." An adequate number of drains around the rig shall be designated as "normally open" to allow run-off of rain water. Normally open drains shall have a plug located in a conspicuous area near the drain which can be easily installed in the event of a spill.

The rig's drain plug program consists at a minimum of a weekly check of all deck drains leading to the sea to verify that their status is as designated. If normally open they shall verify that the drain is open and that the plug is available in the area. If normally closed they shall verify that the plug is securely installed in the drain.

In the event a leak or spill is observed, the event shall be contained (drain plug installation and/or spill kit deployment as appropriate) and reported immediately.

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 contain hydrocarbons and cannot be discharged overboard. When oil-based mud is used for drilling it will have to be collected in portable tanks and sent to shore for processing.

### **3) Mud Drain System**

None

### **4) Oily Water Processing**

Oily 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 has to be sent ashore for disposal. On board the MODU an oil record log has to be kept according to instructions included in the log. Any and all pollution pans are subjected to a sheen test before being pumped out. If the water passes the sheen test then it is pumped overboard. If it does not pass the sheen test then the water/oil mixture is pumped to a dirty oil tank and sent to shore for disposal. 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.

### **5) Lower Hull Bilge System**

- The main bilge system is designed to drain the pontoons. There are Goulds electrically driven, self-priming centrifugal pumps - one for each main pump room. The aux pumps can be pump out with the bilge pump but has to be lined up manually from the main pump room.
- Bilge water is pumped overboard after a sheen test has been completed.



- The pontoon bilge pumps are operable from the Bridge and have audible and visual bilge alarms set for high and low levels.
- Portable submersible pumps are carried onboard the rig to service all column void spaces and are also used for emergency bilge pumps in the event of the main pump room flooding.
- Alternate means of pumping the bilges in each pontoon pump room include the use of:
  - The ballast system emergency bilge valve which is operated from the control panel.
  - Portable submersible pumps
  - Emergency bilge suction line connected directly to the ballast manifold. (Main Pump rooms only)

The Bilge pumps are manual/automatic type pumps. They are equipped with sensors that give a high and a high-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.

## **6) Emergency Bilge System**

Main ballast pumps may also be used for emergency bilge pumping directly from the pump rooms via remotely actuated direct bilge suction valves on the ballast system. These valves will operate in a fully flooded compartment. The ballast pumps can be supplied from the emergency switchboard.

## **7) 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 has to be sent ashore for disposal. On board all drilling Units, an oil record log has to be kept according to instructions included in the log. The rig floor has two skimmer tanks and each is subjected to a sheen test before pumping overboard to ensure environmental safety. All three anchor winch windlasses have skimmer tanks and are subjected to sheen tests before discharge as well.

## **8) 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.

## **9) Rig Floor Drainage**

The rig floor is typically outfitted with a Facet International MAS 34-3 separator. The separator has coalescent plates that remove the solids from the drainage and the remaining drainage goes to a skimmer tank. From the skimmer tank it is drained to one of the column dirty oil tank systems where it is then sent through 2 separators and cleaned further to reduce oil content to less than 15 ppm.

## **10) Columns #3 & 4**

The drains on the decks and machinery spaces are separated at mid ship and directed to either the #3 or #4 columns. The separators in these columns go through three cycles of circulation and remove oil to <15 ppm, then discharge the clean product to sea.

## **11) 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.



## 12) 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 has to be filled out.
- The oily water collection tank overflow valve is closed.
- The drill floor drains are lined-up to the drill floor skimmer tank. The skimmer tanks have a high alarm which sounds by means of an air horn. Before tanks are pumped out a sheen test is performed. Water is pumped out the skimmer tanks down the shunt line. Oil containment side is pumped out into 550 gal tote tanks.
- The BOP test area drains are normally lined-up to drain overboard.
- 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.
- The bilge system is normally pumped directly overboard after a sheen test has been performed.
- The engine dirty oil sump can be drained down in port column oily water separator which discharges water overboard from the water side and oil being pumped out into a 550 gal tote tank oil containment side. There is a high audible alarm on the ballast control panel.

### D. Storage Tanks – Atwood Condor DP Semi-Submersible or similar:

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		Marine Diesel (0.91 SG)
Diesel Tank in stbd 2	Drilling Rig	2713	1		Marine Diesel (0.91 SG)
Diesel Tank in stbd 3	Drilling Rig	3456	1		Marine Diesel (0.91 SG)
Diesel Tank in stbd 4	Drilling Rig	653	1		Marine Diesel (0.91 SG)
Diesel Tank in port 1	Drilling Rig	2090	1		Marine Diesel (0.91 SG)
Diesel Tank in port 2	Drilling Rig	1366	1		Marine Diesel (0.91 SG)
Diesel Tank in port 3	Drilling Rig	4787	1		Marine Diesel (0.91 SG)
Diesel Tank in port 4	Drilling Rig	3456	1		Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	129	1		Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	129	1		Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	139	1		Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	129	1		Marine Diesel (0.91 SG)
Diesel Day Tank	Drilling Rig	100	1		Marine Diesel (0.91 SG)
Diesel Day Tank	Drilling Rig	115	1		Marine Diesel (0.91 SG)
Diesel Day Tank	Drilling Rig	114	1		Marine Diesel (0.91 SG)
Diesel Day Tank	Drilling Rig	115	1		Marine Diesel (0.91 SG)
Lube Oil Tank	Drilling Rig	86.25	4	345	Lube Oil (0.91 SG)



**Storage Tanks – Noble Don Taylor Drillship or similar:**

Type of Storage Tank	Type of Facility	Tank Capacity (bbls)	Number of Tanks	Total Capacity (bbls)	Fluid Gravity (Specific)
Fuel oil	Drilling Rig	2,889	4	11,556	Marine Diesel (0.91 SG)
Fuel oil	Drilling Rig	3,225	4	12,900	Marine Diesel (0.91 SG)
Fuel oil	Drilling Rig	2,887	4	11,548	Marine Diesel (0.91 SG)
Fuel oil	Drilling Rig	2,680	4	10,720	Marine Diesel (0.91 SG)
Fuel oil	Drilling Rig	178	8	1,424	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**

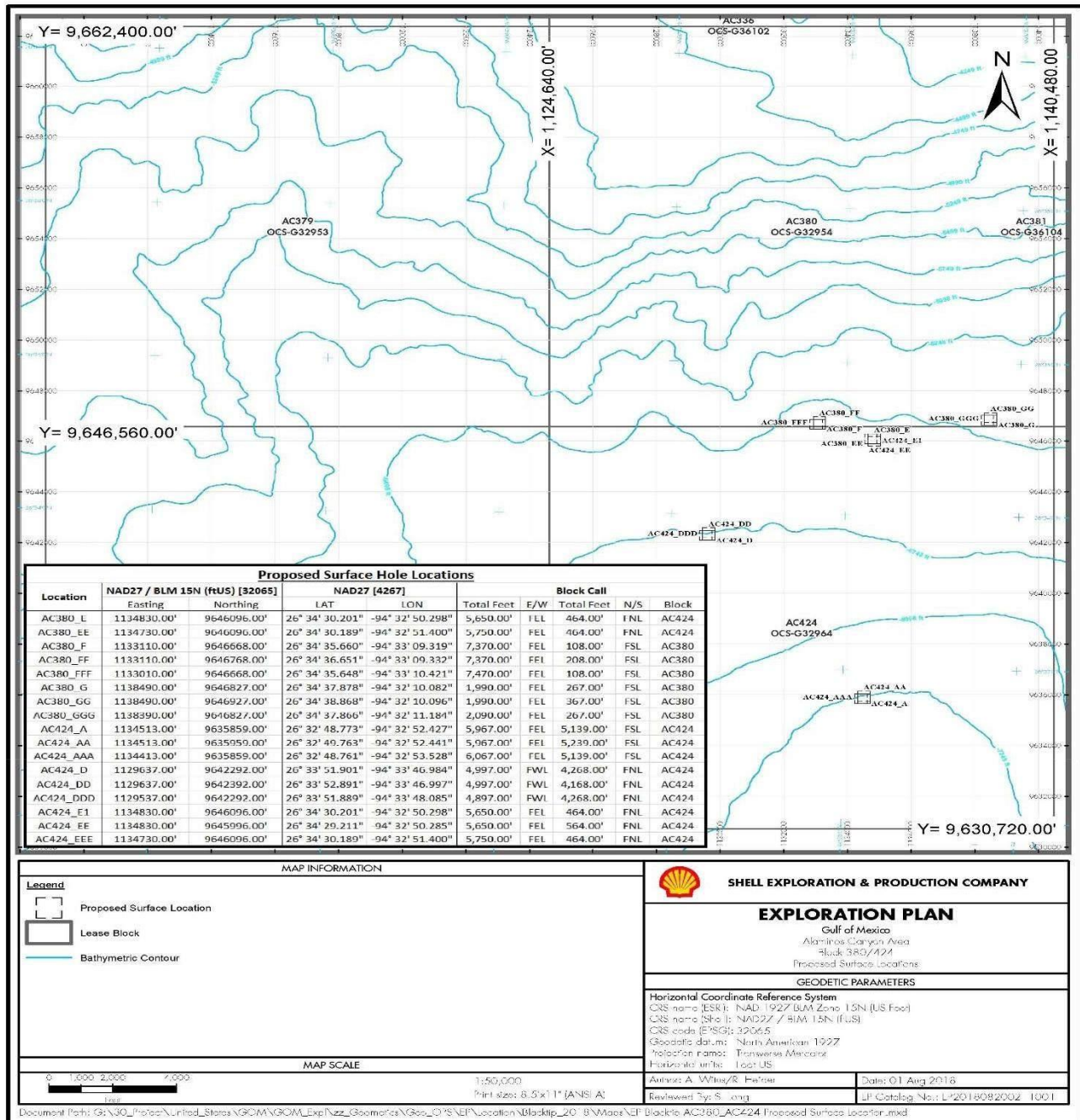
- HSE (health safety and environment) are the primary topics in pre-tour and pre-job safety meetings. The discussion around no harm to people or environment is a key mindset. All personnel are reminded daily to inspect work areas for safety issues as well as potential pollution issues.
- All tools that 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 on a checklist. The checklist is used daily to verify drain plugs are installed.
- 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.
- The rig is involved in a recycling program for cardboard, plastic, paper, glass and aluminum.
- Fuel hoses and SBM are changed on annual basis.
- TODO spill prevention fittings are installed on all liquid take on hoses.
- Waste paint thinner is recycled on board with a solvent still to reduce hazard of shipping and storage.
- All equipment on board utilizes Envirorite hydraulic fluid as opposed to hydraulic oil.
- Shell has obtained ISO14001 certification.
- Shell uses low sulfur fuel.

**G. Description of Previously Approved Lease Activities**

The leases covered in this plan do not have previous activity.



## Attachment 1A - Bathymetry and Surface Locations





**Attachment 1B - Bottom-Hole Locations**

Omitted from Public Information Copies



OCS PLAN INFORMATION FORM

General Information													
Type of OCS Plan:	X	Exploration Plan (EP)	Development Operations Coordination Document (DOCD)										
Company Name: Shell Offshore Inc.							BOEM Operator Number: 0689						
Address: 701 Poydras St., Room 2418							Contact Person: Tracy Albert						
New Orleans, LA 70131							Phone Number: 504.425.4652						
							Email Address: tracy.albert@shell.com						
If a service fee is required under 30 CFR 550.125(a) provide:							Amount Paid: \$18,365			Receipt Nos. 26A3B1B			
Project and Worst-Case Discharge (WCD) Information													
Lease(s) OCS-G 32954, 32964				Area: AC			Block(s): 380, 424			Project Name: Blacktip			
Objectives(s):	X	Oil		Gas		Sulphur		Salt	Onshore Support Base(s) Fourchon & Galveston				
Platform/Well Name: D						Total Volume of WCD: 125,000 BOPD				API Gravity: 41°			
Distance to Closest Land (Miles): 164							Volume from uncontrolled blowout: 9.0 MMBBL						
Have you previously provided information to verify the calculations and assumptions of your WCD?											Yes	X	No
If so, provide the Control Number of the EP or DOCD with which this information was provided										NA			
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						See attached							
Development drilling													
Well completion and well flow testing						See attached							
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						See attached							
Installation of lease term pipelines													
Commence production													
Other (Specify and attach description)													
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	Other (attached description)							
Drilling Rig Name (If known): Noble Don Taylor or similar, Atwood Condor or Similar													
Description of Lease Term Pipelines													
From (Facility/Area/Block)			To (Facility/Area/Block)			Diameter (Inches)			Length (Feet)				
NA													



## Attachment 1C.1 Schedule

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

Well	Start date	Duration	End date
2018*	10/31/2018	61	12/31/2018
AC 380 E	1/1/2019	220	8/9/2019
AC 424 D	1/1/2020	220	8/8/2020
AC 380 F	1/1/2021	220	8/9/2021
AC 424 A	1/1/2022	220	8/9/2022
AC 380 G	1/1/2023	220	8/9/2023
AC 424 E1	1/1/2024	220	8/8/2024
AC 380 EE	1/1/2025	220	8/9/2025
AC 424 EE	1/1/2026	220	8/9/2026
AC 380 FF	1/1/2027	220	8/9/2027
AC 424 AA	1/1/2028	220	8/8/2028
AC 380 GG	1/1/2029	220	8/9/2029
AC 424 DD	1/1/2030	220	8/9/2030
AC 380 FFF	1/1/2031	220	8/9/2031
AC 424 EEE	1/1/2032	220	8/8/2032
AC 380 GGG	1/1/2033	220	8/9/2033
AC 424 AAA	1/1/2034	220	8/9/2034
AC 424 DDD	1/1/2035	220	8/9/2035

\*2018 contingency days only in case project is expedited for some reason.



**Attachment 1D**

Proposed Well/Structure Location											
Well or Structure Name/Number (if renaming well or structure, reference previous name): E					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		41°	
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32954				OCS-G 32964			OCS OCS			
Area Name	AC				AC						
Block No.	380				424						
Blockline Departure (in feet)	N/S Departure: 464' FNL							N/S Departure:			
	E/W Departure 5,650' FEL							N/S Departure: E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,134,830							X:			
	Y: 9,646,096							Y:			
Lat/Long	Latitude: 26.57506							Latitude			
	Longitude: -94.54731							Longitude			
Water Depth (Feet): 6,542'									MD (Feet)		TVD (Feet
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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): EE					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		41°	
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32954				OCS-G 32964			OCS OCS			
Area Name	AC				AC						
Block No.	380				424						
Blockline Departure (in feet)	N/S Departure: 464' FNL							N/S Departure:			
	E/W Departure 5,750' FEL							N/S Departure: E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,134,730							X:			
	Y: 9,646,096							Y:			
Lat/Long	Latitude: 26.57505							Latitude			
	Longitude: -94.54761							Longitude			
Water Depth (Feet): 6,545'									MD (Feet)		TVD (Feet
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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): F					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		41°	
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32954				OCS-G 32954			OCS OCS			
Area Name	AC				AC						
Block No.	380				380						
Blockline Departure (in feet)	N/S Departure: 108' FSL							N/S Departure:			
	E/W Departure 7,370' FEL							N/S Departure: E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,133,110							X:			
	Y: 9,646,668							Y:			
Lat/Long	Latitude: 26.57657							Latitude			
	Longitude: -94.55259							Longitude			
Water Depth (Feet): 6,549'									MD (Feet)		TVD (Feet
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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): FF					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	41°		
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32954				OCS-G 32954			OCS OCS			
Area Name	AC				AC						
Block No.	380				380						
Blockline Departure (in feet)	N/S Departure: 208' FSL							N/S Departure:			
	E/W Departure 7,370' FEL							N/S Departure: E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,133,110							X:			
	Y: 9,646,668							Y:			
Lat/Long	Latitude: 26.57657							Latitude			
	Longitude: -94.55259							Longitude			
Water Depth (Feet): 6,549'								MD (Feet)		TVD (Feet)	
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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): FFF					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		41°	
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32954				OCS-G 32954			OCS OCS			
Area Name	AC				AC						
Block No.	380				380						
Blockline Departure (in feet)	N/S Departure: 108' FSL							N/S Departure:			
	E/W Departure 7,470' FEL							N/S Departure: E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,133,010							X:			
	Y: 9,646,668							Y:			
Lat/Long	Latitude: 26.57657							Latitude			
	Longitude: -94.55289							Longitude			
Water Depth (Feet): 6,552'									MD (Feet)		TVD (Feet
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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 11**

Proposed Well/Structure Location											
Well or Structure Name/Number (if renaming well or structure, reference previous name): G					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		41°	
	Surface Location				Bottom Hole Location (for Wells)			Completion (for multiple enter separate lines)			
Lease Number	OCS-G 32954				OCS-G 32954			OCS OCS			
Area Name	AC				AC						
Block No.	380				380						
Blockline Departure (in feet)	N/S Departure: 267' FSL							N/S Departure:			
	E/W Departure 1,990' FEL							E/W Departure:			
Lambert X-Y Coord.	X: 1,138,490							X:			
	Y: 9,646,827							Y:			
Lat/Long	Latitude: 26.57719							Latitude			
	Longitude: -94.53613							Longitude			
Water Depth (Feet): 6,447'									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): GG					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		41°	
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32954				OCS-G 32954			OCS OCS			
Area Name	AC				AC						
Block No.	380				380						
Blockline Departure (in feet)	N/S Departure: 367' FSL							N/S Departure:			
	E/W Departure 1,990' FEL							N/S Departure: E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,138,490							X:			
	Y: 9,646,927							Y:			
Lat/Long	Latitude: 26.57746							Latitude			
	Longitude: -94.53614							Longitude			
Water Depth (Feet): 6,438'									MD (Feet)		TVD (Feet
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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): GGG					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	41°		
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32954				OCS-G 32954			OCS OCS			
Area Name	AC				AC						
Block No.	380				380						
Blockline Departure (in feet)	N/S Departure: 267' FSL							N/S Departure:			
	E/W Departure 2,090' FEL							N/S Departure: E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,138,390							X:			
	Y: 9,646,827							Y:			
Lat/Long	Latitude: 26.57719							Latitude			
	Longitude: -94.53644							Longitude			
Water Depth (Feet): 6,438'									MD (Feet)	TVD (Feet)	
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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): 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): 125,000 BOPD				For structures, volume of all storage and pipelines (bbls): NA			API Gravity of fluid		41°	
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32964				OCS-G 32964			OCS OCS			
Area Name	AC				AC						
Block No.	424				424						
Blockline Departure (in feet)	N/S Departure: 5,139' FSL							N/S Departure:			
	E/W Departure 5,968' FEL							E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,134,513							X:			
	Y: 9,635,859							Y:			
Lat/Long	Latitude: 26.54688							Latitude			
	Longitude: -94.54790							Longitude			
Water Depth (Feet): 7,251'									MD (Feet)		TVD (Feet
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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): AA					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	41°		
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32964				OCS-G 32964			OCS OCS			
Area Name	AC				AC						
Block No.	424				424						
Blockline Departure (in feet)	N/S Departure: 5,239' FSL							N/S Departure:			
	E/W Departure 5,968' FEL							E/W Departure:  E/W Departure:			
Lambert X-Y Coord.	X: 1,134,513							X:			
	Y: 9,635,959							Y:			
Lat/Long	Latitude: 26.54716							Latitude			
	Longitude: -94.54790							Longitude			
Water Depth (Feet): 7,215'								MD (Feet)		TVD (Feet)	
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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 1N**

Proposed Well/Structure Location											
Well or Structure Name/Number (if renaming well or structure, reference previous name): AAA					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		41°	
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32964				OCS-G 32964			OCS OCS			
Area Name	AC				AC						
Block No.	424				424						
Blockline Departure (in feet)	N/S Departure: 5,139' FSL							N/S Departure:			
	E/W Departure 6,068' FEL							N/S Departure: E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,134,413							X:			
	Y: 9,635,859							Y:			
Lat/Long	Latitude: 26.54688							Latitude			
	Longitude: -94.54820							Longitude			
Water Depth (Feet): 7,251'									MD (Feet)		TVD (Feet
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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 10**

Proposed Well/Structure Location											
Well or Structure Name/Number (if renaming well or structure, reference previous name): D					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		41°	
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32964				OCS-G 32964			OCS OCS			
Area Name	AC				AC						
Block No.	424				424						
Blockline Departure (in feet)	N/S Departure: 4,268' FNL							N/S Departure:			
	E/W Departure 4,997' FWL							E/W Departure:			
Lambert X-Y Coord.	X: 1,129,637							X:			
	Y: 9,642,292							Y:			
Lat/Long	Latitude: 26.54642							Latitude			
	Longitude: -94.56305							Longitude			
Water Depth (Feet): 6,746'								MD (Feet)		TVD (Feet)	
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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 1P**

Proposed Well/Structure Location											
Well or Structure Name/Number (if renaming well or structure, reference previous name): DD					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		41°	
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32964				OCS-G 32964			OCS OCS			
Area Name	AC				AC						
Block No.	424				424						
Blockline Departure (in feet)	N/S Departure: 4,168' FNL							N/S Departure:			
	E/W Departure 4,997' FWL							E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,129,637							X:			
	Y: 9,642,392							Y:			
Lat/Long	Latitude: 26.56469							Latitude			
	Longitude: -94.56305							Longitude			
Water Depth (Feet): 6,746'									MD (Feet)		TVD (Feet
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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 1Q**

Proposed Well/Structure Location											
Well or Structure Name/Number (if renaming well or structure, reference previous name): DDD					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		41°	
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32964				OCS-G 32964			OCS OCS			
Area Name	AC				AC						
Block No.	424				424						
Blockline Departure (in feet)	N/S Departure: 4,268' FNL							N/S Departure:			
	E/W Departure 4,897' FWL							E/W Departure:			
Lambert X-Y Coord.	X: 1,129,537							X:			
	Y: 9,642,292							Y:			
Lat/Long	Latitude: 26.56442							Latitude			
	Longitude: -94.56336							Longitude			
Water Depth (Feet): 6,746'									MD (Feet)		TVD (Feet
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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 1R**

Proposed Well/Structure Location											
Well or Structure Name/Number (if renaming well or structure, reference previous name): E1					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	41°		
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32964				OCS-G 32964			OCS OCS			
Area Name	AC				AC						
Block No.	424				424						
Blockline Departure (in feet)	N/S Departure: 464' FNL							N/S Departure:			
	E/W Departure 5,650' FEL							N/S Departure: E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,134,830							X:			
	Y: 9,646,096							Y:			
Lat/Long	Latitude: 26.57506							Latitude			
	Longitude: -94.54731							Longitude			
Water Depth (Feet): 6,542'									MD (Feet)	TVD (Feet)	
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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 1S**

Proposed Well/Structure Location											
Well or Structure Name/Number (if renaming well or structure, reference previous name): EE					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		41°	
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32964				OCS-G 32964			OCS OCS			
Area Name	AC				AC						
Block No.	424				424						
Blockline Departure (in feet)	N/S Departure: 564' FNL							N/S Departure:			
	E/W Departure 5,650' FEL							N/S Departure: E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,134,830							X:			
	Y: 9,645,996							Y:			
Lat/Long	Latitude: 26.57478							Latitude			
	Longitude: -94.54730							Longitude			
Water Depth (Feet): 6,542'									MD (Feet)		TVD (Feet
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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 1T**

Proposed Well/Structure Location											
Well or Structure Name/Number (if renaming well or structure, reference previous name):     EEE					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		41°	
	<b>Surface Location</b>				<b>Bottom Hole Location (for Wells)</b>			<b>Completion (for multiple enter separate lines)</b>			
Lease Number	OCS-G 32964				OCS-G 32964			OCS OCS			
Area Name	AC				AC						
Block No.	424				424						
Blockline Departure (in feet)	N/S Departure: 464' FNL							N/S Departure:			
	E/W Departure   5,750' FEL							N/S Departure:  E/W Departure:  E/W Departure:			
Lambert X-Y Coord.	X: 1,134,730							X:			
	Y: 9,646,096							Y:			
Lat/Long	Latitude: 26.57505							Latitude			
	Longitude: -94.54761							Longitude			
Water Depth (Feet): 6,542'									MD (Feet)		TVD (Feet
Anchor Radius (if applicable) in feet:											
<b>Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</b>											
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 exploration 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**

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

### **C. Production**

Information regarding production is not included in this EP as such information is only necessary in the case of DOCDs.

### **D. Oil Characteristics**

Information regarding oil characteristics is not included in this EP as such information is only necessary in the case of DOCDs.

### **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, Subpart I-Bonding; 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**

Information regarding Suspension of Production is not included in this EP as such information is only necessary in the case of DOCDs.



## J. Blowout scenario

The following WCD was previously submitted in Anadarko's plan S-7901 and is being updated for Operator name.

This Section 2J was prepared by Shell Offshore Inc. (Shell) pursuant to the guidance provided in the Bureau of Ocean Energy Management (BOEM) Notice to Lessees (NTL) No. 2015-N01 with respect to blowout and worst-case discharge scenario descriptions. Shell intends to comply with all applicable laws, regulations, rules and Notices to Lessees.

Shell focuses on an integrated, three-pronged approach to a blowout, including prevention, intervention/containment, and recovery.

1. Shell believes that the best way to manage blowouts is to prevent them from happening. Significant effort goes into design and execution of wells and into building and maintaining staff competence. Shell continues to invest independently in Research and Development (R&D) to improve safety and reliability of our well systems.
2. Shell is a founding member of the Marine Well Containment Company (MWCC), which provides robust well containment (shut-in and controlled flow) capabilities. Additionally, Shell is investing in R&D to improve containment systems.
3. As outlined in Shell's Oil Spill Response Plan (OSRP), and detailed in EP Section 9, Shell has contracts with Oil Spill Removal Organizations (OSROs) to provide the resources necessary to respond to this Worst-Case Discharge (WCD) scenario. The capabilities for on-water recovery, aerial and subsea dispersant application, in-situ burning, and nighttime monitoring and tracking have been significantly increased.

The WCD blowout scenario is calculated for the exploration well "D" of the target sands and based on the guidelines outlined in NTL No. 2015-N01 and subsequent Frequently Asked Questions (FAQ). The WCD for this well falls below the WCD exploratory scenario included in Shell's regional OSRP. Shell's Regional OSRP has response capabilities based on the first 30-day average daily rate; thus, 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.

The WCD scenario, in terms of both initial and the sustained rates, has a low probability of being realized. Some of the factors that are likely to reduce rates and volumes, and 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 capabilities.

Uncontrolled blowout (volume first day)	125,000 bbl oil
Uncontrolled blowout rate (first 30 days average daily rate)	125,000 BOPD
Duration of flow (days) based on relief well	72 Days
Total volume of spill (bbls) until relief well drilled	9.0 mmbbl oil

*Table 1: Worst Case Discharge Summary*



## Project Overview

The Blacktip structure is located in blocks AC380, AC381, AC423 and AC424 of the US GoM. Well 'D' is considered the base plan, while the other wells proposed in this plan could be used as possible appraisal well locations or as re-spud locations in case of operational or mechanical need.

### 1) Purpose

Pursuant with 30 CFR 250.213(g), 250.219, 250.250, and NTL No. 2015-N01, this document provides a blowout scenario description, further information regarding any potential oil spill, the assumptions and calculations used to determine the WCD and the measures taken to 1) enhance the ability to prevent a blowout and 2) respond and manage a blowout scenario if it were to occur. These calculations are based on best technical estimates of subsurface parameters that are derived from the offset wells, and from seismic. These 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.

### 2) Background

This attachment has been developed to document the additional information requirements for Exploration Plans as requested by NTL No. 2015-N01 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.

### 3) Information Requirements

#### a) Blowout scenario

All well locations addressed in this EP were assessed for Worst Case Discharge using the expected well path, the expected reservoir thickness, structural elevation, and rock/fluid properties for each. The Blacktip "D" well with a bottom hole location in block AC424 represents the highest 30-day average well flow potential. The "D" well will be drilled through the reservoirs as outlined in the Geological and Geophysical Information Section of the EP, and described above, utilizing a typical subsea wellhead system, conductor, surface and intermediate casing program, and using a Dynamically Positioned Drill ship rig with a marine riser and subsea Blowout Preventer. A hydrocarbon influx and a well control event are modeled to occur from the reservoir. The simulated blowout model results in unrestricted flow from the well at the seafloor. This represents the worst-case discharge, with no restrictions in the wellbore, plus failure/loss of the subsea BOP, and a blowout to the seabed.

#### b) Estimated flow rate of the potential blowout

Category	EP
Type of Activity	Drilling
Facility Location (area/block)	AC424
Facility Designation	DP
Distance to Nearest Shoreline (miles)	164 statute miles
Uncontrolled blowout volume (first day)	125,000 bbl oil
Uncontrolled blowout volume (first 30 day average daily rate)	125,000 BOPD

*Table 2: Estimated Flow Rates of a Potential Blowout*



**c) Total volume and maximum duration of the potential blowout**

Duration of flow (days)	72
Total volume of spill (bbls)	9.0 mmbbl oil

*Table 3: Estimated Duration and Volume of a Potential Blowout*

There is usually a decline in the discharge rate as time proceeds, which is illustrated by the difference between the first 24-hour volume and 30-day average rate. The total volume calculated until a well is killed in a potential blowout further demonstrates this decline. At very short times, e.g. during the first 24 hours, the pressure profile in the reservoir changes from the moment when a 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. 2015-N01 estimates for 24-hour and 30-day rates as well as maximum duration volumes.

**d) Assumptions/calculations used in determining the WCD for Blacktip Well “D” AC424**

Omitted from Public Information Copies

**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 from. 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.

<b>Rig Name</b>	<b>Rig Type</b>
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 Shell contracted rigs capable of operating at this location is shown in Table 4 above. It is expected to take an average of 2 days to safely secure (kill) the well that the rig is working on; up to the point the rig departs location, and a further 10 days transit to mobilize/demobilize to the relief well site depending on distance to travel. The relief well will take approximately 30 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 mobilize and drill a relief well would be approximately 72 days for this well.

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**

**A. Geological description**

Omitted from Public Information Copies

**B. Structure Contour Map(s)**

Omitted from Public Information Copies

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

Omitted from Public Information Copies

**D. Geological Structure Cross-section(s)**

Omitted from Public Information Copies

**E. Stratigraphic Column with Time vs Depth Table**

Omitted from Public Information Copies

**F. Shallow Hazards Report**

The following report used in our analysis and is was provided to BOEM with Anadarko's Plan: *Geoscience Earth & Marine Services, Inc. (GEMS) Project Number 0817-2703*.

**G. Shallow Hazards Assessment**

See Section 6A of this plan for detailed site assessment, 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<sub>2</sub>S)**

**A. Concentration**

0 ppm

**B. Classification**

Omitted from Public Information Copies

**C. H<sub>2</sub>S Contingency Plan**

Shell will not be required to provide a H<sub>2</sub>S 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<sub>2</sub>S at concentrations greater than 500 parts per million (ppm) and therefore have not included modeling for H<sub>2</sub>S.

#### **SECTION 5: MINERAL RESOURCE CONSERVATION INFORMATION**

Information regarding Mineral Resource Conservation is not included in this EP as such information is only necessary in the case of DOCDs.



## **SECTION 6: BIOLOGICAL, PHYSICAL AND SOCIOECONOMIC INFORMATION**

### **A. Wellsite Clearance Letters**

Shell Offshore Inc., (Shell) contracted Geoscience Earth & Marine Services (GEMS) to provide assessments of shallow geohazard constraints at and surrounding proposed locations A and D in Block 424 (OCS-G-32964), and locations E1, F, and G in Block 380 (OCS-G 32954), Alaminos Canyon Area, Gulf of Mexico. This letter addresses specific seafloor and subsurface conditions around the proposed locations to the top of salt.

Seafloor conditions appear favorable within the vicinity of the proposed surface locations. There are no potential sites for deepwater benthic communities within 2,000 ft and no sonar targets of archaeological significance were identified in the vicinity of any of the proposed wellsites. There is a low potential for encountering overpressured sands within the limit of investigation based on the stratigraphy and the drilling history in the area. There is generally a low potential for significant shallow gas at the proposed locations based on seismic attributes and amplitude analysis.

### **Geohazard Assessment**

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

- Geoscience Earth & Marine Services, (GEMS) "Shallow Hazards Assessment, Coral Prospect Blocks 379-381, 423-424, and 468, Alaminos Canyon Area, Gulf of Mexico" (GEMS Project No. 0817 2703) submitted to Anadarko Petroleum Corporation Inc., in December, 2017.

### **Archaeological Assessment**

The archaeological discussions within this summary are based on the findings provided within the following reports:

- Fugro GeoServices Inc. (FGSI), 2012, Archaeological survey blocks 380, 381, & 424 Alaminos Canyon Area, Gulf of Mexico, Report No. 2412-5015, September 2012. Report submitted to Statoil Gulf of Mexico, LLC.

### **Available Data**

Anadarko provided exploration 3-D seismic time and depth-velocity volumes for the geohazard analysis, covering an approximate 200 square-mile area within the Alaminos Canyon (AC) protraction area. The data volumes include all or portions of Federal lease Blocks AC 334-338, 378-382, 422-426, 466-470, and 511-514. Seafloor and subsurface mapping was limited to the Study Area, which encompasses all of blocks AC 379 381, 423-424, and 468. High-resolution geophysical data covering AC 380, 424, and the western half of AC 381 were also provided. The high-resolution geophysical dataset was collected by Fugro GeoServices, Inc., (FGSI) in July, 2012 using an AUV (Autonomous Underwater Vehicle). These data included 2-12 kHz subbottom profiler, 120-kHz side-scan sonar, and 3 m (10 ft) bin multibeam bathymetry data.

GEMS extracted the power spectrum diagrams from the 3 D seismic data cube at each of the proposed wellsites (Illustrations AC 424-A-1, and AC 424-D-1, AC 380-E1-1, AC 380-F-1, and AC 380-G-1). The extractions, as specified in NTL 2008-G05 (MMS, 2008a), were generated within a 1000-ft radius of the intersection of the inline and crossline at the proposed wellsites. The extraction time interval consisted of the seafloor to one second below seafloor. We converted the amplitude vs. frequency spectrum, generated by the SMT software, to power vs. frequency by squaring the amplitude values as described by J. A. Coffeen, 1978. The frequency bandwidth at 50% power for each of the spectrums meets or exceeds current NTL guidelines.

### **Oil Field Infrastructure and Military Warning Areas**

There are no existing wells, pipelines, umbilicals, or cable within 2,000 ft of any of the proposed locations. The closest existing well to any of the proposed locations is Shell's well #1 located several miles to the south in AC 557 (BOEM, 2018a).

Blocks AC 380 and 424 are located within military warning area W-602; therefore, drilling activities must be coordinated with the appropriate military command for this warning area. Military warning areas (MWA) represent regions where the



U.S. Department of Defense conducts various testing and training operations. Lessees within MWA's are required to enter into an agreement with the appropriate command headquarters concerning the control of electromagnetic emissions and the use of boats and aircraft within the warning area (NTL 2014-G04; BOEM, 2014).

## PROPOSED WELLSITE A ALAMINOS CANYON BLOCK 424 (OCS G-32964)

### Proposed Well Location

The surface location for the Proposed Exploration Wellsite AC424-A is in the southeast quadrant of Block 424. Shell provided the following coordinates:

**Table A-1. Proposed Location Coordinates**

Proposed Wellsite AC424-A			
Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		Line Reference	Block Calls (AC 424)
X: 1,134,512 ft	Latitude: 26.546881351° N	Inline 37250	5,968 ft FEL
Y: 9,635,859 ft	Longitude: 94.547899517° W	Crossline 3185	5,139 ft FSL

Shell will drill this well using a dynamically positioned drilling vessel. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in Illustration AC 424-A-1.

### Archaeological Assessment

An archaeological assessment of side-scan sonar and other AUV data covered AC 424 and the surrounding area (FGSI, 2012). One unidentified sonar contact occurs within 2,000 ft of the Proposed Wellsite A, in Alaminos Canyon Block 424. The contact as reported is listed in the following table:

**Table A-2. Unidentified Contacts Near AC424-A**

Sonar Contacts within 2,000 ft of Proposed Wellsite AC424-A									
No.	Area	Block	Length (Feet)	Width (Feet)	Height (Feet)	Shape	X NAD27 (Feet)	Y NAD27 (Feet)	Distance & Direction from Site
31	AC	424	16.6	4.6	0.00	Linear	1,135,237	9,637,463	1,760 ft/NE

The unidentified contact is likely a linear-shaped geological formation, and is not recommended for archaeological avoidance (FGSI, 2012). The standard 100 ft geohazard avoidance applies to this contact.

### Wellsite Conditions

The proposed well is located within a relatively benign intraslope basin. The shallow stratigraphy at the proposed well location generally consists of interbedded hemipelagic clays and silty-clays, fine-grained turbidites, and mass-transport deposits. Some thin sand layers and channelized sediments will likely be encountered.

**Water Depth and Seafloor Conditions.** The water depth at the proposed surface location is -7,251 ft and the seafloor slopes about 2.7° to the south. The seafloor around the proposed location is relatively smooth and featureless. A drape of acoustically transparent sediments occurs at the seabed. The drape is about 5 ft thick and consists of very soft, high water content pelagic clays.

**Deepwater Benthic Communities.** Deepwater benthic communities are not expected at the proposed wellsite. There are no interpreted indicators of significant, high-density, benthic communities within 2,000 ft of the proposed wellsite. The seafloor amplitude rendering extracted from the 3-D dataset does not show any elevated amplitudes near the proposed



wellsite (Illustration AC 424-A-2). In addition, side scan sonar records indicate a homogenous seabed near the proposed location, suggesting normal Gulf of Mexico surficial sediments. There are no BOEM water bottom anomalies mapped within 2,000 ft of the proposed wellsite (BOEM, 2018b).

**Stratigraphy.** Stratigraphic conditions from the seabed to the limit of investigation (LOI), 5,561 ft BML or 12,182 ft BSL, are shown on the Tophole Prognosis Chart (Illustration AC 424-A-3). The deep stratigraphy, as defined by the 3-D data, was subdivided into 6 units or sequences (Illustration AC 424 A 3). Horizons 30 and the Top of Salt are not present or traceable at the proposed wellsite location.

Near-Surface Sediments. An acoustically transparent drape, about 5 ft thick, occurs at the seabed. Sediments will be very soft with high water contents that will gradually increase in strength and decrease in water content with depth. Beneath the drape is about 85 ft of numerous, parallel and continuous reflections representing hemipelagic silty clays. Mass-transport deposits (MTD) occur from 90 ft to 140 ft BML. The MTD over lie a section of parallel and continuous reflections below 140 ft to the limit of acoustic penetration achieved by the subbottom profiler.

Unit 1 (Seafloor to Horizon 10). Unit 1 beneath the proposed Wellsite A is 234 ft thick (Illustration AC 424-A-3). The unit consists of bedded hemipelagic sediments intercalated with thin, chaotic, mud-rich MTDs.

Unit 2 (Horizon 10 to Horizon 20). Unit 2 occurs between 234 ft and 632 ft BML beneath the proposed wellsite (Illustration AC 424-A-3). Unit 2 consists of low amplitude, semi-continuous to chaotic reflectors, representing hemipelagic clays and clay-rich turbidites with thin mass-transport deposits. The mass-transport deposits are most prevalent towards the base of the unit.

Unit 5 (Horizon 20 to Horizon 40). Unit 5 occurs between 632 ft and 1,139 ft BML. Unit 5 consists of chaotic, low to moderate-amplitude reflectors, possibly representing a sand-prone channelized section. The sediments within this sequence appear to have been disrupted by numerous mass-transport episodes and no channels could be laterally correlated.

Unit 7 (Horizon 40 to Horizon 50). Unit 7 occurs between 1,139 ft and 1,665 ft BML. The sequence consists of low to moderate-amplitude, semi-continuous to chaotic reflectors. These reflectors likely represent interbedded fine-grained mass transport deposits and turbidites. Some thin sands may be present in this unit.

Unit 8 (Horizon 50 to Horizon 60). Unit 8 occurs between 1,665 ft and 3,710 ft BML. The sequence consists of alternating sequences of low- to moderate-amplitude chaotic reflectors and moderate-amplitude parallel reflectors, indicating alternating fine-grained mass-transport deposits and turbidites with possible thin sands.

Unit 10 (Horizon 60 to LOI). Unit 10 occurs between 3,710 ft and 5,561 ft BML. The sequence consists of alternating chaotic low-amplitude reflectors, interlayered with semi-continuous low to moderate-amplitude reflectors. The sediments within this unit are likely alternating clay-prone mass-transport deposits and generally fine-grained turbidites. Some thin sands are possible.

**Faults.** A vertical wellbore beneath the proposed Wellsite A location will not intersect any seafloor or buried faults (Illustration AC 424-A-3).

**Shallow Gas and Shallow Water Flow.** Significant shallow gas is not expected at this proposed wellsite (Illustration AC 424-A-3). The potential for shallow water flow, however, at this well location is considered negligible to high.

Shallow Gas. There are no apparent subsurface high-amplitude anomalies directly below the proposed wellsite. The potential for encountering shallow gas is considered negligible in the clay-rich sediments between the seafloor and 632 ft BML (Units 1 and 2). The potential for encountering minor amounts of gas within sand-rich sediments below 632 ft to the LOI (5,561 ft BML) is generally considered low.



**Shallow Water Flow.** The potential for shallow water flow (SWF) at this well location is considered negligible to low (Illustration AC 424-A-3). Possible sand-prone sediments between Horizon 20 (632 ft bml) and the Limit of Investigation (5,561 ft bml) are designated with a low potential for shallow water flow (Illustration AC 424 A 3). The remaining clay-prone sediments in the upper 632 ft bml (seafloor to Horizon 20) are designated with a negligible potential for shallow water flow.

#### **Proposed Wellsite A, AC 424, Concluding Remarks**

The Proposed Wellsite A, Alaminos Canyon Block 424 (OCS G-32964), appears suitable for exploration drilling operations. No seafloor obstructions or conditions exist that will be a constraint to equipment at the proposed location. The potential for encountering shallow gas and/or SWF is considered negligible to low. AC 424 is in Military Warning Area, W-602. Therefore, the appropriate military command must be notified prior to the commencement of drilling operations.

#### **PROPOSED WELLSITE D ALAMINOS CANYON BLOCK 424(OCS G-32964)**

#### **Proposed Well Location**

The surface location for the Proposed Exploration Wellsite D lies in the northwest quadrant of AC 424 (Illustration AC 424-D-2). Shell provided the following coordinates:

**Table D-1. Proposed Location Coordinates**

<b>Proposed Wellsite AC 424-D</b>			
<b>Spheroid &amp; Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North</b>		<b>Line Reference</b>	<b>Block Calls (AC 424)</b>
X: 1,129,637 ft	Latitude: 26.564416932° N	Inline 37380	4,997 ft FWL
Y: 9,642,292 ft	Longitude: 94.563051000° W	Crossline 3087	4,268 ft FNL

Shell will drill this well using a dynamically positioned drilling vessel. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in Illustration AC 424-D-1.

#### **Archaeological Assessment**

An archaeological assessment of side-scan sonar and other AUV data covered AC 424 and the surrounding area (FGSI, 2012). Three unidentified sonar contact occurs within 2,000 ft of the Proposed Wellsite D, in Alaminos Canyon Block 424. The contacts as reported are listed in the following table:

**Table D-2. Unidentified Contacts Near AC 424-D**

<b>Sonar Contacts within 2,000 ft of Proposed Wellsite AC 424-D</b>									
<b>No.</b>	<b>Area</b>	<b>Block</b>	<b>Length (Feet)</b>	<b>Width (Feet)</b>	<b>Height (Feet)</b>	<b>Shape</b>	<b>X NAD27 (Feet)</b>	<b>Y NAD27 (Feet)</b>	<b>Distance &amp; Direction from Site</b>
24	AC	424	18.6	4.4	0.0	Linear	1,130,216	9,461,788	768 ft/SE
25	AC	424	8.0	4.6	0.0	Irregular	1,129,233	9,641,561	835 ft/SSW
26	AC	424	19.7	6.6	0.0	Irregular	1,129,299	9,641,388	965 ft/SSW

Unidentified contact No. 24 is likely man-made debris, and contact Nos. 25 and 26 are interpreted to be irregular geologic formations. None of the contacts not recommended for archaeological avoidance (FGSI, 2012). The standard 100 ft geohazard avoidance applies to these contacts.



## Wellsite Conditions

The surface location of the proposed well is downslope of a large seafloor escarpment that defines the northern headscarp of the Alaminos Canyon. The seafloor near the wellsite is hummocky due to a history of slumping and mass-transport deposits.

**Water Depth and Seafloor Conditions.** The water depth at the proposed surface location is -6,746 ft and the seafloor slopes about 1.9° to the south.

Based on the current geophysical data provided, the present-day seabed and near-surface sediments are stable and not prone to failure. An approximate 5 ft surficial drape of soft, high water content silty clays covers the seafloor at the proposed wellsite.

**Deepwater Benthic Communities.** Deepwater benthic communities are not expected at the proposed wellsite. There are no interpreted indicators of significant, high-density, benthic communities within 2,000 ft of the proposed location (Illustration AC 424-D-2). The seafloor amplitude rendering extracted from the 3-D dataset does not show any elevated amplitudes near the proposed wellsite (Illustration AC 424-D-2). In addition, side-scan sonar records indicate a generally homogenous seabed near the proposed location, suggesting normal Gulf of Mexico surficial sediments. Areas exhibiting increased seafloor reflectivity to the northeast of the proposed wellsite are the result of overconsolidated sediments exposed at the seafloor due to erosion.

No water bottom anomalies as defined by BOEM (BOEM, 2018b) occur within 2,000 ft of the proposed location.

**Stratigraphy.** Stratigraphic conditions from the seabed to the top of salt are shown on the Tophole Prognosis Chart (Illustration AC 424-D-3). The top of salt is estimated to be 3,735 ft BML or -10,481 ft below sea level (BSL). The deep stratigraphy, as defined by the 3-D data, was subdivided into 6 units or sequences (Illustration AC 424-D-3).

Near-Surface Sediments. An acoustically transparent drape, about 5 ft thick, occurs at the seabed. Sediments will be very soft with high water contents that will gradually increase in strength and decrease in water content with depth. Beneath the drape is about 90 ft of numerous, parallel and continuous reflections representing hemipelagic silty clays. Mass-transport deposits (MTD) occur from 95 ft to 133 ft BML. The MTD overlie a section of parallel and continuous reflections below 133 ft to the limit of acoustic penetration achieved by the subbottom profiler (~200 ft BML).

Unit 1 (Seafloor to Horizon 10). Unit 1 beneath the proposed Wellsite D is 161 ft thick (Illustration AC 424-D-3). The unit consists of bedded hemipelagic sediments intercalated with chaotic, mud-rich mass-transport deposits.

Unit 2 (Horizon 10 to Horizon 20). Unit 2 occurs between 161 ft and 439 ft BML beneath the proposed wellsite (Illustration AC 424-D-3). Unit 2 generally consists of low-amplitude, semi-continuous to chaotic reflectors, representing hemipelagic clays and clay-rich turbidites with thin mass-transport deposits.

Unit 4 (Horizon 20 to Horizon 30). Unit 4 occurs between 439 ft and 814 ft BML. Unit 4 consists of low-amplitude semi-continuous to chaotic reflectors. The sediments are likely alternating fine-grained mass-transport deposits and clay-prone turbidites. Some thin sand layers may be encountered.

Unit 6 (Horizon 30 to Horizon 50). Unit 6 occurs between 814 ft and 917 ft BML. The sequence consists of low-to moderate-amplitude, continuous reflectors. These reflectors likely represent fine-grained turbidites containing possible thin sand layers.

Unit 8 (Horizon 50 to Horizon 60). Unit 8 occurs between 917 ft and 1,483 ft BML. The sequence consists of low to moderate-amplitude semi-continuous to chaotic reflectors, indicating fine-grained mass-transport deposits and turbidites with possible thin sand layers.

Unit 10 (Horizon 60 to Top of Salt). Unit 10 occurs between 1,483 ft and 3,735 ft BML. The sequence consists of an upper segment of chaotic to semi-continuous low-amplitude reflectors representing alternating fine-grained turbidites and MTDs overlying similar reflectors with increased amplitude. The deeper segment may represent a rubble zone of rafted, overconsolidated sediments with variable properties. Some thin sand layers may be encountered throughout Unit 10. The Top of Salt at the wellsite is not clearly defined but is estimated to be encountered at approximately 3,735 ft bml.



**Faults.** A vertical wellbore beneath the proposed Wellsite D location will not intersect any seafloor or buried faults (Illustration AC 424-D-3).

**Shallow Gas and Shallow Water Flow.** Significant shallow gas is not expected at this proposed wellsite (Illustration AC424-D-3). The potential for shallow water flow, however, at this well location is considered negligible to high.

Shallow Gas. There are no apparent subsurface high-amplitude anomalies directly below the proposed wellsite. The potential for encountering shallow gas is considered negligible in the clay-rich sediments between the seafloor and 439 ft BML (Units 1 and 2). The potential for encountering minor amounts of gas within sand-rich sediments below 439 ft to the Top of Salt (3,735 ft BML) is generally considered low.

Shallow Water Flow. The potential for shallow water flow (SWF) at this well location is considered negligible to low (Illustration AC 424-D-3). Possible sand-prone sediments between Horizon 20 (439 ft bml) and the Top of Salt (3,735 ft bml) are designated with a low potential for shallow water flow (Illustration AC 424-D-3). The remaining clay-prone sediments in the upper 439 ft bml (seafloor to Horizon 20) are designated with a negligible potential for shallow water flow.

### **Proposed Wellsite D, AC 424, Concluding Remarks**

The Proposed Wellsite D, Alaminos Canyon Block 424 (OCS G-32964), appears suitable for exploration drilling operations. No seafloor obstructions or conditions exist that will be a constraint to equipment at the proposed location. The potential for encountering shallow gas and/or SWF is considered negligible to low. A rafted rubble zone may be encountered between 2,815 ft bml to the Top of Salt (3,735 ft bml). The sediments in the rubble zone will likely be overconsolidated and have variable sediment properties.

AC 424 is in Military Warning Area, W-602. Therefore, the appropriate military command must be notified prior to the commencement of drilling operations.

### **PROPOSED WELLSITE E1 ALAMINOS CANYON BLOCK 380 (OCS G-32964)**

#### **Proposed Well Location**

The surface location for the Proposed Exploration Wellsite AC 380-E1 lies in the northeastern quadrant of AC 424 (Illustration AC 380-E1-2). Shell provided the following coordinates:

**Table E1-1. Proposed Location Coordinates**

Proposed Wellsite AC 380-E1			
Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		Line Reference	Block Calls (AC 424)
X: 1,134,830 ft	Latitude: 26.575055936° N	Inline 38160	5,650 ft FEL
Y: 9,646,096 ft	Longitude: 94.547305038° W	Crossline 3099	464 ft FNL

Shell will drill this well using a dynamically positioned drilling vessel. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in Illustration AC 380-E1-1.

#### **Archaeological Assessment**

An archaeological assessment of side-scan sonar and other AUV data covered AC 380 and the surrounding area (FGSI, 2012). Two unidentified sonar contact occurs within 2,000 ft of the Proposed Wellsite E1, in Alaminos Canyon Block 380. The contacts as reported are listed in the following table:



**Table E1-2. Unidentified Contacts Near AC 380-E1**

<b>Sonar Contacts within 2,000 ft of Proposed Wellsite AC 380-E1</b>									
<b>No.</b>	<b>Area</b>	<b>Block</b>	<b>Length (Feet)</b>	<b>Width (Feet)</b>	<b>Height (Feet)</b>	<b>Shape</b>	<b>X NAD27 (Feet)</b>	<b>Y NAD27 (Feet)</b>	<b>Distance &amp; Direction from Site</b>
24	AC	380	13.7	10.2	0.0	Irregular	1,134,156	9,646,460	766 ft/NW
22	AC	380	20.7	8.7	0.0	Rectangle	1,333,877	9,645,966	961 ft/W

The unidentified contacts are interpreted as possible irregular geologic formations, and are not recommended for archaeological avoidance (FGSI, 2012). The standard 100 ft geohazard avoidance applies to these contacts.

### **Wellsite Conditions**

The surface location of the proposed well is downslope of a large seafloor escarpment that defines the northern headscarp of the Alaminos Canyon. The seafloor near the wellsite is hummocky due to a history of slumping and mass-transport deposits.

**Water Depth and Seafloor Conditions.** The water depth at the proposed surface location is -6,542 ft and the seafloor slopes about 2.0° to the southwest.

A drape of acoustically transparent sediments occurs at the seabed. The drape is about 5 ft thick and consists of very soft, high water content pelagic clays.

**Deepwater Benthic Communities.** Deepwater benthic communities are not expected at the proposed wellsite. There are no interpreted indicators of significant, high-density, benthic communities within 2,000 ft of the proposed location (Illustration AC 380-E1-2). The seafloor amplitude rendering extracted from the 3-D dataset does not show any elevated amplitudes near the proposed wellsite (Illustration AC 380-E1-2). In addition, side-scan sonar records indicate a generally homogenous seabed near the proposed location, suggesting normal Gulf of Mexico surficial sediments. Areas exhibiting increased seafloor reflectivity to the northeast of the proposed wellsite are the result of overconsolidated sediments exposed at the seafloor due to erosion.

No water bottom anomalies as defined by BOEM (BOEM, 2018b) occur within 2,000 ft of the proposed location.

**Stratigraphy.** Stratigraphic conditions from the seabed to the top of salt are shown on the Tophole Prognosis Chart (Illustration AC 380-E1-3). The top of salt is estimated to be 3,258 ft BML or -9,800 ft below sea level (BSL). The deep stratigraphy, as defined by the 3-D data, was subdivided into six units or sequences (Illustration AC 380-E1-3).

**Near-Surface Sediments.** An acoustically transparent drape, about 5 ft thick, occurs at the seabed. Sediments will be very soft with high water contents that will gradually increase in strength and decrease in water content with depth. Beneath the drape is about 38 ft of numerous, parallel and continuous reflections representing hemipelagic silty clays. A thin MTD occurs from 43 ft to 53 ft BML. The MTD overlies a section of parallel and continuous reflections below 53 ft to the limit of acoustic penetration achieved by the subbottom profiler (~143 ft BML).

**Unit 1 (Seafloor to Horizon 10).** Unit 1 beneath the proposed Wellsite E1 is 108 ft thick (Illustration AC 380-E1-3). The unit consists of bedded hemipelagic sediments intercalated with chaotic, mud-rich mass-transport deposits.

**Unit 2 (Horizon 10 to Horizon 20).** Unit 2 occurs between 108 ft and 372 ft BML beneath the proposed wellsite (Illustration AC 380-E1-3). Unit 2 generally consists of low-amplitude, semi-continuous to chaotic reflectors, representing hemipelagic clays and clay-rich turbidites with thin mass-transport deposits.

**Unit 4 (Horizon 20 to Horizon 30).** Unit 4 occurs between 372 ft and 725 ft BML. Unit 4 consists of low-amplitude semi-continuous to chaotic reflectors. The sediments are likely alternating fine-grained mass-transport deposits and clay-prone turbidites. Some thin sand layers may be encountered.

**Unit 6 (Horizon 30 to Horizon 50).** Unit 6 occurs between 725 ft and 838 ft BML. The sequence consists of low-to moderate-amplitude, continuous reflectors. These reflectors likely represent fine-grained turbidites containing possible thin sand layers.



Unit 8 (Horizon 50 to Horizon 60). Unit 8 occurs between 838 ft and 1,096 ft BML. The sequence consists of low to moderate-amplitude semi-continuous to chaotic reflectors, indicating fine-grained mass-transport deposits and turbidites with possible thin sand layers.

Unit 10 (Horizon 60 to Top of Salt). Unit 10 occurs between 1,096 ft and 3,258 ft BML. The sequence consists of an upper segment of chaotic to semi-continuous low-amplitude reflectors representing alternating fine-grained turbidites and MTDs overlying similar reflectors with increased amplitude. The deeper segment may represent a rubble zone of rafted, overconsolidated sediments with variable properties. Some thin sand layers may be encountered throughout Unit 10. The Top of Salt at the wellsite is not clearly defined but is estimated to be encountered at approximately 3,258 ft bml.

**Faults.** A vertical wellbore beneath the proposed Wellsite E1 location will not intersect any seafloor or buried faults (Illustration AC 380-E1-3).

**Shallow Gas and Shallow Water Flow.** Significant shallow gas is not expected at this proposed wellsite (Illustration AC 380-E1-3). The potential for shallow water flow is considered negligible to low.

Shallow Gas. There are no apparent subsurface high-amplitude anomalies directly below the proposed wellsite. The potential for encountering shallow gas is considered negligible in the clay-rich sediments between the seafloor and 372 ft BML (Units 1 and 2). The potential for encountering minor amounts of gas within sand-rich sediments below 372 ft to the Top of Salt (3,258 ft BML) is generally considered low (Illustration AC 380-E1-3).

Shallow Water Flow. The potential for shallow water flow (SWF) at this well location is considered negligible to low (Illustration AC 380-E1-3). Possible sand-prone sediments between Horizon 20 (372 ft bml) and the Top of Salt (3,258 ft bml) are designated with a low potential for shallow water flow (Illustration AC 380-E1-3). The remaining clay-prone sediments in the upper 372 ft bml (seafloor to Horizon 20) are designated with a negligible potential for shallow water flow.

### Proposed Wellsite E1, AC 380, Concluding Remarks

The Proposed Wellsite E1, Alaminos Canyon Block 380 (OCS G-32954), appears suitable for exploration drilling operations. No seafloor obstructions or conditions exist that will be a constraint to equipment at the proposed location. The potential for encountering shallow gas and/or SWF is considered negligible to low. A rafted rubble zone may be encountered between 2,887 ft bml to the Top of Salt (3,258 ft bml). The sediments in the rubble zone will likely be overconsolidated and have variable sediment properties.

AC 380 and AC 424 are in Military Warning Area, W-602. Therefore, the appropriate military command must be notified prior to the commencement of drilling operations.

### **PROPOSED WELLSITE F ALAMINOS CANYON BLOCK 380 (OCS G-32954)**

### Proposed Well Location

The surface location for the Proposed Exploration Wellsite F lies in the south-central portion of AC 380 (Illustration AC 380-F-2). Shell provided the following coordinates:

**Table F-1. Proposed Location Coordinates**

Proposed Wellsite AC 380-F			
Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		Line Reference	Block Calls (AC 380)
X: 1,133,110 ft	Latitude: 26.576572333° N	Inline 38060	7,370 ft FEL
Y: 9,646,668 ft	Longitude: 94.552588624° W	Crossline 3080	108 ft FSL

Shell will drill this well using a dynamically positioned drilling vessel. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in Illustration AC 380-F.



## Archaeological Assessment

An archaeological assessment of side-scan sonar and other AUV data covered AC 380 and the surrounding area (FGSI, 2012). Two unidentified sonar contacts occur within 2,000 ft of the Proposed Wellsite F, in Alaminos Canyon Block 380. The contacts as reported are listed in the following table:

**Table F-2. Unidentified Contacts Near AC 380-F**

Sonar Contacts within 2,000 ft of Proposed Wellsite AC 380-F									
No.	Area	Block	Length (Feet)	Width (Feet)	Height (Feet)	Shape	X NAD27 (Feet)	Y NAD27 (Feet)	Distance & Direction from Site
21	AC	380	13.7	10.2	0.0	Irregular	1,134,156	9,646,460	1,067 ft/E
22	AC	380	20.7	8.7	0.0	Rectangle	1,133,877	9,645,966	1,040 ft/SE

The unidentified contacts are interpreted as possible irregular geologic formations, and are not recommended for archaeological avoidance (FGSI, 2012). The standard 100 ft geohazard avoidance applies to these contacts.

## Wellsite Conditions

The surface location of the proposed well is downslope of a large seafloor escarpment that defines the northern headscarp of the Alaminos Canyon. The seafloor near the wellsite is hummocky due to a history of slumping and mass-transport deposits.

**Water Depth and Seafloor Conditions.** The water depth at the proposed surface location is -6,552 ft and the seafloor slopes about 2.5° to the northeast.

A drape of acoustically transparent sediments occurs at the seabed. The drape is about 5 ft thick and consists of very soft, high water content pelagic clays.

**Deepwater Benthic Communities.** Deepwater benthic communities are not expected at the proposed wellsite. There are no interpreted indicators of significant, high-density, benthic communities within 2,000 ft of the proposed location (Illustration AC 380-F-2). The seafloor amplitude rendering extracted from the 3-D dataset does not show any elevated amplitudes near the proposed wellsite (Illustration AC 380-F-2). Side-scan sonar records indicate a variable textured seabed in the vicinity of the proposed location. Areas of low reflectivity generally suggest normal Gulf of Mexico surficial sediments. Areas exhibiting increased seafloor reflectivity are the result of overconsolidated sediments exposed at the seafloor due to erosion.

No water bottom anomalies as defined by BOEM (BOEM, 2018b) occur within 2,000 ft of the proposed location.

**Stratigraphy.** Stratigraphic conditions from the seabed to the top of salt are shown on the Tophole Prognosis Chart (Illustration AC 380-F-3). The top of salt is estimated to be 2,975 ft BML or -9,527 ft below sea level (BSL). The deep stratigraphy, as defined by the 3-D data, was subdivided into 5 units or sequences (Illustration AC 380-F-3). Horizons 30 and 40 were not present or traceable at the proposed well location.

**Near-Surface Sediments.** An acoustically transparent drape, about 5 ft thick, occurs at the seabed. Sediments will be very soft with high water contents that will gradually increase in strength and decrease in water content with depth. Beneath the drape is about 38 ft of numerous, parallel and continuous reflections representing hemipelagic silty clays. An MTD occurs from 43 ft to 85 ft BML. The MTD overlies a section of parallel and continuous reflections below 85 ft to the limit of acoustic penetration achieved by the subbottom profiler (~106 ft BML).

**Unit 1 (Seafloor to Horizon 10).** Unit 1 beneath the proposed Wellsite F is 106 ft thick (Illustration AC 380-F-3). The unit consists of low- to moderate-amplitude parallel to chaotic reflectors. The parallel reflections represent hemipelagic clays and silty-clays, while the chaotic intervals represent fine-grained mass-transport deposits.

**Unit 2 (Horizon 10 to Horizon 20).** Unit 2 occurs between 106 ft and 388 ft BML beneath the proposed wellsite (Illustration AC 380-F-3). Unit 2 generally consists of low-amplitude, semi-continuous to chaotic reflectors, representing hemipelagic clays and clay-rich turbidites with thin, fine-grained mass-transport deposits.



Horizon 20 to Horizon 50. This sequence occurs between 388 ft and 521 ft BML and is very limited in areal extent. The sequence consists of chaotic, low to moderate-amplitude reflectors, possibly representing a sand-prone channelized section. The sediments within this sequence appear to have been disrupted by numerous mass-transport episodes and no channels could be laterally correlated.

Unit 8 (Horizon 50 to Horizon 60). Unit 8 occurs between 521 ft and 851 ft BML. The sequence consists of low to moderate-amplitude semi-continuous to chaotic reflectors, indicating fine-grained mass-transport deposits and turbidites with possible thin sand layers.

Unit 10 (Horizon 60 to Top of Salt). Unit 10 occurs between 851 ft and 2,975 ft BML. The sequence consists of chaotic to semi-continuous, low-amplitude reflectors. The sediments within this unit are likely fine-grained mass-transport deposits and turbidites that have been disturbed by the influx of shallow salt. Some thin sand layers are possible. The Top of Salt at the wellsite is not clearly defined but is estimated to be encountered at approximately 2,975 ft bml.

**Faults.** A vertical wellbore beneath the proposed Wellsite F location will not intersect any seafloor or buried faults (Illustration AC 380-F-2).

**Shallow Gas and Shallow Water Flow.** Significant shallow gas is not likely to be encountered within the shallow sediments from the seafloor to the Top of Salt (2,975 ft bml), Illustration AC380-F-3. The potential for shallow water flow is considered negligible to low.

Shallow Gas. There are no apparent subsurface high-amplitude anomalies directly below the proposed wellsite. The potential for encountering shallow gas is considered negligible in the clay-rich sediments between the seafloor and 388 ft BML (Units 1 and 2). The potential for encountering minor amounts of gas within sand-rich sediments below 388 ft to the top of salt (2,975 ft BML) is generally considered low.

Shallow Water Flow. The potential for shallow water flow (SWF) at this well location is considered negligible to low (Illustration AC 380-F-3). Possible sand-prone sediments between Horizon 20 (388 ft bml) and the Top of Salt (2,975 ft bml) are designated with a low potential for shallow water flow (Illustration AC 380-F-3). The remaining clay-prone sediments in the upper 388 ft bml (seafloor to Horizon 20) are designated with a negligible potential for shallow water flow.

### **Proposed Wellsite F, AC 380, Concluding Remarks**

The Proposed Wellsite F, Alaminos Canyon Block 380 (OCS G-32954), appears suitable for exploration drilling operations. No seafloor obstructions or conditions exist that will be a constraint to equipment at the proposed location. The potential for encountering shallow gas and/or SWF is considered negligible to low.

AC 380 is in Military Warning Area, W-602. Therefore, the appropriate military command must be notified prior to the commencement of drilling operations.

### **PROPOSED WELLSITE G ATWATER VALLEY BLOCK 380 (OCS G-32954)**

#### **Proposed Well Location**

The surface location for the Proposed Exploration Wellsite AC 380-G lies in the southeast corner of Block AC 380 (Illustration AC 380-G-2). Shell provided the following coordinates:

**Table G-1. Proposed Location Coordinates**

Proposed Wellsite AC 380-G			
Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		Line Reference	Block Calls (AC 380)
X: 1,138,490 ft	Latitude: 26.577188311° N	Inline 38450	1,990 ft FEL
Y: 9,646,827 ft	Longitude: 94.536133997° W	Crossline 3125	267 ft FSL



Shell will drill this well using a dynamically positioned drilling vessel. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in Illustration AC 380-G-1.

### Archaeological Assessment

An archaeological assessment of side-scan sonar and other AUV data covered AC 380 and the surrounding area (FGSI, 2012). One unidentified sonar contact occurs within 2,000 ft of the Proposed Wellsite G, in Alaminos Canyon Block 380. The contact as reported is listed in the following table:

**Table G-2. Unidentified Contacts Near AC 380-G**

Sonar Contacts within 2,000 ft of Proposed Wellsite AC 380-G									
No.	Area	Block	Length (Feet)	Width (Feet)	Height (Feet)	Shape	X NAD27 (Feet)	Y NAD27 (Feet)	Distance & Direction from Site
20	AC	380	13.2	4.4	0.0	linear	1,138,975	9,646,765	489 ft/E

The unidentified contact is interpreted to be a possible linear-shaped geological formation, and is not recommended for archaeological avoidance (GEMS, 2018). The standard 100 ft geohazard avoidance applies to this contact.

### Wellsite Conditions

The surface location of the proposed well is downslope of a large seafloor escarpment that defines the northern headscarp of the Alaminos Canyon. The seafloor near the wellsite is hummocky due to a history of slumping and mass-transport deposits.

**Water Depth and Seafloor Conditions.** The water depth at the proposed surface location is -6,447 ft and the seafloor slopes about 5.3° to the south.

A drape of acoustically transparent sediments occurs at the seabed. The a very thin drape of about 2.5 ft thick exists at the proposed wellsite, and consists of very soft, high water content pelagic clays.

**Deepwater Benthic Communities.** Deepwater benthic communities are not expected at the proposed wellsite. There are no interpreted indicators of significant, high-density, benthic communities within 2,000 ft of the proposed location (Illustration AC 380-G-2). The seafloor amplitude rendering extracted from the 3-D dataset does not show any elevated amplitudes near the proposed wellsite (Illustration AC 380-G-2). Side-scan sonar records indicate a variable textured seabed in the vicinity of the proposed location. Areas of low reflectivity generally suggest normal Gulf of Mexico surficial sediments. Areas exhibiting increased seafloor reflectivity are the result of overconsolidated sediments exposed at the seafloor due to erosion.

No water bottom anomalies as defined by BOEM (BOEM, 2018b) occur within 2,000 ft of the proposed location.

**Stratigraphy.** Stratigraphic conditions from the seabed to the top of salt are shown on the Tophole Prognosis Chart (Illustration AC 380-G-3). The top of salt is estimated to be 2,611 ft BML or -9,058 ft below sea level (BSL). The deep stratigraphy, as defined by the 3-D data, was subdivided into 5 units or sequences (Illustration AC 380-G-3).

Near-Surface Sediments. The uppermost 2.5 ft of sediment at the proposed well is a Holocene drape consisting of very soft, high water content clays. Beneath the drape, sediments consist of alternating stratified reflectors, representing clays and silty-clays, and fine-grained mass-transport deposits (MTDs). Mass-transport deposits will be encountered between 10 ft and 43 ft bml and between 75 ft and 103 ft bml. Additional thin MTDs may be encountered in the shallow section between 103 ft and 150 ft bml.

Unit 1 (Seafloor to Horizon 10). Unit 1 beneath the proposed Wellsite G is 172 ft thick (Illustration AC 380-G-3). The unit consists of bedded hemipelagic sediments intercalated with thin, chaotic, mud-rich mass-transport deposits.

Unit 2 (Horizon 10 to Horizon 20). Unit 2 occurs between 172 ft and 498 ft BML beneath the proposed wellsite (Illustration AC 380-G-3). Unit 2, generally consists of low-amplitude, semi-continuous to chaotic reflectors, representing hemipelagic clays and clay-rich turbidites with thin, fine-grained mass-transport deposits.



Horizon 20 to Horizon 50. The sedimentary section between Horizon 20 to Horizon 50 (498 ft to 701 ft bml), consists of chaotic, low-amplitude reflectors representing clay-rich turbidites and fine-grained MTDs with some possible thin sand layers.

Unit 8 (Horizon 50 to Horizon 60). Unit 8 occurs between 701 ft and 1,428 ft BML. The sequence consists of low- to moderate-amplitude semi-continuous to chaotic reflectors, indicating fine-grained mass-transport deposits and turbidites with possible thin sand layers.

Unit 10 (Horizon 60 to Top of Salt). Unit 10 occurs between 1,428 ft and 2,611 ft BML. The seismic character of the upper portion of Unit 10, from Horizon 60 (1,428 ft bml) to 1,954 ft bml, consists of low-amplitude discontinuous to chaotic reflectors. The sediments are likely interbedded clay-rich mass-transport deposits and fine-grained turbidites. Some thin sand layers are possible. The seismic character in the remainder of Unit 10, from 1,954 ft bml to the Top of Salt (2,611 ft bml), consists of moderate-amplitude semi-continuous reflectors. This sedimentary section may represent a rubble zone of rafted, overconsolidated sediments with variable properties.

**Faults.** A vertical wellbore beneath the proposed Wellsite G location will not intersect any seafloor or buried faults (Illustration AC 380-G-2).

**Shallow Gas and Shallow Water Flow.** Significant shallow gas is not likely to be encountered within the shallow sediments from the seafloor to the Top of Salt (2,611 ft bml), Illustration AC380-G-3. The potential for shallow water flow is considered negligible to low.

Shallow Gas. There are no apparent subsurface high-amplitude anomalies directly below the proposed wellsite. The potential for encountering shallow gas is considered negligible in the clay-rich sediments between the seafloor and 498 ft BML (Units 1 and 2). The potential for encountering minor amounts of gas within sand-rich sediments below 498 ft to the top of salt (2,611 ft BML) is generally considered low.

Shallow Water Flow. The potential for shallow water flow (SWF) at this well location is considered negligible to low (Illustration AC 380-G-3). Possible sand-prone sediments between Horizon 20 (498 ft bml) and the Top of Salt (2,611 ft bml) are designated with a low potential for shallow water flow (Illustration AC 380-G-3). The remaining clay-prone sediments in the upper 498 ft bml (seafloor to Horizon 20) are designated with a negligible potential for shallow water flow.

### **Proposed Wellsite G, AC 380, Concluding Remarks**

The Proposed Wellsite G, Alaminos Canyon Block 380 (OCS G-32954), appears suitable for exploration drilling operations. No seafloor obstructions or conditions exist that will be a constraint to equipment at the proposed location. Engineers should be aware of the potential for overpressured sands within various sequences at depth. A rafted rubble zone may be encountered between 1,954 ft bml and the Top of Salt. The sediments in the rubble zone will likely be overconsolidated and have variable sediment properties.

AC 380 is in Military Warning Area, W-602. Therefore, the appropriate military command must be notified prior to the commencement of drilling operations.

### **Closing**

The proposed wellsites in Alaminos Canyon Blocks 380 and 424 appear suitable for exploration drilling operations. No seafloor obstructions or conditions exist that will be a constraint to equipment at the proposed locations.

### **GEOSCIENCE EARTH & MARINE SERVICES, INC.**

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Attachments (3 Illustrations per Wellsite)



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

Currently there are no designated critical habitats for the listed species in the Gulf of Mexico Outer Continental Shelf; however, it is possible that one or more of these species could be seen in the area of our operations. The following table reflects the Federally-listed endangered and threatened species in the lease area and along the northern Gulf coast:

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

*Table 6.6 – 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	<i>Stenella frontalis</i>	
Blainville's Beaked Whale	<i>Mesoplodon densirostris</i>	
Blue Whale	<i>Balaenoptera musculus</i>	E
Bottlenose Dolphin	<i>Tursiops truncatus</i>	
Bryde's Whale	<i>Balaenoptera edeni</i>	
Clymene Dolphin	<i>Stenella clymene</i>	
Cuvier's Beaked Whale	<i>Ziphius cavirostris</i>	
Dwarf Sperm Whale	<i>Kogia simus</i>	
False Killer Whale	<i>Pseudorca crassidens</i>	
Fin Whale	<i>Balaenoptera physalus</i>	E
Fraser's Dolphin	<i>Lagenodelphis hosei</i>	
Gervais' Beaked Whale	<i>Mesoplodon europaeus</i>	
Humpback Whale	<i>Megaptera novaeangliae</i>	E
Killer Whale	<i>Orcinus orca</i>	
Melon-headed Whale	<i>Peponocephala electra</i>	
Minke Whale	<i>Balaenoptera acutorostrata</i>	
North Atlantic Right Whale	<i>Eubalaena glacialis</i>	E
Pantropical Spotted Dolphin	<i>Stenella attenuata</i>	
Pygmy Killer Whale	<i>Feresa attenuata</i>	
Pygmy Sperm Whale	<i>Kogia breviceps</i>	
Risso's Dolphin	<i>Grampus griseus</i>	
Rough-toothed Dolphin	<i>Steno bredanensis</i>	
Sei Whale	<i>Balaenoptera borealis</i>	E
Short-finned Pilot Whale	<i>Globicephala macrorhynchus</i>	
Sowerby's Beaked Whale	<i>Mesoplodon bidens</i>	
Sperm Whale	<i>Physeter macrocephalus</i>	E
Spinner Dolphin (Long-snouted)	<i>Stenella longirostris</i>	
Striped Dolphin	<i>Stenella coeruleoalba</i>	
Florida manatee	<i>Trichechus manatus</i>	E

Table 6.7 – 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.

#### **I. Archaeological Report**

See previous Section for this data.

#### **J. Air and Water Quality Information**

Drilling/completion 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 drilling 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.



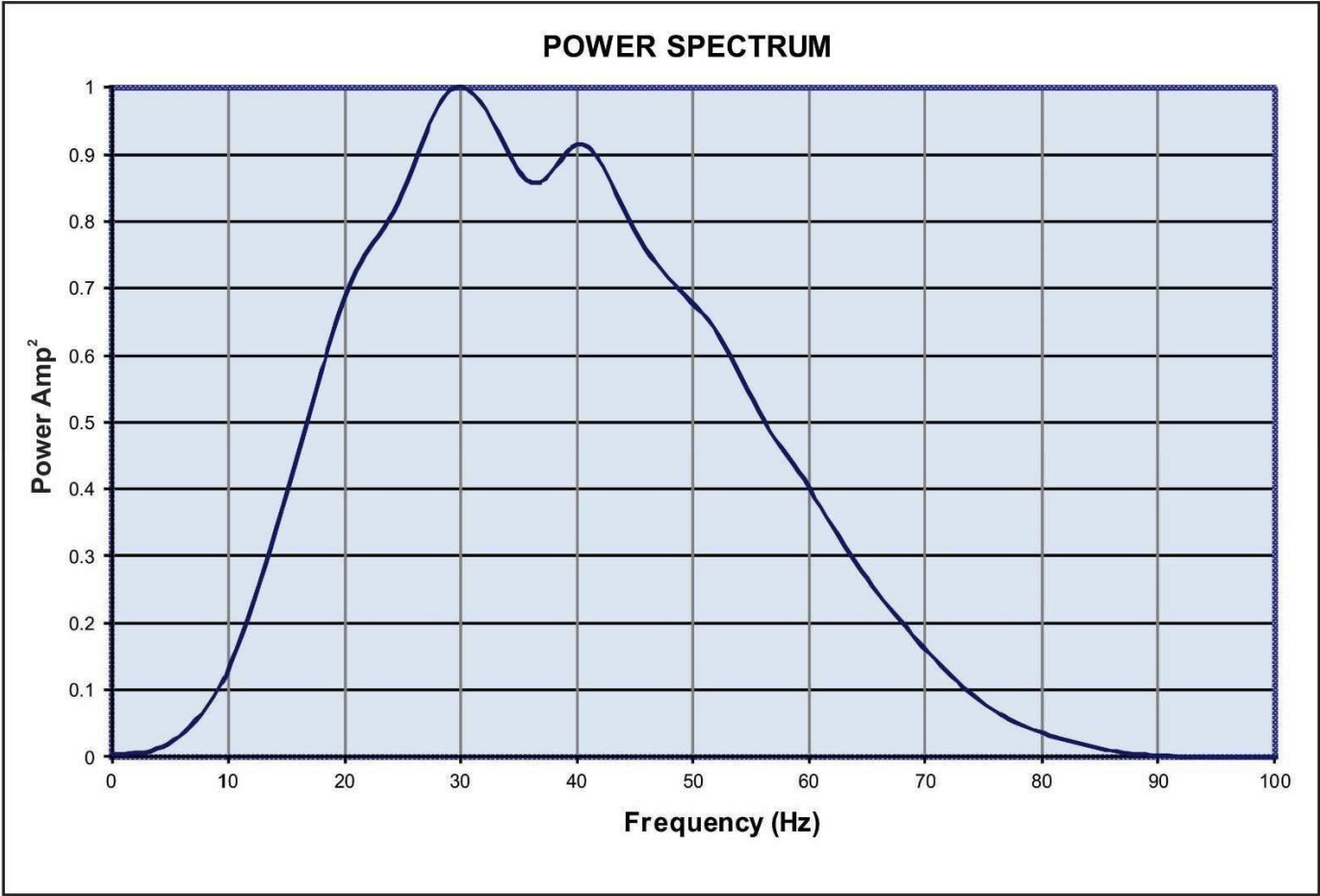
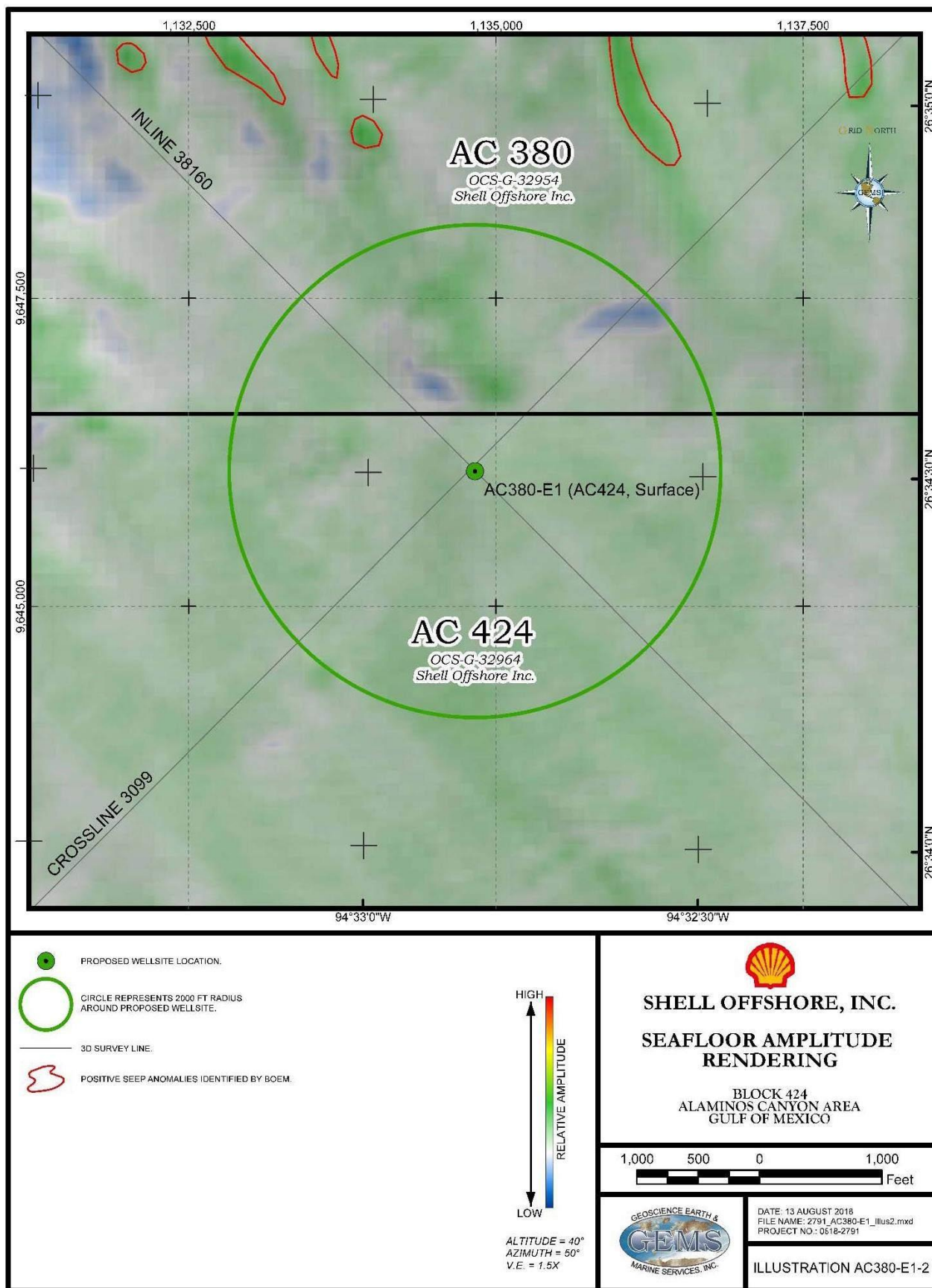


Illustration AC 380-E1-1. Power Spectrum Analysis Curve Proposed Wellsite AC 380-E1







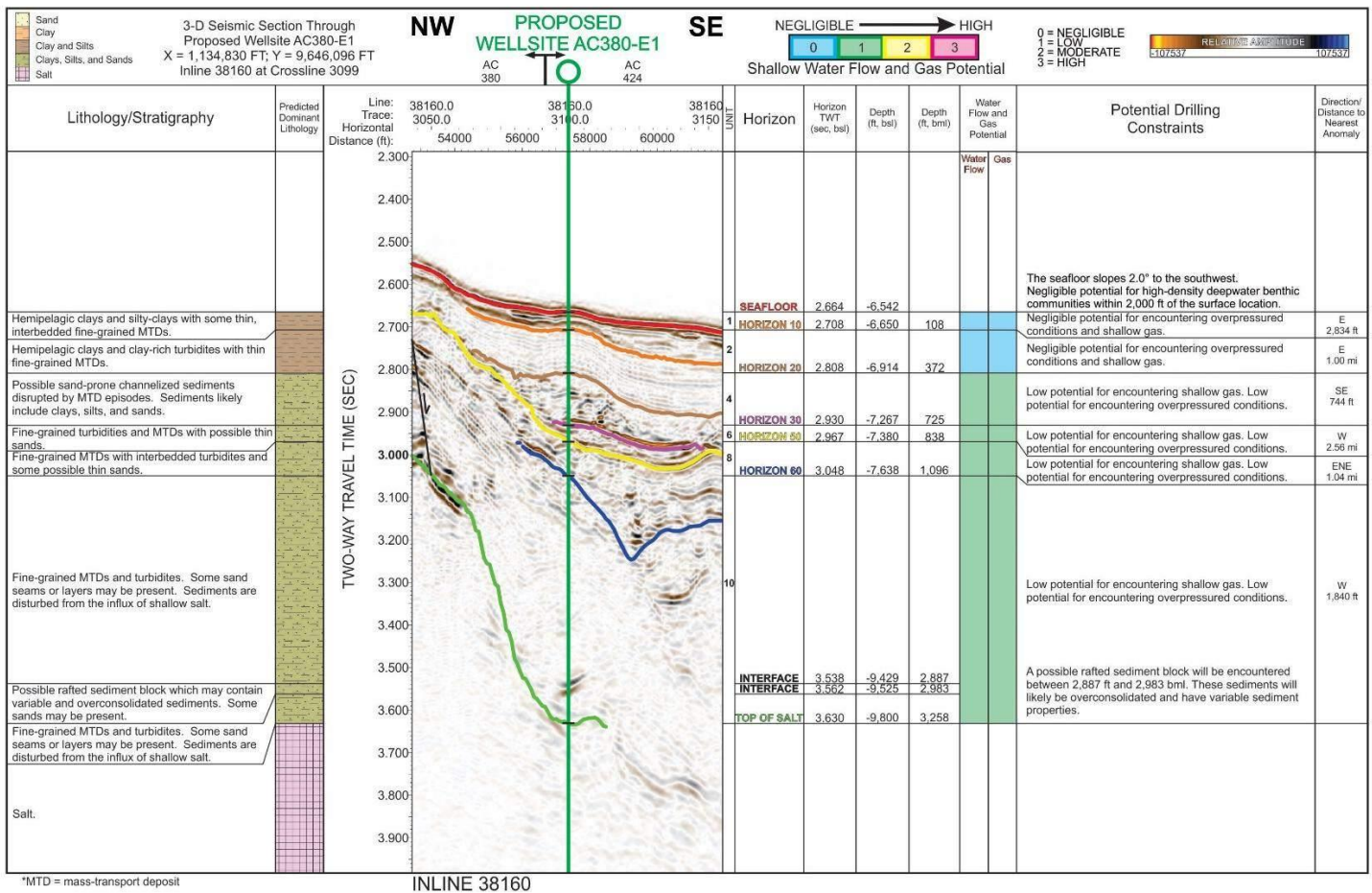


Illustration AC 380-E1-3. Tophole Prognosis Chart, Proposed Wellsite AC380-E1, Alaminos Canyon Area, Block 424



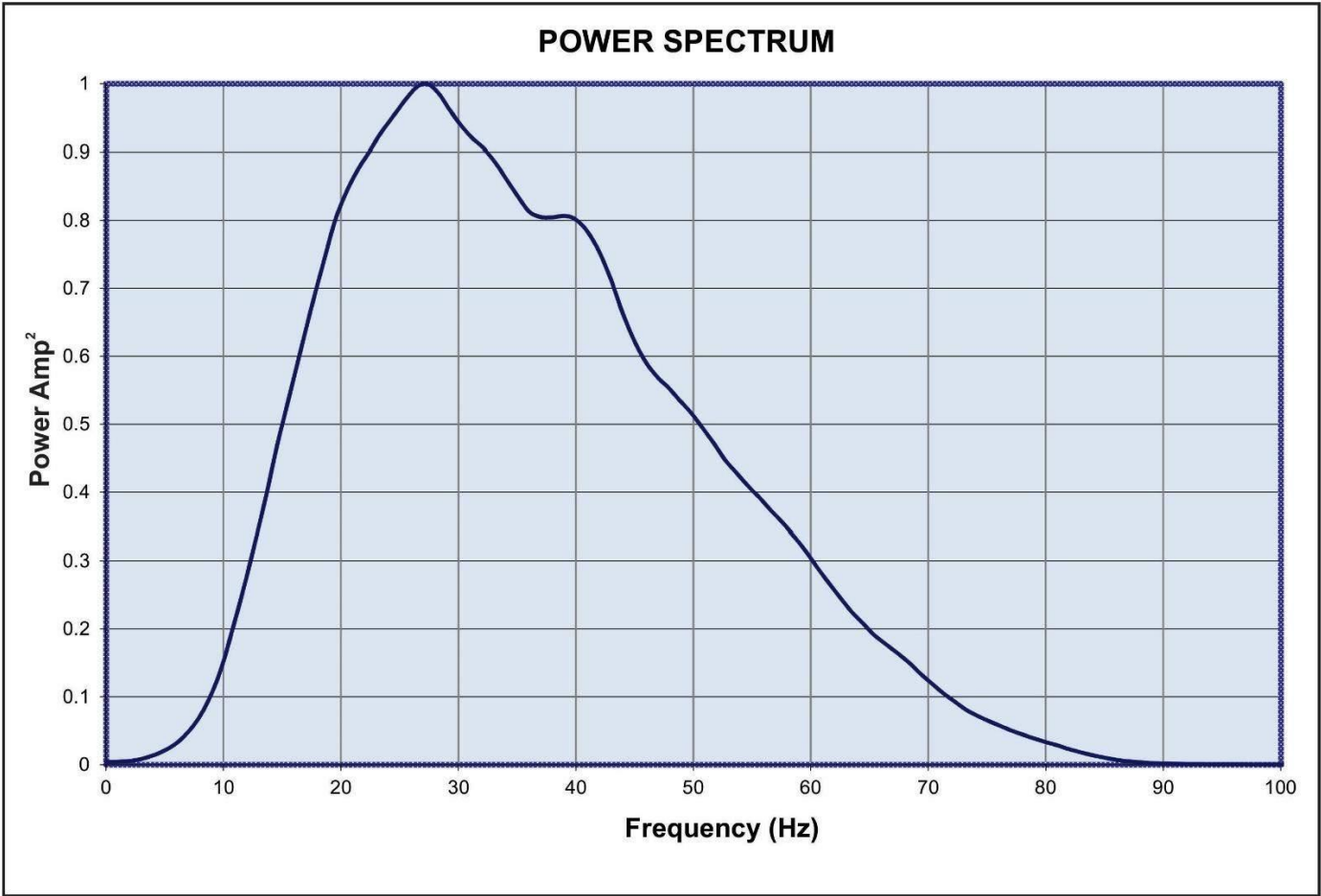
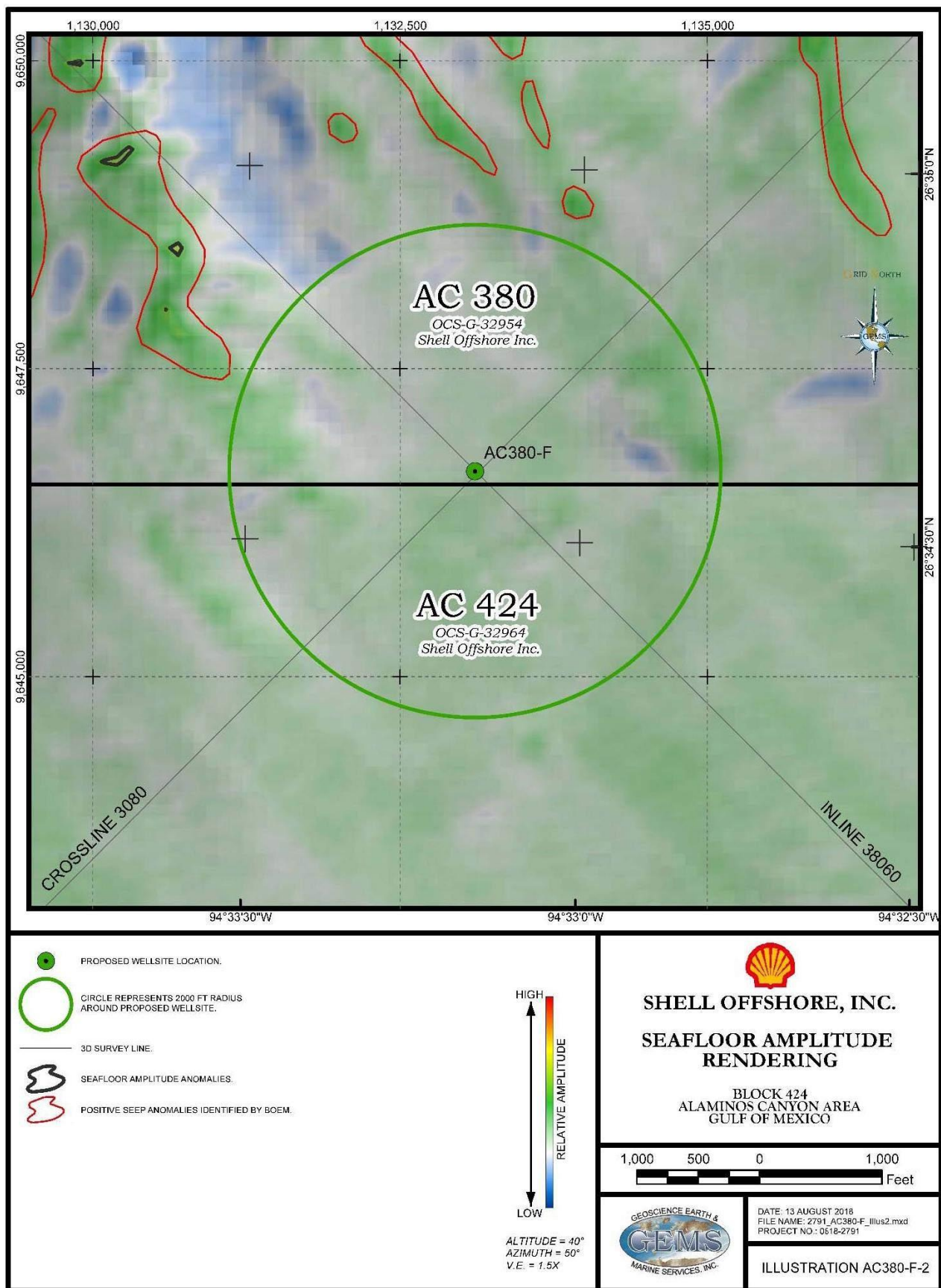


Illustration AC 380-F-1. Power Spectrum Analysis Curve Proposed Wellsite AC 380-F







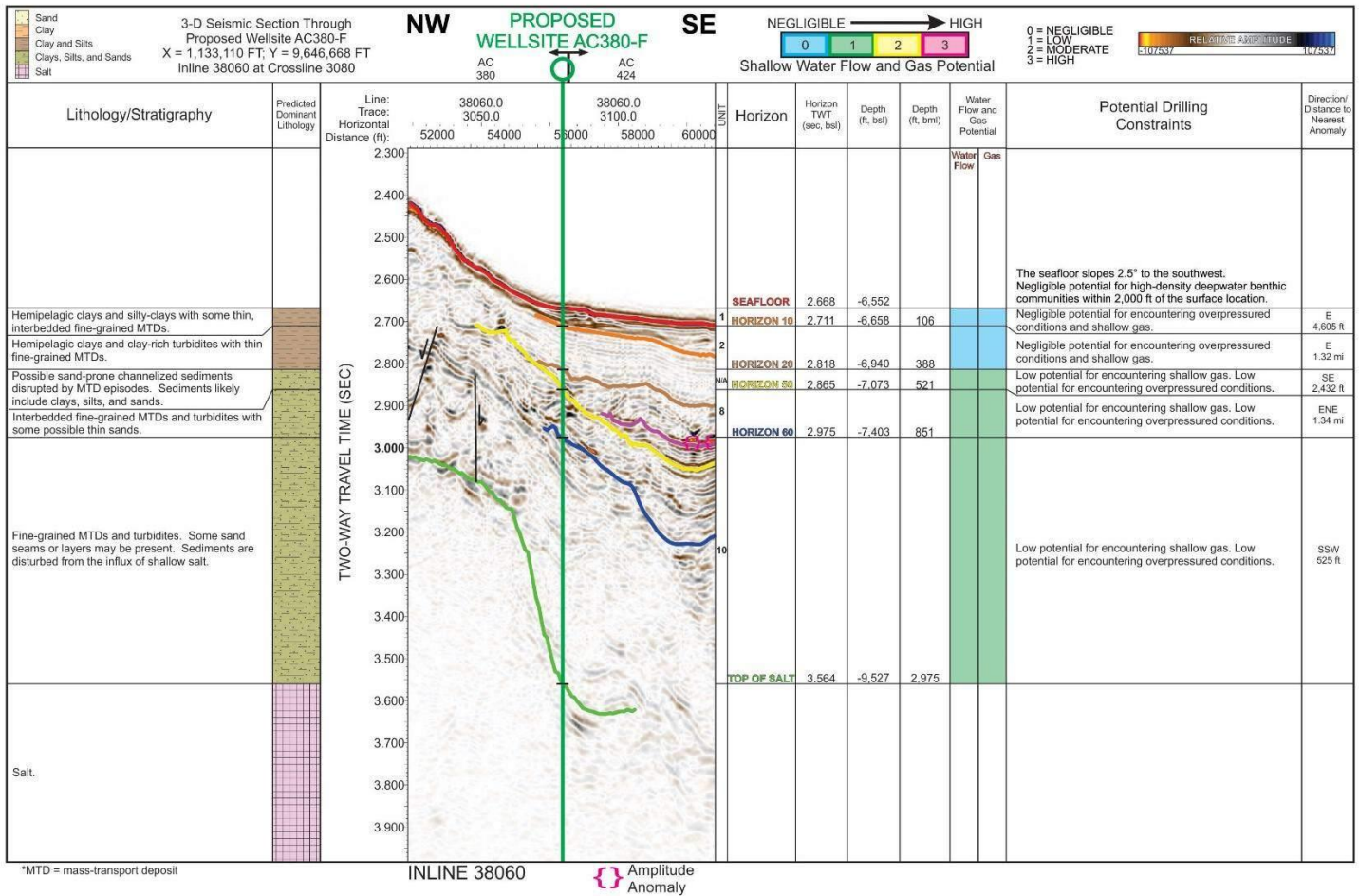


Illustration AC 380-F-3. Tophole Prognosis Chart, Proposed Wellsite AC380-F, Alaminos Canyon Area, Block 380



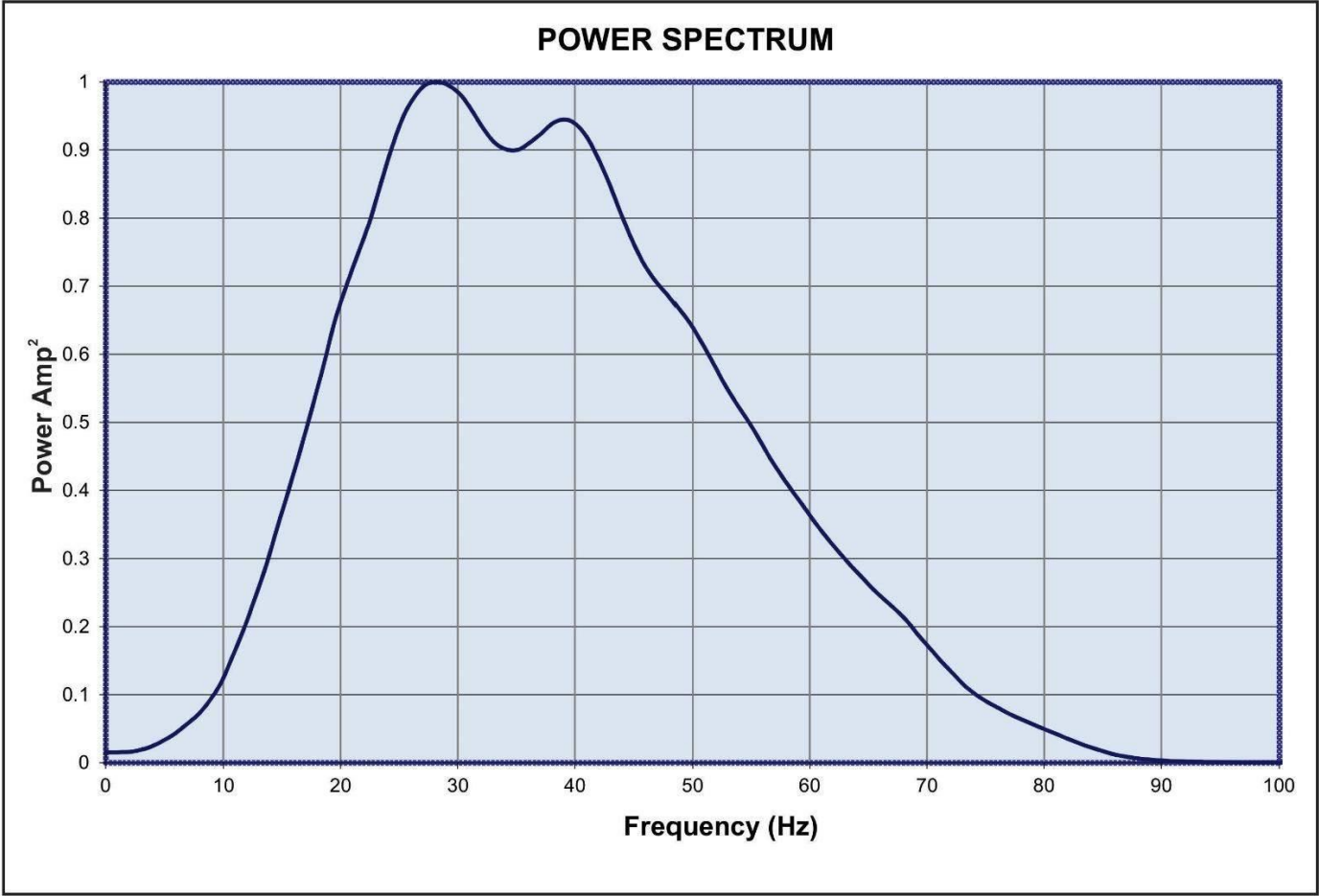
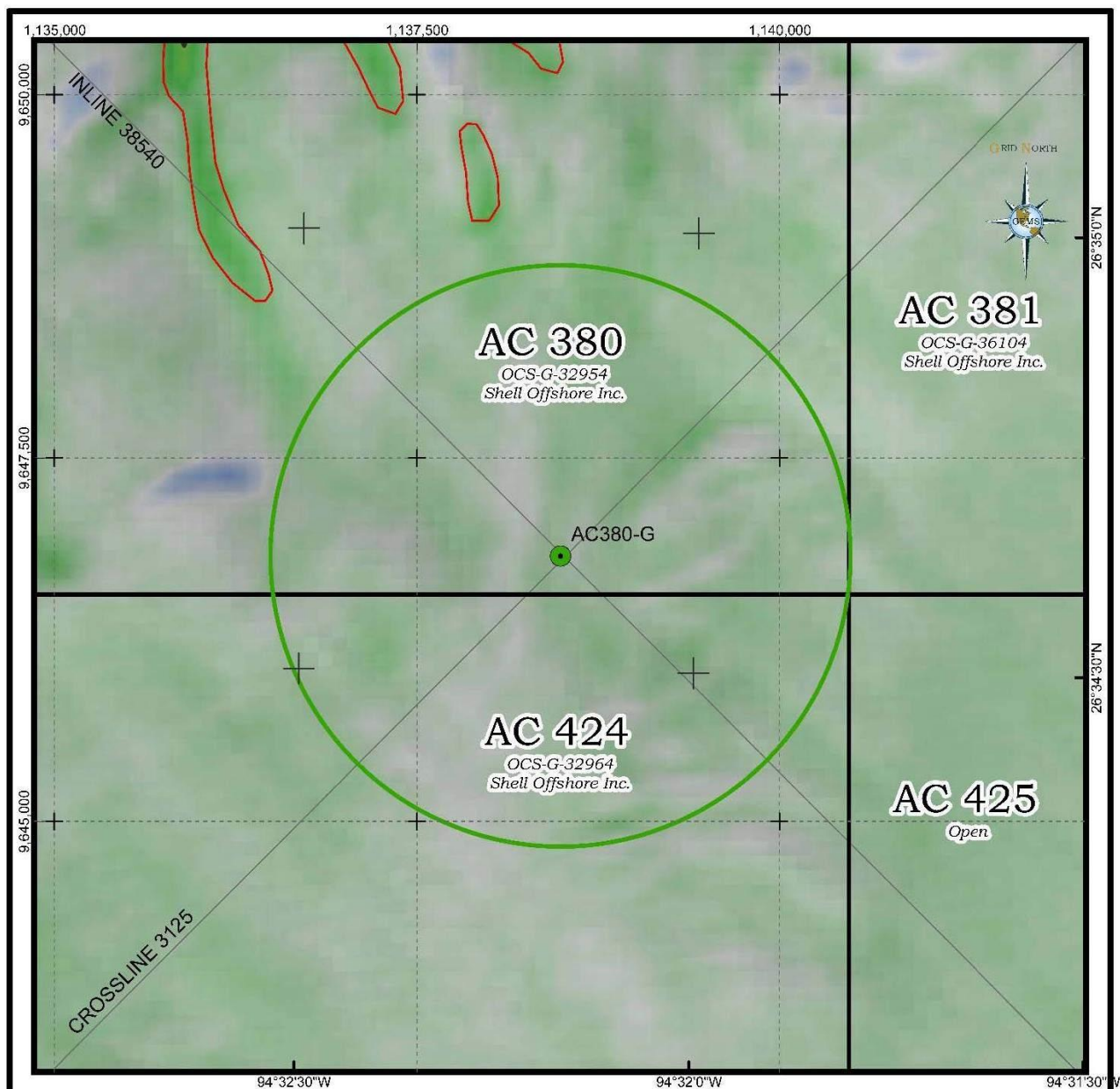
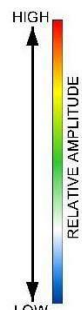


Illustration AC 380-G-1. Power Spectrum Analysis Curve Proposed Wellsite AC 380-G





- PROPOSED WELLSITE LOCATION.
- CIRCLE REPRESENTS 2000 FT RADIUS AROUND PROPOSED WELLSITE.
- 3D SURVEY LINE.
- SEAFLOOR AMPLITUDE ANOMALIES.
- POSITIVE SEEP ANOMALIES IDENTIFIED BY BOEM.

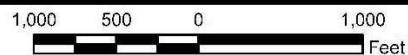


ALTITUDE = 40°  
AZIMUTH = 50°  
V.E. = 1.5X



# **SHELL OFFSHORE, INC.** **SEAFLOOR AMPLITUDE RENDERING**

BLOCK 380  
ALAMINOS CANYON AREA  
GULF OF MEXICO



DATE: 13 AUGUST 2018  
FILE NAME: 2791\_AC380-G\_illus2.mxd  
PROJECT NO.: 0516-2791

ILLUSTRATION AC380-G-2



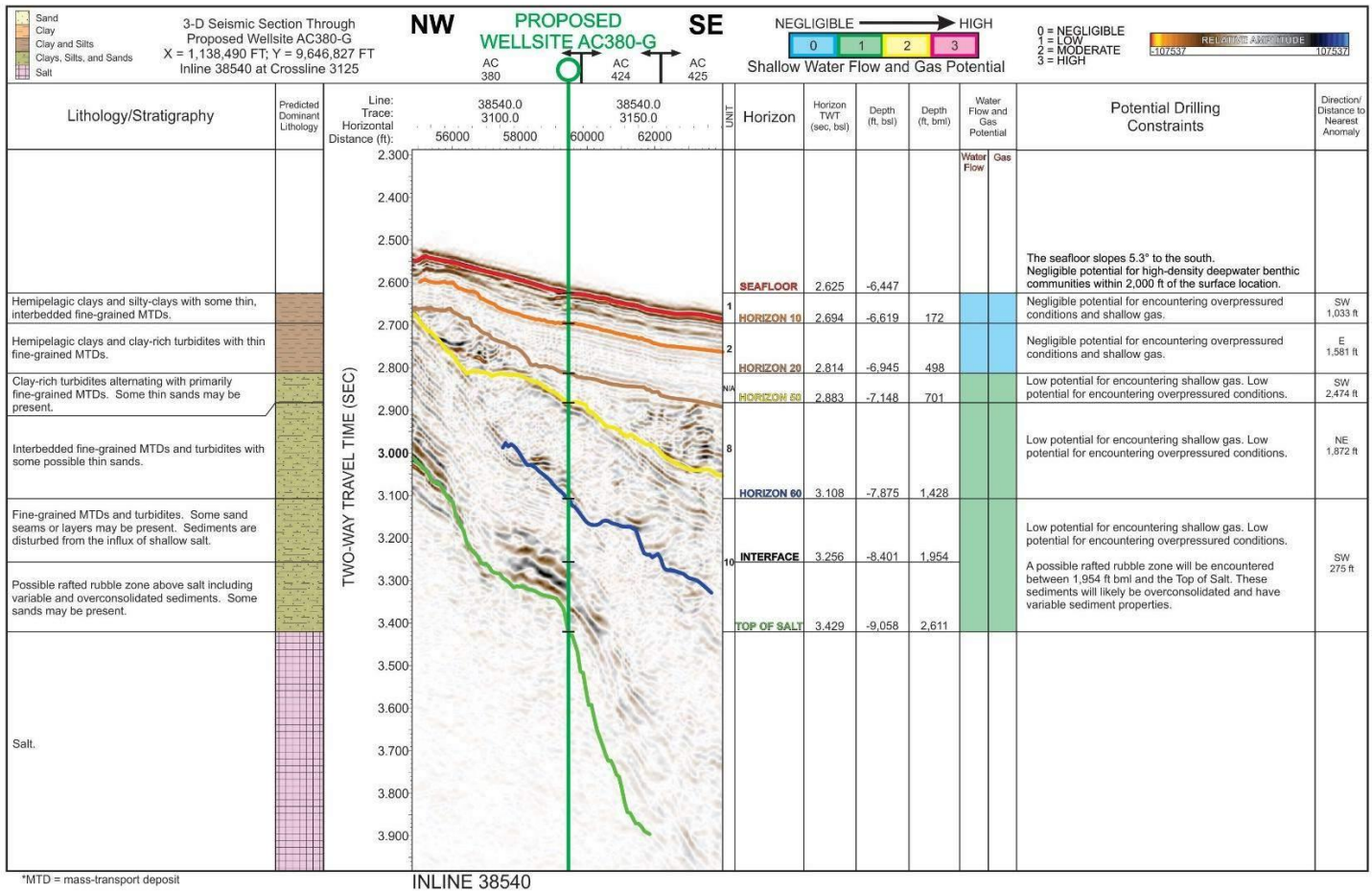


Illustration AC 380-G-3. Tophole Prognosis Chart, Proposed Wellsite AC380-G, Alaminos Canyon Area, Block 380



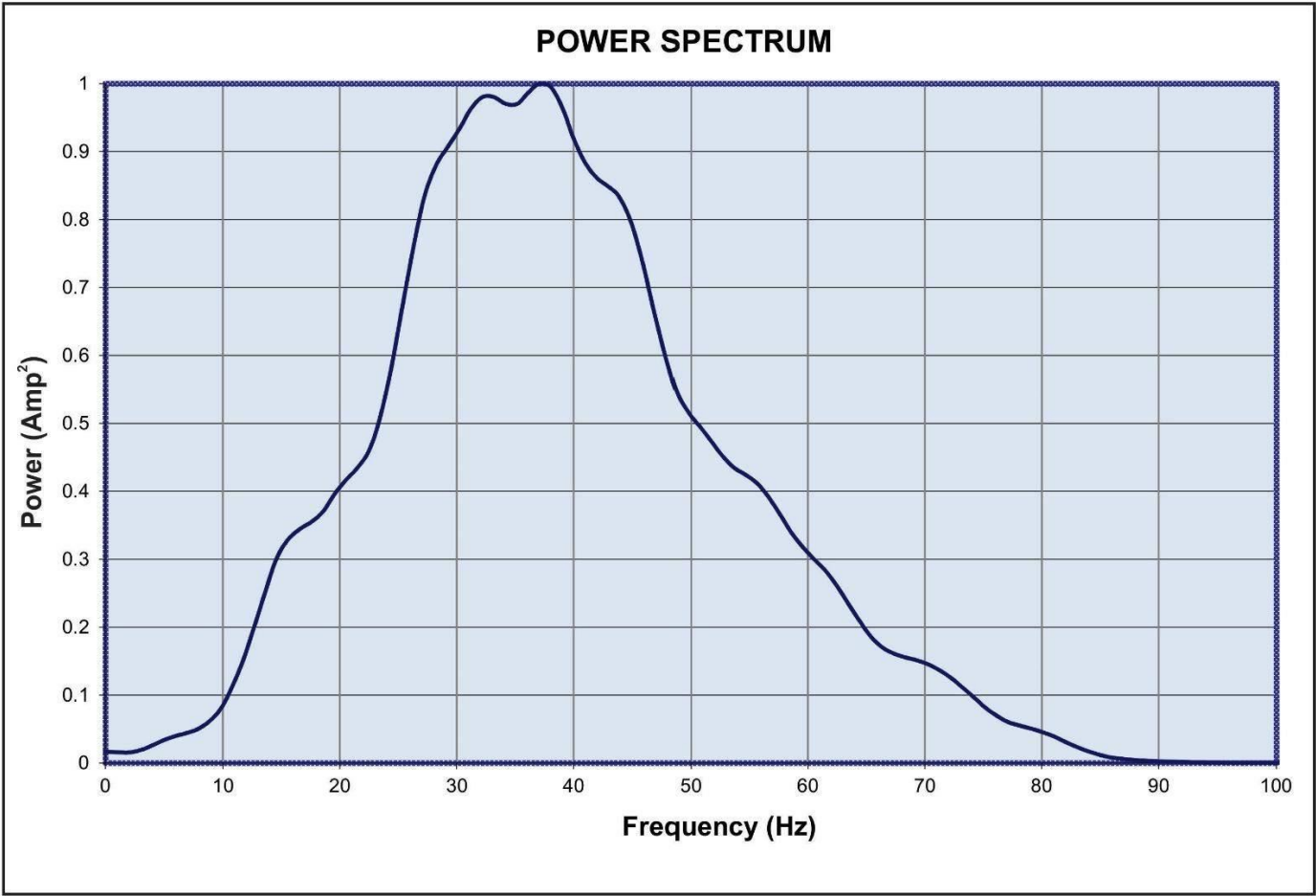
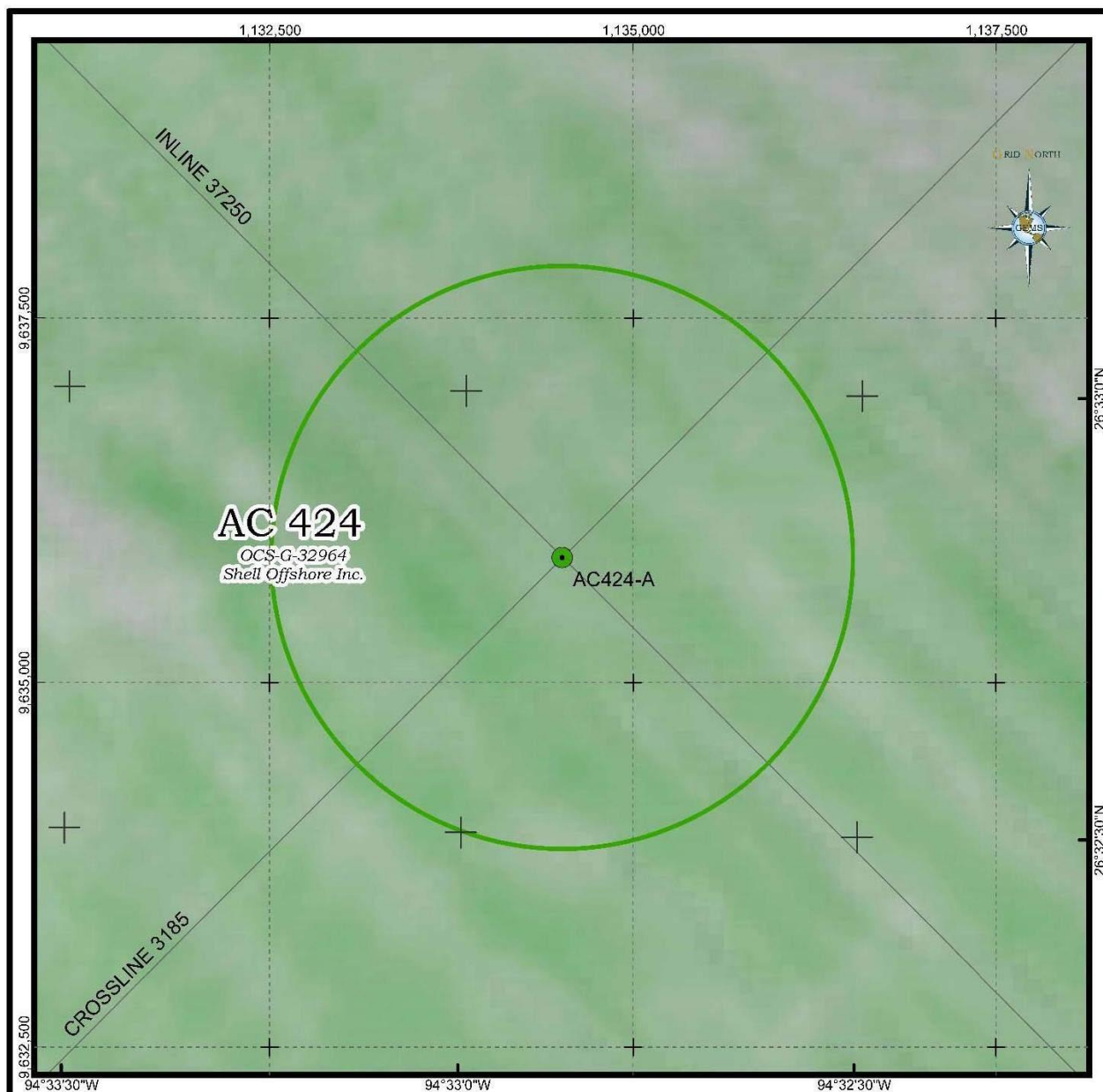



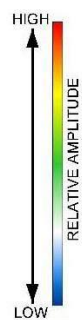


Illustration AC 424-A-1. Power Spectrum Analysis Curve Proposed Wellsite ACT 424-A





-  PROPOSED WELLSITE LOCATION.
-  CIRCLE REPRESENTS 2000 FT RADIUS AROUND PROPOSED WELLSITE.
-  3D SURVEY LINE.

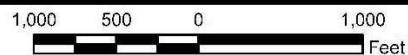


ALTITUDE = 40°  
AZIMUTH = 50°  
V.E. = 1.5X



# **SHELL OFFSHORE, INC.** **SEAFLOOR AMPLITUDE RENDERING**

BLOCK 424  
ALAMINOS CANYON AREA  
GULF OF MEXICO



DATE: 13 AUGUST 2018  
FILE NAME: 2791\_AC424-A\_Illus2.mxd  
PROJECT NO.: 0518-2791

ILLUSTRATION AC424-A-2



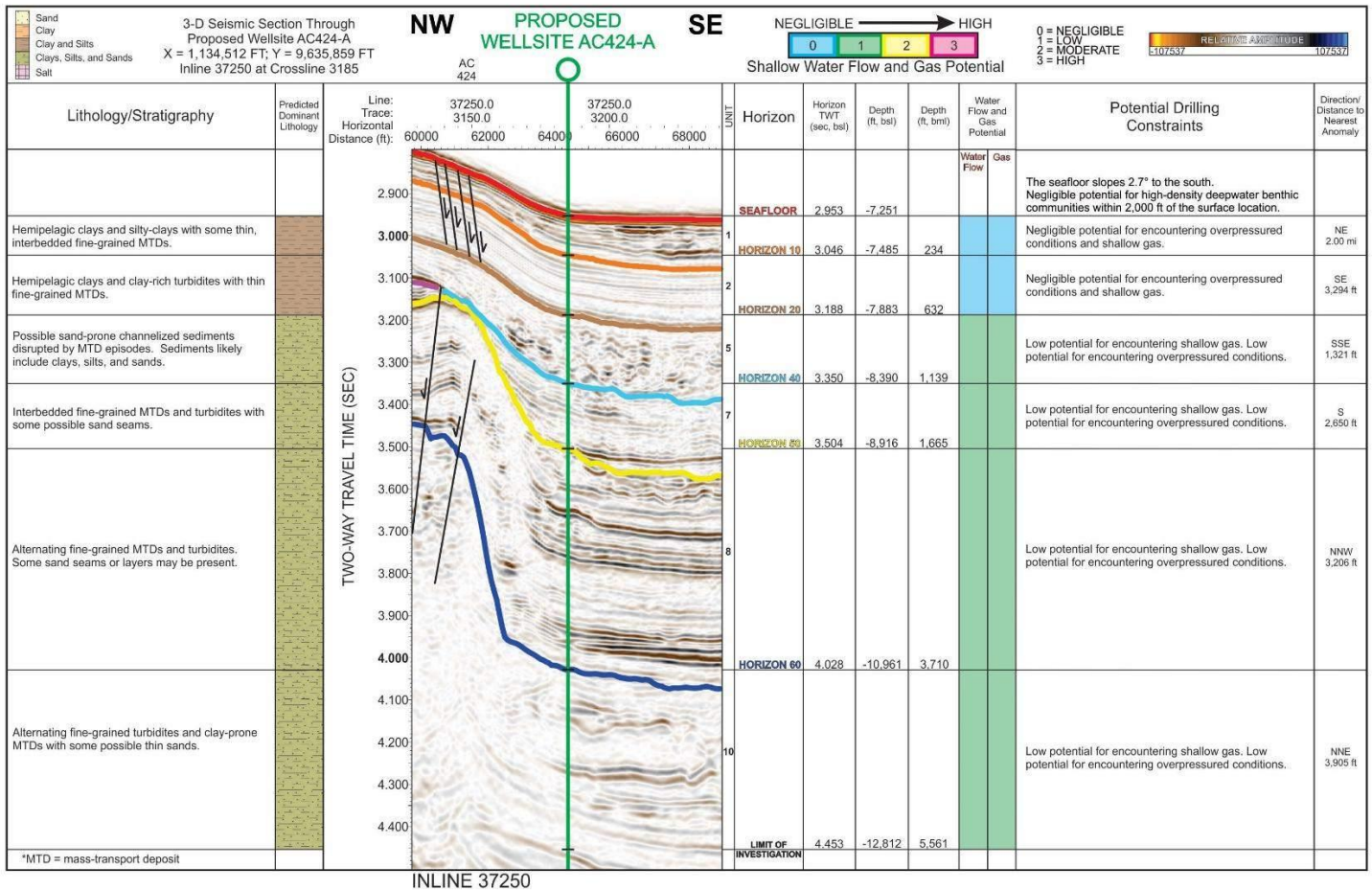


Illustration AC 424-A-3. Tophole Prognosis Chart, Proposed Wellsite AC424-A, Alaminos Canyon Area, Block 424



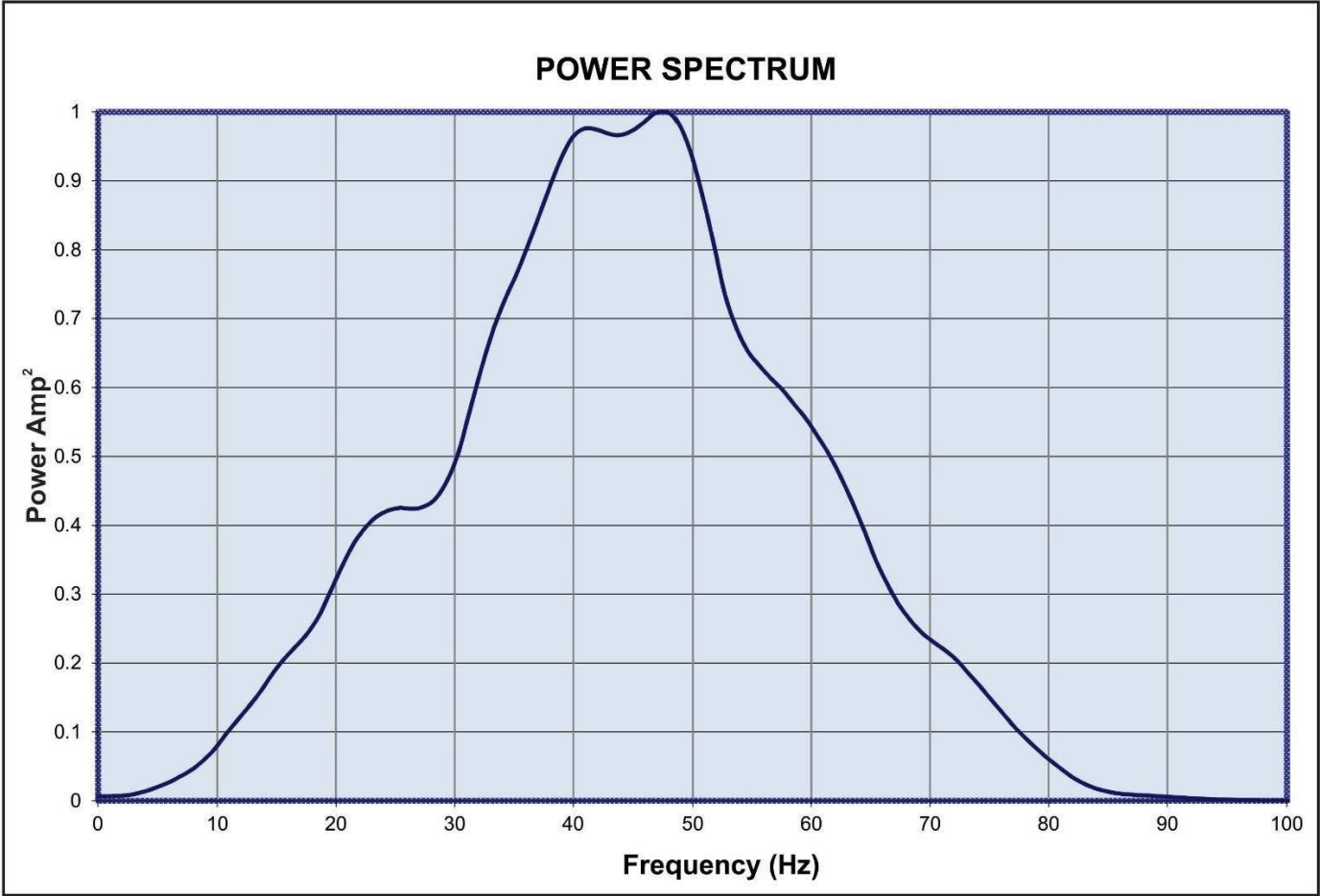
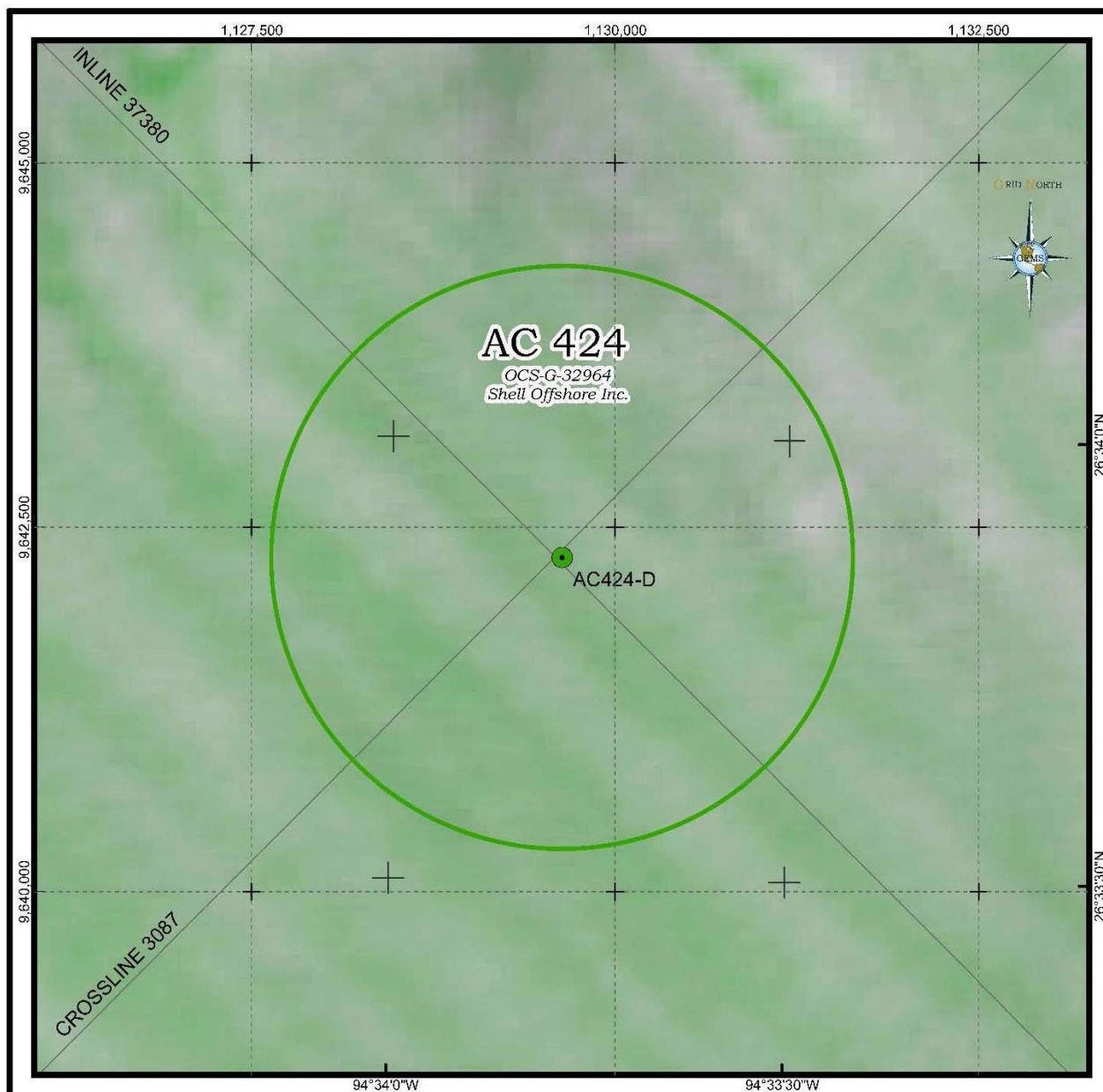



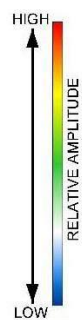


Illustration AC 424-D-1. Power Spectrum Analysis Curve Proposed Wellsite AC 424-D





-  PROPOSED WELLSITE LOCATION.
-  CIRCLE REPRESENTS 2000 FT RADIUS AROUND PROPOSED WELLSITE.
-  3D SURVEY LINE.

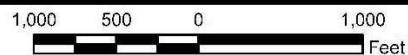


ALTITUDE = 40°  
AZIMUTH = 50°  
V.E. = 1.5X



**SHELL OFFSHORE, INC.**  
**SEAFLOOR AMPLITUDE  
RENDERING**

BLOCK 424  
ALAMINOS CANYON AREA  
GULF OF MEXICO



DATE: 13 AUGUST 2018  
FILE NAME: 2791\_AC424-D\_illus2.mxd  
PROJECT NO.: 0516-2791

ILLUSTRATION AC424-D-2



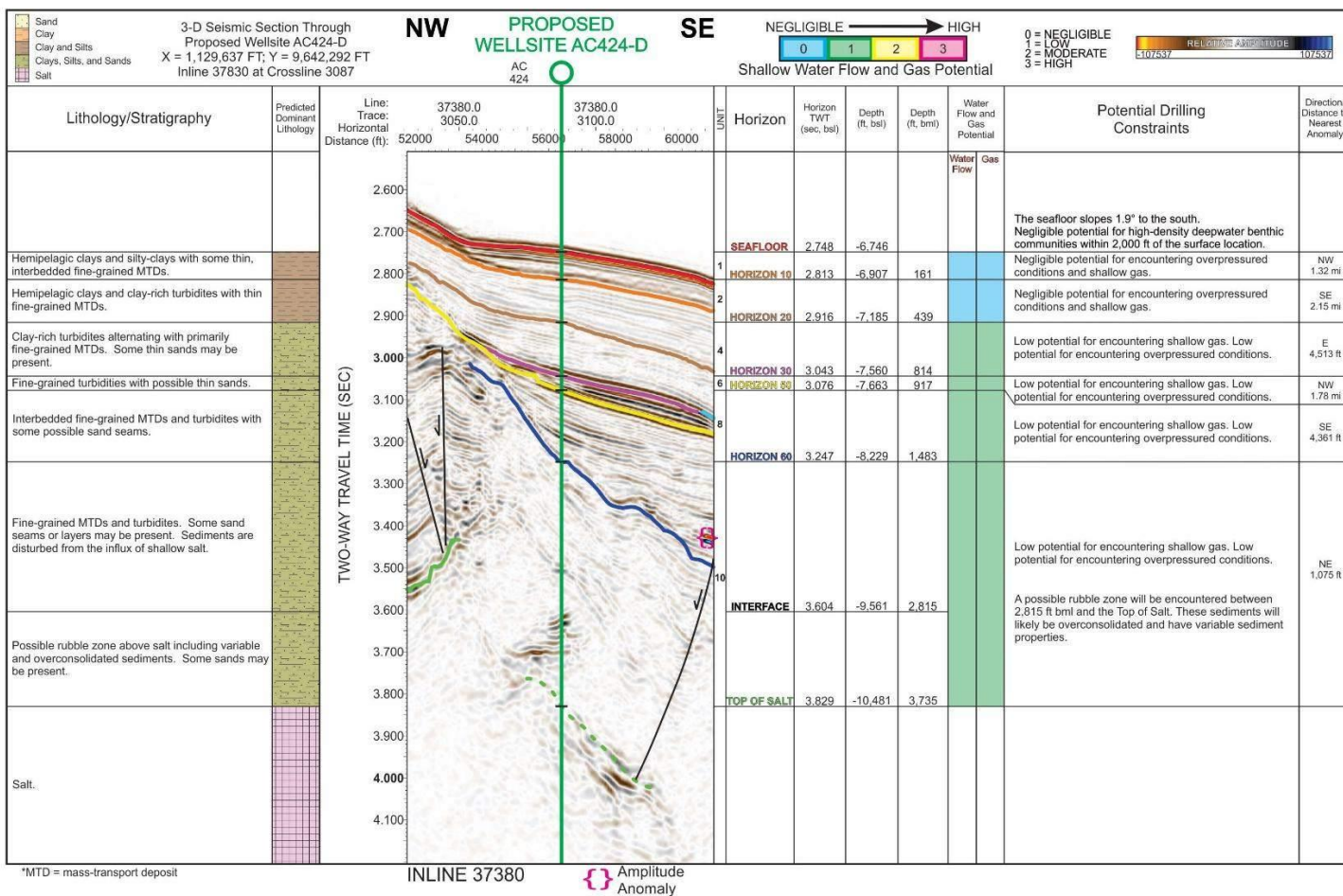


Illustration AC424-D-3. Tophole Prognosis Chart, Proposed Wellsite AC424-D, Alaminos Canyon Area, Block 424



## 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
<b>Will drilling occur? If yes, you should list muds and cuttings</b>					
<i>EXAMPLE: Cuttings wetted with synthetic based fluid</i>	<i>Cuttings generated while using synthetic based drilling fluid.</i>	<i>X bbl/well</i>	<i>X bbl/day/well</i>	<i>discharge pipe</i>	<i>No</i>
Water-based drilling fluid	barite, additives, mud	85000 bbls/well	17000 bbls/day	Overboard and seafloor discharge prior to 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.	8180 bbls/well	409 bbls/day	Overboard discharge line below the water line	No
Synthetic based drilling fluid adhering to washed drill cuttings	Synthetic based drilling fluid adhering to washed drill cuttings	600 bbls/well	30 bbls/day	Overboard discharge line below the water line	No
Spent drilling fluids - synthetic	Synthetic-based drilling mud	N/A	N/A	N/A	No
Spent drilling fluids - water based	Synthetic-based drilling mud	N/A	N/A	N/A	No
Chemical product waste	Chemical product waste	N/A	N/A	N/A	No
Brine	brine	N/A	N/A	N/A	No
<b>Will humans be there? If yes, expect conventional waste</b>					
<i>EXAMPLE: Sanitary waste water</i>		<i>X liter/person/day</i>	<i>NA</i>	<i>chlorinate and discharge</i>	<i>No</i>
Domestic waste (kitchen water, shower water)	grey water	45000 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	33750 bbls/well	150 bbls/day/well	Treated in the MSD** prior to discharge to meet NPDES limits	No
<b>Is there a deck? If yes, there will be Deck Drainage</b>					
Deck Drainage	Wash and rainwater	4500 bbls/well	20 bbls/day	Drained overboard through deck scuppers	No
<b>Will you conduct well treatment, completion, or workover?</b>					
well treatment fluids	Linear Frac Gel Flush Fluids, Crosslinked Frac Fluids carrying ceramic proppant and acidic breaker fluid	900 bbls/well	10 bbls/day	Overboard discharge line below the water level if oil and grease free and meets LC50 requirements.	No
well completion fluids	Completion brine contaminated with WBDM and displacement spacers	1350 bbls/well	15 bbls/day	Overboard discharge line below the water level if oil and grease free and meets LC50 requirements.	No
workover fluids	NA	NA	NA	NA	No
<b>Miscellaneous discharges. If yes, only fill in those associated with your activity.</b>					
Desalinization unit discharge	Rejected water from watermaker unit	90000 bbls/well	400 bbls/day/well	RO Desalinization Unit Discharge Line below waterline	No
Blowout preventer fluid	Water based	45 bbls/well	0 bbls/day	Discharge Line @ Subsea BOP @ seafloor	No
Ballast water	Uncontaminated seawater	737100 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).	347175 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	27000 bbls/well (assume planned 100% excess is discharged)	200 bbls/day	Discharged at seafloor.	No
Fire water	Treated seawater	15000 bbls/well	2000 bbls/month	Discharged below waterline	No
Cooling water	Treated seawater	102677175 bbls/well	456343 bbls/day/well	Discharged below waterline	No
Hydrate Inhibitor	Hydrate Inhibitor	15 bbls/well methanol	15 bbls/well	Used as needed. Discharged at seafloor.	No
<b>Will you produce hydrocarbons? If yes fill in for produced water.</b>					
Produced water	NA	NA	NA	NA	
<b>Will you be covered by an individual or general NPDES permit?</b>					
			GENERAL PERMIT	GMG290103	
<b>NOTE:</b> 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 or MiSwaco - Fourchon, LA; Ecoserv (Fourchon, La.), R300 Environmental Solutions (Fourchon, La.), or FCC Environmental (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.), R300 Environmental Solutions (Fourchon, La.), or FCC Environmental (Fourchon, LA)	300 bbls / well	Deep Well Injection or landfill	
Cuttings wetted with oil-based fluids	NA	NA	NA	NA	NA	
Completion Fluids	Used brine, acid	Storage tank on supply boat	Halliburton, Baker Hughes, Tetra, or Superior - Fourchon, LA; Ecoserv (Fourchon, La.), R300 Environmental Solutions (Fourchon, La.), or FCC Environmental (Fourchon, LA)	4000 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	NA	NA	NA	NA	NA	
Will you have additional wastes that are not permitted for discharge? If yes, fill in the appropriate rows.						
EXAMPLE: trash and debris	cardboard, aluminum,	barge in a storage bin	shorebase	2 tons total	recycle	
Trash and debris - recyclables	trash and debris	various storage containers on supply boat	Omega Waste Management, 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, used oily rags and pads, empty drums and cooking oil	various storage containers on supply boat	Ecoserv (Fourchon, La.), R300 Environmental Solutions (Fourchon, La.), or FCC Environmental (Fourchon, LA)	<60,000 bbl.	Deep Well Injection, or landfill	
Used oil and glycol	paints, solvents, chemicals, completion and treatment fluids	various storage containers on supply boat	Omega Waste Management, West Patterson, LA	20 bbls/month	Recycle	
Non-Hazardous Waste	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 Injection	
Hazardous Waste	paints, solvents and unused chemicals	various storage containers on supply boat	Omega Waste Management, West Patterson, LA or 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, Hammond, LA	50 bbls/mo	Recycle, treatment, incineration, or landfill	

## 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 EP's	Yes	No
Is any calculated Complex Total (CT) Emission amount (in tons) associated with your proposed exploration 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)?		<b>x</b>
Do your emission calculations include any emission reduction measures or modified emission factors?		<b>x</b>
Are your proposed exploration activities located east of 87.5° W longitude?		<b>x</b>
Do you expect to encounter H <sub>2</sub> S at concentrations greater than 20 parts per million (ppm)?		<b>x</b>
Do you propose to flare or vent natural gas for more than 48 continuous hours From any proposed well?		<b>x</b>
Do you propose to burn produced hydrocarbon liquids?		<b>x</b>

- (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.

Air Pollutant	Plan Emission Amounts (tons)	Calculated Exemption Amounts (tons)	Calculated Complex Total Emission Amounts (tons)
<b>PM</b>			
<b>SO<sub>x</sub></b>			
<b>NO<sub>x</sub></b>			
<b>VOC</b>			
<b>CO</b>			

**(2) Contact:** Josh O'Brien, (504) 425-9097, [Joshua.E.OBrien@shell.com](mailto:Joshua.E.OBrien@shell.com)

### **B. Worksheets**

See attached worksheets.

### **C. Emissions Reduction Measures**

NA



<b>COMPANY</b>	Shell Offshore Inc
<b>AREA</b>	Alaminos Canyon
<b>BLOCK</b>	AC-380, AC-424
<b>LEASE</b>	OCS-G-32954, OCS-G-G32964
<b>PLATFORM</b>	DP MODU
<b>WELL</b>	Drilling, Completion, and potential Well Tests AC-380 - E, F, G, EE, FF, GG, FFF, GGG AC-424 - A, D, E1, AA, DD, EE, AAA, DDD, EEE
<b>DISTANCE TO LAND</b>	164
<b>COMPANY CONTACT</b>	Josh O'Brien
<b>TELEPHONE NO.</b>	+1 (504) 425-9097
<b>REMARKS</b>	Blacktip, AC380,424-EP-AQR MODU-20180731-FINAL.xlsx



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

Equipment/Emission Factors	units	PM	SOx	NOx	VOC	CO	REF.	DATE
NG Turbines	gms/hp-hr		0.00247	1.3	0.01	0.83	AP42 3.2-1& 3.1-1	10/96
NG 2-cycle lean	gms/hp-hr		0.00185	10.9	0.43	1.5	AP42 3.2-1	10/96
NG 4-cycle lean	gms/hp-hr		0.00185	11.8	0.72	1.6	AP42 3.2-1	10/96
NG 4-cycle rich	gms/hp-hr		0.00185	10	0.14	8.6	AP42 3.2-1	10/96
Diesel Recip. < 600 hp.	gms/hp-hr	1	0.1835	14	1.12	3.03	AP42 3.3-1	10/96
Diesel Recip. > 600 hp.	gms/hp-hr	0.32	0.1835	11	0.33	2.4	AP42 3.4-1	10/96
Diesel Boiler	lbs/bbl	0.084	0.3025	0.84	0.008	0.21	AP42 1.3-12,14	9/98
NG Heaters/Boilers/Burners	lbs/mmscf	7.6	0.593	100	5.5	84	AP42 1.4-1, 14-2, & 14-3	7/98
NG Flares	lbs/mmscf		0.593	71.4	60.3	388.5	AP42 11.5-1	9/91
Liquid Flaring	lbs/bbl	0.42	6.83	2	0.01	0.21	AP42 1.3-1 & 1.3-3	9/98
Tank Vapors	lbs/bbl				0.03		E&P Forum	1/93
Fugitives	lbs/hr/comp.				0.0005		API Study	12/93
Glycol Dehydrator Vent	lbs/mmscf				6.6		La. DEQ	1991
Gas Venting	lbs/scf				0.0034			

Sulphur Content Source	Value	Units
Fuel Gas	3.33	ppm
Diesel Fuel	0.05	% weight
Produced Gas( Flares)	3.33	ppm
Produced Oil (Liquid Flaring)	1	% weight

Per 40 CFR 80.510(a)(1), Locomotive and Marine (LM) diesel fuels are limited to 500 ppm maximum sulfur, effective June 1, 2007



#### Miscellaneous Constants and Conversions

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



COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL	CONTACT	PHONE	REMARKS								
Shell Offshore Inc	Alaminos Canyon	AC-380, AC-42	OCS-G-32954, OCS-G-3296		Drilling, Completion, and potential Well Test	Josh O'Brien	+1 (504) 425-9	Blacktip, AC380,424-EP-AQR MODU-20180731-FINAL.xlsx								
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
DRILLING	PRIME MOVER>600hp diesel	10728	518	12436	24	61	7.56	4.34	259.93	7.80	56.71	5.54	3.17	190.27	5.71	41.51
	PRIME MOVER>600hp diesel	10728	518	12436	24	61	7.56	4.34	259.93	7.80	56.71	5.54	3.17	190.27	5.71	41.51
	PRIME MOVER>600hp diesel	10728	518	12436	24	61	7.56	4.34	259.93	7.80	56.71	5.54	3.17	190.27	5.71	41.51
	PRIME MOVER>600hp diesel	10728	518	12436	24	61	7.56	4.34	259.93	7.80	56.71	5.54	3.17	190.27	5.71	41.51
	PRIME MOVER>600hp diesel	10728	518	12436	24	61	7.56	4.34	259.93	7.80	56.71	5.54	3.17	190.27	5.71	41.51
	PRIME MOVER>600hp diesel	10728	518	12436	24	61	7.56	4.34	259.93	7.80	56.71	5.54	3.17	190.27	5.71	41.51
	Emergency Generator>600hp diesel	2547	123	2952	1	61	1.80	1.03	61.71	1.85	13.46	0.05	0.03	1.88	0.06	0.41
	Emergency Air Compressor< 600hp	26	1	30	1	61	0.06	0.01	0.80	0.06	0.17	0.00	0.00	0.02	0.00	0.01
	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 (general)	10100	488	11708	24	61	7.12	4.08	244.71	7.34	53.39	5.21	2.99	179.13	5.37	39.08
	Supply Vessel>600hp diesel (general)	10100	488	11708	24	20	7.12	4.08	244.71	7.34	53.39	1.71	0.98	58.73	1.76	12.81
	Supply Vessel>600hp diesel (general)	10100	488	11708	24	20	7.12	4.08	244.71	7.34	53.39	1.71	0.98	58.73	1.76	12.81
	Crew Vessel>600hp diesel	8000	386	9274	24	18	5.64	3.23	193.83	5.81	42.29	1.24	0.71	42.57	1.28	9.29
	Frac Boat Engines >600hp diesel	12100	584	14026	24	3	8.53	4.89	293.17	8.80	63.96	0.31	0.18	10.55	0.32	2.30
	Frac Boat-Completion Equipment >600hp diesel	16500	797	19127	24	3	11.63	6.67	399.78	11.99	87.22	0.42	0.24	14.39	0.43	3.14
DRILLING	OIL BURN	0			24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WELL TEST	GAS FLARE		1420000		24	4		0.84	101.39	85.63	551.67		0.04	4.87	4.11	26.48
	AHV / MPS Vessel>600 hp	13500	652	15649	24	4	9.52	5.46	327.09	9.81	71.37	0.46	0.26	15.70	0.47	3.43
	MPS Vessel>600 hp	10100	488	11708	24	4	7.12	4.08	244.71	7.34	53.39	0.34	0.20	11.75	0.35	2.56
	MISC.	BPD	SCF/HR	COUNT												
	TANK-500BBL	15000			24	4				18.75					0.90	
	TANK-100BBL	15000			24	4				18.75					0.90	
	FUGITIVES-			452		4				0.23					0.01	
	2018 TOTAL						111.01	64.48	3916.21	237.84	1383.99	44.66	25.65	1539.94	51.97	361.40
EXEMPTION CALCULATION	DISTANCE FROM LAND IN MILES											5461.20	5461.20	5461.20	5461.20	101868.87
	164.0															

NOTE - Emissions for MODU activities are estimated at the Potential to Emit (no fuel reduction measures).







COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL
Shell Offshore Inc	Alaminos Canyon	AC-380, AC-424	OCS-G-32954, OCS-G-G32964	DP MODU	Drilling, Completion, and potential Well Tests AC-380 - E, F, G, EE, FF, GG, FFF, GGG AC-424 - A, D, E1, AA, DD, EE, AAA, DDD, EEE
Year	Emitted		Substance		
	PM	SOx	NOx	VOC	CO
<b>AQR Emissions if DP MODU(Semi-sub or Drillship) is Utilized</b>					
<b>2018</b>	<b>44.66</b>	<b>25.65</b>	<b>1539.94</b>	<b>51.97</b>	<b>361.40</b>
<b>2019-2035</b>	<b>150.10</b>	<b>86.17</b>	<b>5171.86</b>	<b>169.60</b>	<b>1191.95</b>
<b>Allowable</b>	<b>5461.20</b>	<b>5461.20</b>	<b>5461.20</b>	<b>5461.20</b>	<b>101868.87</b>

Notes

Emissions for MODU activities are estimated at the Potential to Emit (no fuel reduction measures).



## **SECTION 9: OIL SPILL INFORMATION**

### **A. Oil Spill Response Planning**

All the proposed activities and facilities in this plan will be covered by the Regional OSRP filed by Shell Offshore Inc. (0689) in accordance with 30 CFR 254.47 and NTL 2013-N02. Shell's regional OSRP was approved by BSEE in June 2017. The bi-annual review was found to be in compliance October 3, 2017.

<b>Primary Response Equipment Locations</b>	<b>Preplanned Staging Location(s)</b>
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.

<b>Category</b>	<b>Regional OSRP</b>	<b>EP</b>
Type of Activity	Exploratory Drilling	Exploratory Drilling
Facility Location (area/block)	MC 812	AC 424
Facility Designation	Subsea well B◆	Subsea well D
Distance to Nearest Shoreline (miles)	56	164
Volume		
Storage tanks (total)	N/A	N/A
Flowlines (on facility)	N/A	N/A
Pipelines	N/A	N/A
Uncontrolled blowout (volume per day)	<u>468,000* BOPD</u>	<u>125,000** BOPD</u>
Total Volume	468,000 Bbls	125,000 Bbls
Type of Oil(s) - (crude oil, condensate, diesel)	Crude oil	Crude oil
API Gravity(s)	31°	41°

*Table 9.2 - Worst Case Scenario Determination*

**\*24-hour rate (432,000 BOPD 30-day average)**

**\*\* 24-hour rate (125,000 BOPD 30-day average)**

◆ This well was accepted by BOEM in plan N-9840.

**Certification:** Since Shell Offshore Inc. has the capability to respond to the appropriate worst-case spill scenario included in its regional OSRP, approved by BSEE June 2017. The bi-annual review was found to be in compliance October 2017. 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 plan.

**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 DOCD.

### 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 BOEMRE 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	%
Exploratory AC 424		24	Cameron, TX	3
			Willacy, TX	1
			Kenedy, TX	4
			Kleberg, TX	3
			Nueces, TX	3
			Aransas, TX	3
			Calhoun, TX	4
			<b>Matagorda, TX</b>	<b>8</b>
			Brazoria, TX	2
			Galveston, TX	4
			Jefferson, TX	2
			Cameron, LA	3

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 BOEMRE 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 424 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 815 Worst Case Discharge as effectively as possible. Below is a table outlining the applicable evaporation and surface dispersion quantity:

Alaminos Canyon Block 424		Calculations (BBLS)
i.	TOTAL WCD (based on 30-day average (per day))	125,000
ii.	Loss of volume of oil to natural surface dispersion and evaporation base (approximate bbls per day)* (25% Natural surface evaporation and dispersion in 24 hrs)	-31,250
TOTAL REMAINING		~93,750

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.

<b>MSRC OSRV</b>	8 foot seas
<b>VOSS System</b>	4 foot seas
<b>Expandi Boom</b>	6 foot seas, 20 knot winds
<b>Dispersants</b>	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 65 hours (based on the equipment's Estimated Daily Response Capacity (EDRC)). Shell will continue to ramp up additional on-water mechanical recovery resources as 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 424 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 502,000 barrels/day. Temporary storage associated with the identified skimming and temporary storage equipment equals approximately 298,000 barrels.

	De-rated Recovery Rate (bopd)	Storage (bbls)
Offshore Recovery and Storage	246,934	291,101
Nearshore Recovery and Storage	255,374	7,009
Total	502,308	298,110

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 Activation 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 a 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 system has 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.



# UPPER COAST OF TEXAS

## SHORELINE HABITAT RANKINGS

1B)	EXPOSED, SOLID MAN-MADE STRUCTURES
2A)	EXPOSED WAVE-CUT PLATFORMS IN CLAY
2B)	EXPOSED SCARPS AND STEEP SLOPES IN CLAY
3A)	FINE-TO MEDIUM-GRAINED SAND BEACHES
4)	MIXED SAND AND GRAVEL (SHELL) BEACHES
6A)	GRAVEL BEACHES
6B)	RIPRAP
7)	EXPOSED TIDAL FLATS
8A)	SHELTERED SCARPS IN CLAY OR BEDROCK
8B)	SHELTERED, SOLID MAN-MADE STRUCTURES
8C)	SHELTERED RIPRAP
9A)	SHELTERED TIDAL FLATS
10A)	SALT- AND BRACKISH-WATER MARSHES
10B)	FRESHWATER MARSHES
10C)	SWAMPS
10D)	SCRUB-SHRUB WETLANDS

## HUMAN-USE FEATURES

ACCESS	CRITICAL HABITAT	PARK
AIRPORT / HELIPORT	HISTORICAL SITE	WATER INTAKE
AQUACULTURE SITE	LOCK / DAM	WILDLIFE REFUGE
ARTIFICIAL REEF	MANAGEMENT AREA	HUMAN-USE NUMBER
BOAT RAMP	MARINA	MANAGEMENT AREA BOUNDARY
COAST GUARD	NATURE CONSERVANCY	STATE BOUNDARY

## SENSITIVE BIOLOGICAL RESOURCES

BIRD	TERRESTRIAL MAMMAL	FISH
DIVING BIRD	SMALL MAMMAL	FISH
GULL / TERN	REPTILE / AMPHIBIAN	BENTHIC MARINE HABITAT
PASSERINE BIRD / LANDFOWL	TURTLE	SEAGRASS (PATCHY)
PELAGIC BIRD	OTHER REPTILE / AMPHIBIAN	SEAGRASS (CONTINUOUS)
RAPTOR	INVERTEBRATE	REEF
SHOREBIRD	BEVALVE	HABITAT
WADING BIRD	CEPHALOPOD	PLANT
WATERFOWL	CRAB	RAR NUMBER
NESTING SITE	GASTROPOD	MULTI-GROUP
MARINE MAMMAL	SHRIMP	THREATENED / ENDANGERED / SPECIES OF SPECIAL CONCERN
DOLPHIN		
MANATEE		

Figure 9.C.1 Environmental Sensitivity Index Map Legend



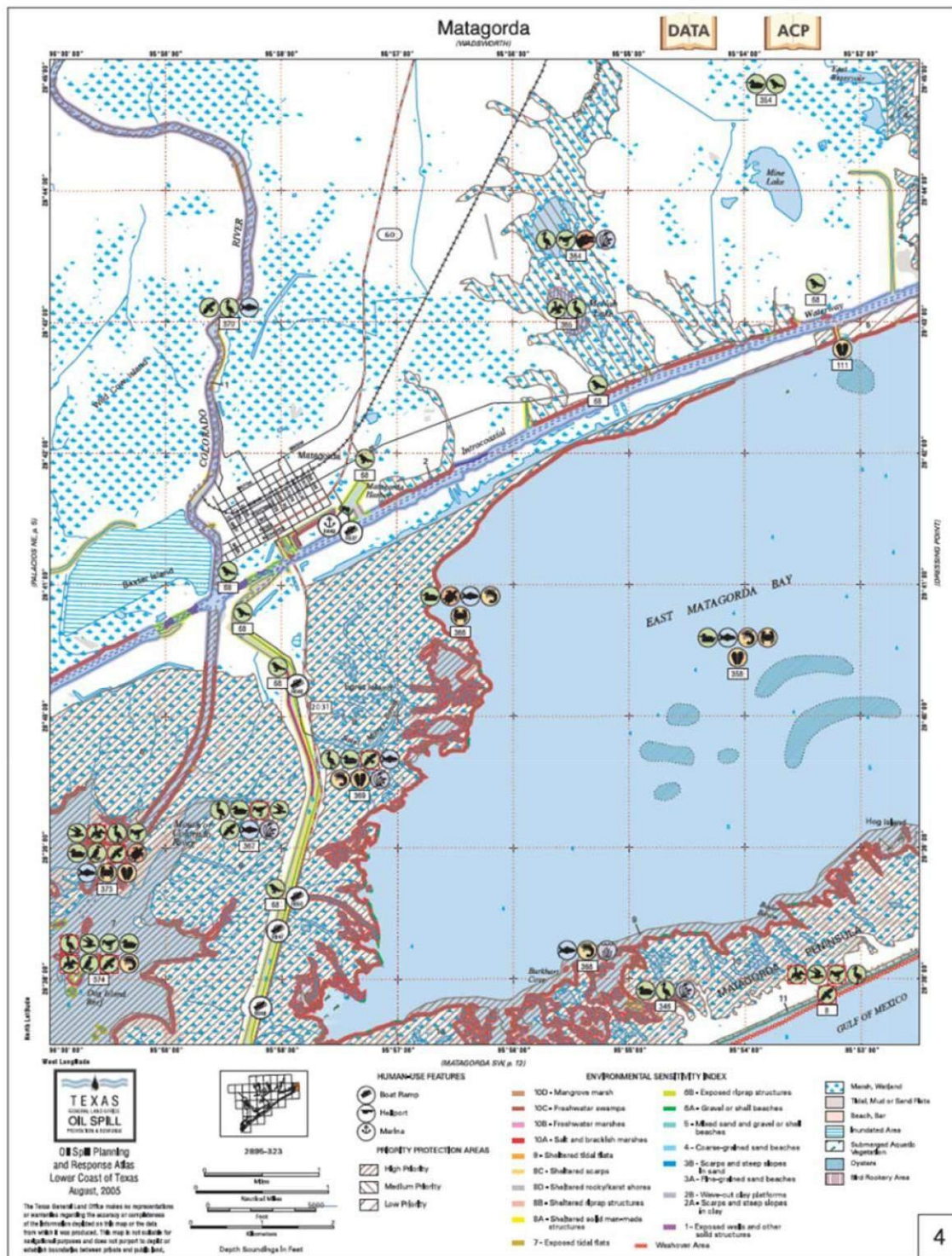


Figure 9.C.2 South Pass ESI Map



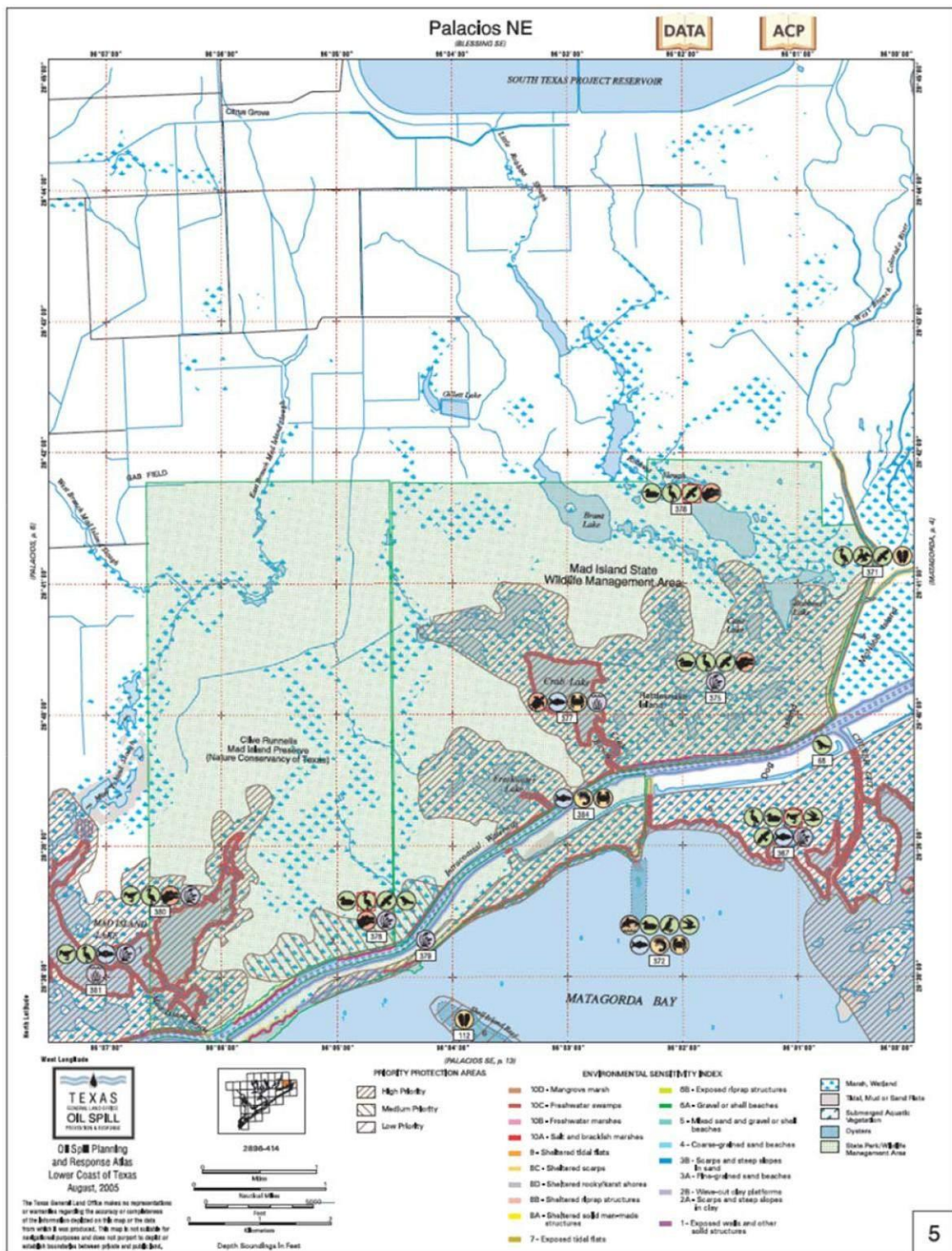


Figure 9.C.3 Garden Island Pass ESI Map







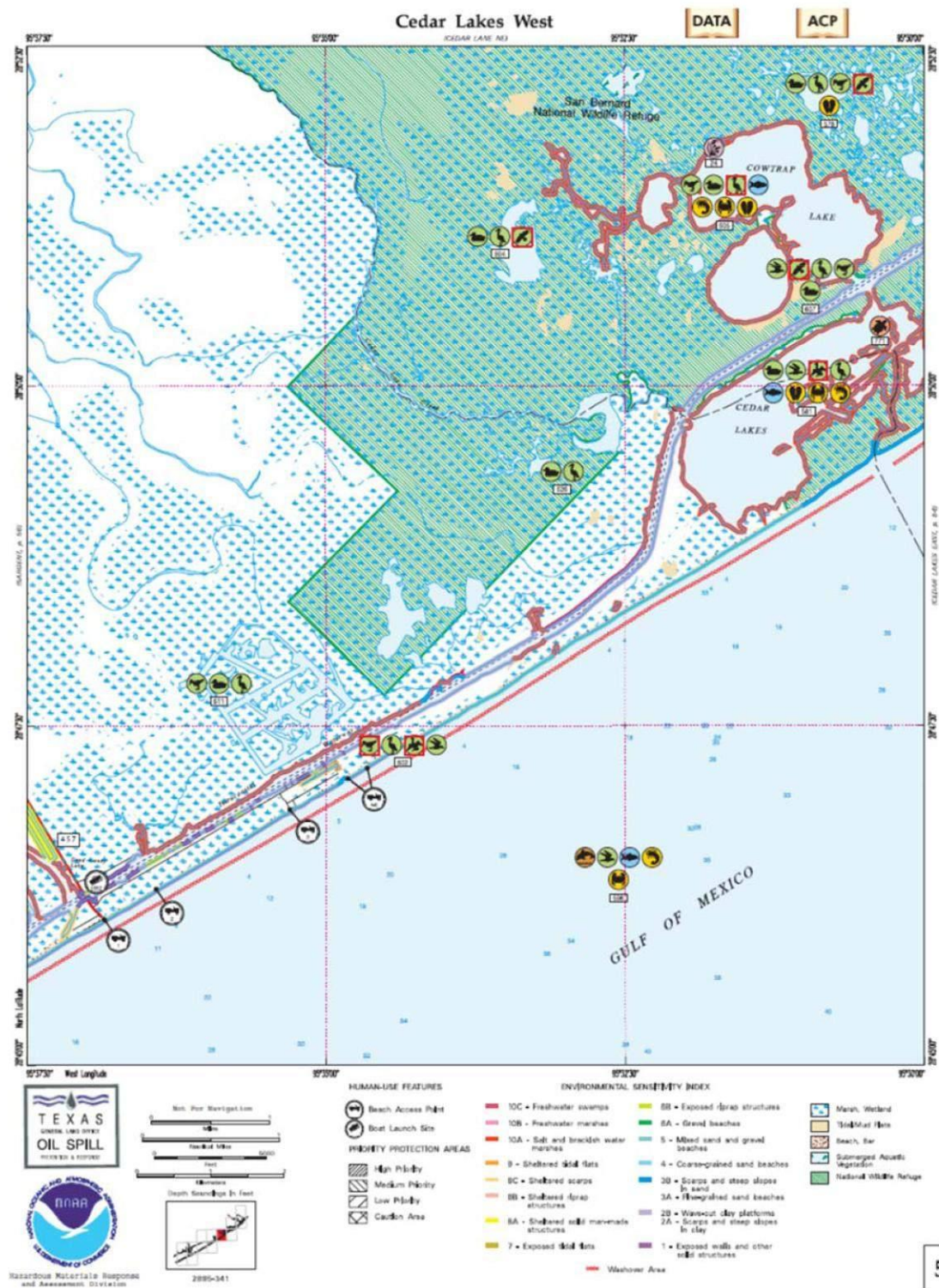


Figure 9.C.5 Main Pass ESI Map



Alaminos Canyon 424 Drilling > 10 Miles													
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.													
FRV Galveston Island	CGA (888) 242-2007	Galveston, TX	Lamor Brush Skimmer	2	22,885	249	Galveston, TX	202	2	0	14	1	17
			36" Boom	64									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	6									
Southern Responder Transrec-350	MSRC (800) OIL-SPIIL	Ingleside, TX	Transrec Skimmer	1	10,567	4,000	Ingleside, TX	191	2	1	13.5	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									
			Stress 1	MSRC (800) OIL-SPIIL									
67" Pressure Inflatable Boom	330'												
Personnel	5												
Appropriate Vessel	2												
Temporary Storage	1												
Texas Responder Transrec-350	MSRC (800) OIL-SPIIL	Galveston, TX	Transrec Skimmer	1	10,567	4,000	Galveston, TX	202	2	1	14.5	1	19
			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									
			Stress 1	MSRC (800) OIL-SPIIL									
67" Pressure Inflatable Boom	330'												
Personnel	5												
Appropriate Vessel	2												
Temporary Storage	1												
FRV H.I. Rich	CGA (888) 242-2007	Vermilion, LA	Lamor Brush Skimmer	2	22,885	249	Vermilion, LA	291	2	0	17	1	20
			36" Boom	64									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	6									
Stress 1	MSRC (800) OIL-SPIIL	Lake Charles, LA	Offshore Skimmer "Gulf Coast Responder"	1	15,840	0	Port O'Connor, TX	177	7	1	12.5	1	22
			67" Pressure Inflatable Boom	330'									
			Personnel	5									
			Appropriate Vessel	2									
			Temporary Storage	1									
Gulf Coast Responder Transrec-350	MSRC (800) OIL-SPIIL	Lake Charles, LA	Transrec Skimmer	1	10,567	4,000	Lake Charles, LA	258	2	1	18.5	1	23
			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									
36" Boom	64												
95' Vessel	1												
X Band Radar	1												
Personnel	6												
Stress 1	MSRC (800) OIL-SPIIL	Port Fourchon, LA	Offshore Skimmer "G.T. Benz Responder"	1	15,840	0	Port O'Connor, TX	177	11	1	12.5	1	26
			67" Pressure Inflatable Boom	330'									
			"Deep Blue Responder"	1									
			Personnel	5									
			Appropriate Vessel	2									

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



Alaminos Canyon 424 Drilling > 10 Miles													
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.													
Stress 1	MSRC (800) OIL-SPIL	Pascagoula, MS	Offshore Skimmer "Mississippi Responder"	1	15,840	0	Port O'Connor, TX	177	11.25	1	12.5	1	26
			67" Pressure Inflatable Boom	330'									
			Personnel	5									
			*Appropriate Vessel	2									
			*Temporary Storage	1		500							
Stress 1	MSRC (800) OIL-SPIL	Fort Jackson, LA	Offshore Skimmer "Louisiana Responder"	1	15,840	0	Port O'Connor, TX	177	11.5	1	12.5	1	26
			67" Pressure Inflatable Boom "Louisiana Responder"	330'									
			Personnel	5									
			*Appropriate Vessel	2									
			*Temporary Storage	1		500							
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	320	2	1	23	1	27
			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									
			FAEG #4 "Buster"	1									
FRV Breton Island	CGA (888) 242-2007	Venice, LA	Lamor Brush Skimmer	2	22,885	249	Venice, LA	383	2	0	24.5	1	28
			36" Boom	64									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	6									
Louisiana Responder Transec 350	MSRC (800) OIL-SPIL	Fort Jackson, LA	Transrec Skimmer	1	10,567	4,000	Fort Jackson, LA	392	2	1	28	1	32
			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									
FAEG #4 "Buster"	1												
***CTCo-5001 Offshore Barge	CGA (888) 242-2007	Houma, LA	Offshore Barge	1	N/A	47,000	Morgan City, LA	306	24-72	0	36.5	1	62 to 110
			Personnel	4									
			Offshore Tug	1									
***CTCo-2606 Offshore Barge	CGA (888) 242-2007	Houma, LA	Offshore Barge	1	N/A	20,000	Morgan City, LA	306	24-72	0	36.5	1	62 to 110
			Personnel	4									
			Offshore Tug	1									
***Moran/ Massachusetts	CGA (888) 242-2007	Houma, LA	Offshore Barge	1	N/A	137,123	Houma, LA	335	24-72	0	39.5	1	65 to 113
			Personnel	4									
			Offshore Tug	1									
***Moran/ Long Island	CGA (888) 242-2007	Houma, LA	Offshore Barge	1	N/A	62,982	Houma, LA	335	24-72	0	39.5	1	65 to 113
			Personnel	4									
			Offshore Tug	1									
DERATED RECOVERY RATE (BBLs/DA Y)												246,934	
STORAGE CAPACITY INCLUDING SKIMMING VESSELS (BARRELS)												291,101	

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



**Alaminos Canyon 424 Drilling > 10 Miles**  
**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	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. <b>NOTE:</b> Total ETA might be effected by weather, sea state, lock closure, 3rd party vessel availability.													
FRV CGA 58 Timbalier Bay	CGA (888) 242-2007	Aransas Pass, TX	Lori Brush Skimmer	2	15,257	65	Aransas Pass, TX	51	2	0	3	1	6
			36" Boom	46									
			46" Vessel	1									
			Personnel	4									
SW CGA-71 FRV	CGA (888) 242-2007	Aransas Pass, TX	Marco Belt Skimmer	2	21,500	249	Aransas Pass, TX	51	2	0	3	1	6
			36" Auto Boom	150									
			Personnel	5									
			56" SWS Vessel	1									
MSRC "Kvichak"	MSRC (800) OIL-SPIIL	Ingleside, TX	* 14'-16" Alum. Flatboat	2	3,588	24	Port O'Connor, TX	19	4	1	1.5	1	8
			Marco I Skimmer	1									
			Personnel	2									
			30" Shallow Water Vessel	1									
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIIL	Ingleside, TX	Skimmer	1	1,371	400	Port O'Connor, TX	19	4	1	1.5	1	8
			18" Boom	50									
			Personnel	4									
			Self-propelled barge	1									
MSRC "Kvichak"	MSRC (800) OIL-SPIIL	Galveston, TX	Marco I Skimmer	1	3,588	24	Port O'Connor, TX	19	5.5	1	1.5	1	9
			Personnel	2									
			30" Shallow Water Vessel	1									
			Skimmer	1									
SBS w/ Queensboro	MSRC (800) OIL-SPIIL	Galveston, TX	18" Boom	50	905	400	Port O'Connor, TX	19	5.5	1	1.5	1	9
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIIL	Galveston, TX	Skimmer	1	1,371	400	Port O'Connor, TX	19	5.5	1	1.5	1	9
			18" Boom	50									
			Personnel	4									
			Non-self-propelled barge	1									
SWS CGA-75 FRV	CGA (888) 242-2007	Galveston, TX	Lori Brush Skimmer	2	22,885	249	Galveston, TX	102	2	0	6	1	9
			36" Boom	150									
			60" Vessel	1									
			X Band Radar	1									
SWS CGA-51 MARCO Shallow Water Skimmer	CGA (888) 242-2007	Lake Charles, LA	Personnel	4	3,588	249	Port O'Connor, TX	19	7	2	1	1	11
			Marco Belt Skimmer	1									
			* 18" Boom (contractor)	100									
			Personnel	3									
SBS w/ Queensboro	MSRC (800) OIL-SPIIL	Lake Charles, LA	34' Skimming Vessel	1	905	400	Port O'Connor, TX	19	7	1	1.5	1	11
			Shallow Water Barge	1									
			Skimmer	1									
			18" Boom	50									
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									

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



**Alaminos Canyon 424 Drilling > 10 Miles**  
**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	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. <b>NOTE:</b> Total ETA might be effected by weather, sea state, lock closure, 3rd party vessel availability.													
SBS w/ Queensboro	MSRC (800) OIL-SPIIL	Lake Charles, LA	Skimmer	1	905	400	Port O'Connor, TX	19	7	1	1.5	1	11
			18" Boom	50'									
			Personnel	4									
			Non-self-propelled barge	1									
SBS w/ Queensboro	MSRC (800) OIL-SPIIL	Lake Charles, LA	Push Boat	1	905	400	Port O'Connor, TX	19	7	1	1.5	1	11
			Skimmer	1									
			18" Boom	50'									
			Personnel	4									
CGA-54 Egmopol Shallow Water Skimmer	CGA (888) 242-2007	Galveston, TX	Non-self-propelled barge	1	1,810	100	Port O'Connor, TX	19	6	2	2.5	1	11
			Push Boat	1									
			Shallow Water Barge	1									
			249										
SBS w/ Queensboro	MSRC (800) OIL-SPIIL	Lake Charles, LA	Skimmer	1	905	400	Port O'Connor, TX	19	7	1	1.5	1	11
			18" Boom	50'									
			Personnel	4									
			Self-propelled barge	1									
SBS w/ Queensboro	MSRC (800) OIL-SPIIL	Lake Charles, LA	Skimmer	1	905	400	Port O'Connor, TX	19	7	1	1.5	1	11
			18" Boom	50'									
			Personnel	4									
			Self-propelled barge	1									
SBS w/ GT-185 w/adaptor	MSRC (800) OIL-SPIIL	Baton Rouge, LA	Skimmer	1	1,371	400	Port O'Connor, TX	19	8.5	1	1.5	1	12
			18" Boom	50'									
			Personnel	4									
			Non-self-propelled barge	1									
MSRC "Kvichak"	MSRC (800) OIL-SPIIL	Belle Chasse, LA	Push Boat	1	3,588	24	Port O'Connor, TX	19	10.25	1	1.5	1	14
			Marco I Skimmer	1									
			Personnel	2									
			30' Shallow Water Vessel	1									
SW CGA-73 FRV	CGA (888) 242-2007	Lake Charles, LA	Marco Belt Skimmer	2	21,500	249	Lake Charles, LA	175	2	0	10.5	1	14
			36" Auto Boom	150'									
			Personnel	5									
			56' SWS Vessel	1									
SWS CGA-55 Egmopol Shallow Water Skimmer	CGA (888) 242-2007	Morgan City, LA	* 14'-16" Alum. Flatboat	2	1,810	100	Port O'Connor, TX	19	9	2	2.5	1	15
			Marco Skimmer	1									
			* 18" Boom (contractor)	100'									
			Personnel	3									
SWS CGA-53 MARCO Shallow Water Skimmer	CGA (888) 242-2007	Leeville, LA	38' Skimming Vessel	1	3,588	34	Port O'Connor, TX	30	11	2	2	1	16
			Shallow Water Barge	1									
			249										
			Marco Belt Skimmer	1									
FRV M/V Bastian Bay	CGA (888) 242-2007	Lake Charles, LA	* 18" Boom (contractor)	100'	15,257	65	Lake Charles, LA	175	2	0	12.5	1	16
			Personnel	3									
			38' Skimming Vessel	1									
			Lori Brush Skimmer	2									
FRV M/V Bastian Bay	CGA (888) 242-2007	Lake Charles, LA	36" Boom	46'	15,257	65	Lake Charles, LA	175	2	0	12.5	1	16
			46' Vessel	1									
			Personnel	4									

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



Alaminos Canyon 424 Drilling > 10 Miles 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	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. <b>NOTE:</b> Total ETA might be effected by weather, sea state, lock closure, 3rd party vessel availability.													
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									
SWS CGA-52 MARCO Shallow Water Skimmer	CGA (888) 242-2007	Venice, LA	Marco Belt Skimmer	1	3,588	34	Port O'Connor, TX	30	12	2	2	1	17
			* 18" Boom (contractor)	100'									
			Personnel	3									
			36' Skimming Vessel	1		249							
			Shallow Water Barge	1									
MSRC "Quick Strike"	MSRC (800) OIL-SPIIL	Lake Charles, LA	LORI Brush Skimmer	2	5,000	50	Lake Charles, LA	175	2	1	12.5	1	17
			Personnel	3									
			47' Fast Response Boat	1									
			Marco Belt Skimmer	2									
SW CGA-72 FRV	CGA (888) 242-2007	Morgan City, LA	36" Auto Boom	150'	21,500	249	Morgan City, LA	265	2	0	15.5	1	19
			Personnel	4									
			56' SWS Vessel	1									
			* 14'-16' Alum. Flatboat	2									
			Lori Brush Skimmer	2									
FRV M/V RW Armstrong	CGA (888) 242-2007	Morgan City, LA	36" Boom	46'	15,257	65	Morgan City, LA	265	2	0	17.5	1	21
			46' Vessel	1									
			Personnel	4									
			Lori Brush Skimmer	2									
			36" Boom	150'									
SWS CGA-76 FRV	CGA (888) 242-2007	Leeville, LA	60' Vessel	1	22,885	249	Leeville, LA	321	2	0	19	1	22
			X Band Radar	1									
			Personnel	4									
			Lori Brush Skimmer	2									
			36" Boom	150'									
SWS CGA-77 FRV	CGA (888) 242-2007	Venice, LA	Lori Brush Skimmer	2	22,885	249	Venice, LA	361	2	0	21	1	24
			36" Boom	150'									
			60' Vessel	1									
			X Band Radar	1									
			Personnel	4									
FRV M/V Grand Bay	CGA (888) 242-2007	Venice, LA	Lori Brush Skimmer	2	15,257	65	Venice, LA	361	2	0	21	1	24
			36" Boom	46'									
			46' Vessel	1									
			Personnel	4									
DERATED RECOVERY RATE (BBLs/DAY)												255,314	
SKIMMING VESSEL STORAGE CAPACITY (BARRELS)												7,009	

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



Alaminos Canyon 424 Drilling >10 Miles 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	316	1	0.25	1.05	2.35
			Spotter Personnel	2						
			Crew - Pilots	1						
Aztec Piper Air Speed - 150 Knots	Airborne Support (985) 851-6391	Houma, LA	Surveillance Aircraft	1	Houma, LA	316	1	0.25	1.84	3.10
			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	316	1	0.25	1.95	3.20
			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	316	1	0.25	1.95	3.20
			Spotter Personnel	2						
			Crew - Pilots	1						

Table 9.D.6 Aerial Surveillance Activation List



## Alaminos Canyon 424 Drilling > 10 Miles 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
<b>NOTE:</b> 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	316	1	0	1.05	0	2.10
			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	316	2	0.5	1.63	0.5	4.65
			Dispersant - Gallons	2000							
			Spotter Personnel	2	Corpus Christi, TX 2nd Flight	200	1.03	0.5	1.03	0.3	2.90
			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	406	3	0.0	1.19	0.5	4.70
			Dispersant - Gallons	4125							
			*Spotter Aircraft	1	Corpus Christi, TX 2nd Flight	200	0.50	0.3	0.58	0.5	1.95
			*Spotter Personnel	2							
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	406	3	0.00	1.91	0.20	5.15
			Dispersant - Gallons	250							
			* Spotter Aircraft	1	Corpus Christi, TX 2nd Flight	200	0.94	0.20	0.94	0.20	2.30
			*Spotter Personnel	2							
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	316	2	0.5	2.10	0.5	5.15
			Dispersant - Gallons	1200							
			Spotter Aircraft	1	Corpus Christi, TX 2nd Flight	200	1.33	0.5	1.33	0.3	3.50
			Spotter Personnel	2							
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	316	2	0.5	2.10	0.5	5.15
			Dispersant - Gallons	1200							
			Spotter Aircraft	1	Corpus Christi, TX 2nd Flight	200	1.33	0.5	1.33	0.3	3.50
			Spotter Personnel	2							
Crew - Pilots	2										
C130-A Aircraft Air Speed - 342 MPH	MSRC (800) OIL-SPIL	Mesa, AZ	C130-A Disp. Aircraft	1	Stennis INTL., MS 1st Flight	406	7	0.3	1.19	0.5	9.05
			Dispersant - Gallons	4125							
			*Spotter Aircraft	1	Corpus Christi, TX 2nd Flight	200	0.50	0.3	0.58	0.5	1.95
			*Spotter Personnel	2							
Crew - Pilots	2										

Table 9.D.7 Offshore Aerial Dispersant Activation List



Alaminos Canyon 424 Drilling > 10 Miles Sample Offshore Boat Spray Dispersant Activation List											
Boat Spray Dispersant System	Supplier & Phone	Warehouse	Boat Spray Dispersant Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours)				
							Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
<b>NOTE:</b> 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	1	Port O'Connor, TX	177	4	0.5	17.5	1	23
			Dispersant (Gallons)	330							
			Personnel	4							
			* Utility Boat	1							
USCG SMART Team	USCG	Mobile, AL	Personnel	4	Port O'Connor, TX	177	11.75	1	12.5	0.5	25.75
			* Crew Boat	1							
Vessel Based Dispersant Spray System	CGA (888) 242-2007	Harvey, LA	Dispersant Spray System	1	Port O'Connor, TX	177	10	0.5	17.5	1	29
			Dispersant (Gallons)	330							
			Personnel	4							
			* Utility Boat	1							

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

Alaminos Canyon 424 Drilling >10 Miles Sample Control, Containment & Subsea Dispersant Package Activation List											
Containment System	Supplier & Phone	Warehouse	Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Days)				
							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	1	Port Fourchon, LA	320	0	1.5	23	0.5	25
			ROV's	2							
Subsea Dispersant Application	RP / MWCC	Port Fourchon, LA	Multi-Service Vessel	1	Port Fourchon, LA	320	1.5	1.5	23	2	28
			ROV's	2							
			Coil Tubing Unit	1							
		Houston, TX	Dispersant	200,000 gal							
			Manifold	1							
Capping Stack	RP / MWCC	Port Fourchon, LA	Subsea Dispersant Injection System	1	Port Fourchon, LA	320	2*	1.5	23	3	30*
			Anchor Handling Tug Supply Vessel	1							
		Houston, TX	ROV's	1							
			Hydraulic System	1							
"Top Hat" Unit	RP / MWCC	Port Fourchon, LA	Capping Stack	1	Port Fourchon, LA	320	13*	1	23	3	40*
			Anchor Handling Tug Supply Vessel	1							
			ROV's	2							
			Multi-Purpose Supply Vessel	1							
		Houston, TX	Drill Ship (Processing Vessel)	1							
			"Top Hat"	1							
			Containment Chamber	1							
			Shuttle Barge	1							

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



Alaminos Canyon 424 Drilling > 10 Miles Sample Nearshore On-Water Recovery Activation List Sample In-Situ Burn Equipment Activation List											
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
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											
SMART In-Situ Burn Monitoring Team	USCG	Mobile, AL	* Air Monitoring Equipment	1	Port O'Connor, TX	177	4	1	12.5	1	18.5
			* Offshore Vessel	1							
			Personnel	4							
ISB Fire-Fighting Team	TBD	TBD	* Offshore Firefighting Vessels	2	Port O'Connor, TX	177	4	1	12.5	1	18.5
			* Cranes	2							
			* Roll-off Boxes	2							
			Personnel	8							
			* Air Monitoring Equipment	2							
Safety Monitoring Team	TBD	TBD	* Air Monitoring Equipment	1	Port O'Connor, TX	177	4	1	12.5	1	18.5
			* Offshore Vessel	1							
			Personnel	4							
Wildlife Monitoring Team	TBD	TBD	* Air Monitoring Equipment	1	Port O'Connor, TX	177	4	1	12.5	1	18.5
			* Offshore Vessel	1							
			Personnel	4							
Aerial Spotting Team (per 2 ISB Task Forces)	TBD	TBD	Fixed Wing Aircraft	1	Port O'Connor, TX	177	4	1	12.5	1	18.5
			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	Port O'Connor, TX	177	4.75	1	12.5	1	19.25
			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	Port O'Connor, TX	177	5.5	1	12.5	1	20
			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	Port O'Connor, TX	177	7	1	12.5	1	21.5
			Tow Line (ft)	600							
			* Appropriate Vessel	2							
			Personnel	2							
			Ignition Device	25							
Supply Team (Supply Vessel System)	MSRC (800) OIL-SPIL	Port O'Connor, TX	*Offshore Vessel 110' - 310'	1	Port O'Connor, TX	177	4	1	35.5	1	41.5
			Personnel	6							
Fire Team (In-Situ Burn Fire System)	CGA (888) 242-2007	Harvey, LA	Fire Boom (ft)	500	Port O'Connor, TX	177	0	24	17.5	6	47.5
			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	Port O'Connor, TX	177	0	24	17.5	6	47.5
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	3							
			Personnel	20							
			Ignition Device	10							
TOTAL FIRE BOOM AVAILABLE (FEET)										20,000	

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



**Alaminos Canyon 424 Drilling > 10 Miles  
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'	Port O'Connor, TX	4	1	1	6
		Containment Boom - 18"	30,000'					
		Jon Boats - 14' to 18' w/25hp motor	4					
		Jon Boats - 16' to 18' w/Outboard motor	4					
		Air Boat - 14'	1					
		Response Boats - 24' to 28'	4					
		Portable Skimmers	6					
		Shallow Water Skimmers	2					
Clean Harbors (800) 645-8265	Houston, TX	Response Personnel	142	Port O'Connor, TX	4.75	1	1	7
		Containment Boom - 18" to 24"	4,500'					
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	3					
		Portable Skimmers	1					
SWS Environmental (877) 742-4215	Houston, TX	Response Personnel	14	Port O'Connor, TX	4.75	1	1	7
		Containment Boom - 18"	10,000'					
		Response Boats - 16' to 25'	1					
		Response Boats - 25' to 42'	2					
		Portable Skimmers	2					
USES Environmental (888) 279-9930	Houston, TX	Response Personnel	19	Port O'Connor, TX	4.75	1	1	7
		Containment - 18"	10,000'					
		Response Boats - 16'	4					
		Response Boats - 26'	1					
Wildlife Ctr. of Texas (713) 861-9453	Houston, TX	Portable Skimmers	1	Port O'Connor, TX	4.75	1	1	7
		Wildlife Specialist - Personnel	6 to 20					
ES&H Environmental (877) 437-2634	Houston, TX	Containment Boom - 10"	500'	Port O'Connor, TX	4.75	1	1	7
		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					
Garner Environmental (800) 424-1716	Deer Park, TX	Containment Boom - 18"	16,000'	Port O'Connor, TX	5	1	1	7
		Response Boats - 12'	2					
		Response Boats - 16' to 20'	5					
		Response Boats - 30'	2					
		Portable Skimmers	13					
Miller Env. Services (800) 929-7227	Houston, TX	Containment Boom - 18"	12,000'	Port O'Connor, TX	4.75	1	1	7
		Shallow Water Skimmers	1					
		Response Boats - 28'	1					
		Responder Personnel	38					
OMI (800) 645-6671	Houston, TX	Containment Boom - 18" to 24"	4000'	Port O'Connor, TX	4.75	1	1	7
		Response Boats - 16'	3					
		Response Boats - 25' to 28'	1					
		Portable Skimmers	1					
Miller Env. Services (800) 929-7227	Beaumont, TX	Containment Boom - 18"	14,000'	Port O'Connor, TX	6	1	1	8
		Response Boats - 18'	2					
		Response Boats - 24'	2					
		Shallow Water Skimmers	1					
		Response Personnel	47					
Phoenix Pollution Control & Environmental Services (281) 838-3400	Baytown, TX	Containment Boom - 18"	13,000'	Port O'Connor, TX	5.25	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					

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



**Alaminos Canyon 424 Drilling > 10 Miles  
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
Garner Environmental (800) 424-1716	La Marque, TX	Containment Boom - 6"	9,500'	Port O'Connor, TX	5.25	1	1	8
		Response Boats - 16'	5					
		Response Boats - 24'	1					
		Portable Skimmers	7					
AMPOL (800) 482-6765	Port Arthur, TX	Containment Boom - 18" to 24"	16,000'	Port O'Connor, TX	6.25	1	1	9
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	3					
Miller Env. Services (800) 929-7227	Sulphur, LA	Containment Boom - 10"	600'	Port O'Connor, TX	7	1	1	9
		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					
Clean Harbors (800) 645-8265	Port Arthur, TX	Response Personnel	49	Port O'Connor, TX	6.25	1	1	9
		Containment Boom - 18" to 24"	3,000'					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	2					
USES Environmental (888) 279-9930	Lake Charles, LA	Response Personnel	54	Port O'Connor, TX	7	1	1	9
		Containment Boom - 10"	100'					
		Containment Boom - 18"	7,700'					
		Response Boats - 16'	3					
ES&H Environmental (877) 437-2634	Lake Charles, LA	Response Boats - 27'	1	Port O'Connor, TX	7	1	1	9
		Response Boats - 37'	1					
		Containment Boom - 10"	500'					
		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					
OMI (800) 645-6671	Port Arthur, TX	Wildlife Hazing Cannon	40	Port O'Connor, TX	6.25	1	1	9
		Containment Boom - 18" to 24"	4000'					
		Response Boats - 14' to 20'	6					
		Response Boats - 21' to 36'	2					
Garner Environmental (800) 424-1716	Port Arthur, TX	Shallow Water Skimmers	1	Port O'Connor, TX	6.25	1	1	9
		Containment Boom - 6"	22,000'					
		Response Boats - 14' to 20'	8					
		Response Boats - 21' to 36'	1					
ES&H Environmental (877) 437-2634	Lafayette, LA	Portable Skimmers	3	Port O'Connor, TX	8	1	1	10
		Containment Boom - 10"	500'					
		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					
AMPOL (800) 482-6765	New Iberia, LA	Wildlife Hazing Cannon	12	Port O'Connor, TX	8.5	1	1	11
		Containment Boom - 6" to 10"	4,150'					
		Containment Boom - 18" to 24"	34,050'					
		Response Boats - 14' to 20'	3					
		Response Boats - 21' to 36'	3					
Clean Harbors (800) 645-8265	New Iberia, LA	Portable Skimmers	27	Port O'Connor, TX	8.5	1	1	11
		Containment Boom - 18" to 24"	33,800'					
		Containment Boom - 6" to 10"	500'					
		Response Boats - 21' to 36'	4					

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



**Alaminos Canyon 424 Drilling > 10 Miles  
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	Morgan City, LA	Containment Boom - 10"	2,000'	Port O'Connor, TX	9	1	1	11
		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					
Clean Harbors (800) 645-8265	Baton Rouge, LA	Containment Boom - 18" to 24"	14,000'	Port O'Connor, TX	8.5	1	1	11
		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'	Port O'Connor, TX	8.5	1	1	11
		Response Boats - 25' to 42'	2					
		Shallow Water Skimmers	1					
		Response Personnel	6					
OMI (800) 645-6671	Port Allen, LA	Containment Boom - 18" to 24"	2,500'	Port O'Connor, TX	8.5	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'	Port O'Connor, TX	9	1	1	11
		Containment Boom - 6" to 10"	400'					
		Response Boats - 16'	2					
		Response Boats - 25' to 28'	1					
		Portable Skimmers	3					
		Response Personnel	3					
USES Environmental (888) 534-2744	Geismar, LA	Containment Boom - 18"	1,000'	Port O'Connor, TX	9	1	1	11
		Response Boats - 16'	2					
		Portable Skimmers	1					
OMI (800) 645-6671	New Iberia, LA	Containment Boom - 18" to 24"	12,000'	Port O'Connor, TX	8.5	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					
Wildlife Ctr. of Texas (713) 861-9453	Baton Rouge, LA	Wildlife Specialist - Personnel	6 to 20	Port O'Connor, TX	8.5	1	1	11
OMI (985) 798-1005	Houma, LA	Containment Boom - 18" to 24"	2,000'	Port O'Connor, TX	9.75	1	1	12
		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					
ES&H Environmental (877) 437-2634	Houma, LA	Containment Boom - 10"	2,000'	Port O'Connor, TX	9.75	1	1	12
		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 424 Drilling > 10 Miles  
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
AMPOL (800) 482-6765	Harvey, LA	Containment Boom - 18" to 24"	8,000'	Port O'Connor, TX	10	1	1	12
		Containment Boom - 6" to 10"	3,000'					
Lawson Environmental Service (985) 876-0420	Houma, LA	Containment Boom - 18"	30,000'	Port O'Connor, TX	9.75	1	1	12
		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					
USES Environmental (888) 279-9930	Meraux, LA	Portable Skimmers	6	Port O'Connor, TX	10	1	1	12
		Containment Boom - 18"	6,000'					
		Containment Boom - 10"	1,000'					
		Response Boats - 16'	23					
		Response Boats - 18'	1					
		Response Boats - 24'	1					
		Response Boats - 26'	2					
CGA (888) 242-2007	Harvey, LA	Response Boats - 28'	1	Port O'Connor, TX	10	1	1	12
		Portable Skimmers	2					
		Wildlife Rehab Trailer	1					
		Wildlife Husbandry Trailer	1					
		Support Trailer	3					
USES Environmental (888) 279-9930	Hahnville, LA	Bird Scare Cannons	120	Port O'Connor, TX	10	1	1	12
		Contract Truck (Third Party)	3					
		Personnel (Responder/Mechanic)	4					
		Containment Boom - 18"	500'					
		Response Boats - 18"	2					
USES Environmental (888) 279-9930	Amelia, LA	Containment Boom - 18"	500'	Port O'Connor, TX	9.25	1	1	12
		Containment Boom - 18"	500'					
		Containment Boom - 18"	600'					
USES Environmental (888) 279-9930	Marrero, LA	Containment Boom - 18"	600'	Port O'Connor, TX	10	1	1	12
		Containment Boom - 18"	600'					
USES Environmental (888) 279-9930	Lafitte, LA	Containment Boom - 18"	1,000'	Port O'Connor, TX	10.25	1	1	13
		Response Boats - 18"	2					
ES&H Environmental (877) 437-2634	Port Fourchon, LA	Containment Boom - 18"	1,000'	Port O'Connor, TX	11	1	1	13
		Response Boats - 22' to 25'	1					
		Portable Skimmers	1					
ES&H Environmental (877) 437-2634	Belle Chasse, LA	Containment Boom - 10"	1,500'	Port O'Connor, TX	10.25	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					
		Containment Boom - 18" to 24"	4,500'					
OMI (800) 645-6671	Belle Chasse, LA	Containment Boom - 6" to 10"	500'	Port O'Connor, TX	10.25	1	1	13
		Response Boats - 20'	1					
		Response Boats - 25' to 28'	2					
		Portable Skimmers	12					
		Shallow Water Skimmers	1					
		Bird Scare Cannons	12					
		Response Personnel	24					

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



**Alaminos Canyon 424 Drilling > 10 Miles  
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	Golden Meadow, LA	Containment Boom - 10"	1,000'	Port O'Connor, TX	10.5	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					
USES Environmental (888) 279-9930	Biloxi, MS	Wildlife Hazing Cannon	12	Port O'Connor, TX	10.5	1	1	13
		Containment Boom - 18"	2,000'					
OMI (800) 645-6671	Galliano, LA	Response Boats - 16'	1	Port O'Connor, TX	10.25	1	1	13
		Containment Boom - 18" to 24"	2,000'					
		Containment Boom - 6" to 10"	500'					
		Response Boats - 16'	1					
		Response Boats (Barge) - 25' to 33'	1					
		Response Boats - 25' to 28'	1					
USES Environmental (888) 279-9930	Venice, LA	Portable Skimmers	3	Port O'Connor, TX	11.5	1	1	14
		Containment Boom - 18"	10,000'					
		Response Boats - 16'	15					
		Response Boats - 26'	2					
		Response Boats - 30'	1					
		Portable Skimmers	2					
USES Environmental (888) 279-9930	Mobile, AL	Shallow Water Skimmers	1	Port O'Connor, TX	11.75	1	1	14
		Containment Boom - 10"	800'					
		Containment Boom - 18"	5,000'					
		Response Boats - 16'	1					
		Response Boats - 18'	1					
		Response Boats - 20'	1					
OMI (800) 645-6671	Venice, LA	Response Boats - 26'	1	Port O'Connor, TX	11.5	1	1	14
		Portable Skimmers	2					
		Containment Boom - 18" to 24"	1,500'					
		Response Boats - 16'	4					
		Response Boats (Barge) - 25' to 33'	1					
		Response Boats - 25' to 28'	2					
AMPOL (800) 482-6765	Venice, LA	Response Boats - (Cabin Boat) 27' to 30'	1	Port O'Connor, TX	11.5	1	1	14
		Shallow Water Skimmers	3					
		Portable Skimmers	2					
		Containment Boom - 18" to 24"	2,250'					
ES&H Environmental (877) 437-2634	Venice, LA	Response Boats - 14' to 20'	2	Port O'Connor, TX	11.5	1	1	14
		Response Boats - 21' to 36'	1					
		Portable Skimmers	2					
		Containment Boom - 10"	2,000'					
		Containment Boom - 18"	13,000'					
		Containment Boom - 24"	10,000					
		Jon Boat - 12' to 16'	4					
		Response Boats - 22' to 25'	1					
SWS Environmental (877) 742-4215	Pensacola, FL	Response Boats - 26' to 29'	2	Port O'Connor, TX	12.5	1	1	15
		Portable Skimmers	5					
		Wildlife Hazing Cannon	25					
		Containment Boom - 18"	2,500'					
		Response Boats - 16' to 25'	2	Port O'Connor, TX				
		Shallow Water Skimmers	1					
		Response Personnel	2					

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



**Alaminos Canyon 424 Drilling > 10 Miles  
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
USES Environmental (888) 279-9930	Memphis, TN	Containment Boom - 6"	850'	Port O'Connor, TX	13.5	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					
SWS Environmental (877) 742-4215	Memphis, TN	Portable Skimmers	2	Port O'Connor, TX	13.5	1	1	16
		Containment Boom - 6"	100'					
		Containment Boom - 12"	800'					
		Containment Boom - 18"	800'					
		Response Boats - 25' to 42'	1					
		Shallow Water Skimmers	1					
		Response Personnel	9					
		Response Personnel	9					
SWS Environmental (877) 742-4215	Panama City, FL	Containment Boom - 18"	7,000'	Port O'Connor, TX	14.5	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'	Port O'Connor, TX	16.75	1	1	19
		Response Boats - 16' to 25'	2					
		Shallow Water Skimmers	1					
		Response Personnel	8					
		Response Personnel	8					
SWS Environmental (877) 742-4215	Tampa, FL	Containment Boom - 18"	2,000'	Port O'Connor, TX	18.75	1	1	21
		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'	Port O'Connor, TX	18.75	1	1	21
		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'	Port O'Connor, TX	18.75	1	1	21
		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'	Port O'Connor, TX	19	1	1	21
		Response Boats - 16' to 25'	3					
		Shallow Water Skimmers	1					
		Response Personnel	7					
		Response Personnel	7					
SWS Environmental (877) 742-4215	Fort Lauderdale, FL	Containment Boom - 18"	1,000'	Port O'Connor, TX	21	1	1	23
		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	Port O'Connor, TX	26	1	1	28

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**

No incidental takes are anticipated. Although marine mammals may be seen in the area, Shell does not believe that its operations proposed under this EP will result. 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"

### **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 Blocks 380 (G-32954) & 424 (G-32964):**

These leases were acquired in Lease Sale #207 held on February 1, 2009 and have an expected expiration date of January 31, 2019. Shell Offshore Inc. became operator July 17, 2018.

These leases are 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

The following stipulations are associated with these leases:

#### *Stipulation No. 8 – Protected Species*

This Stipulation is addressed in the following sections of this plan:

Section 6, Threatened or endangered species, critical habitat and marine mammal information

Section 10, Environmental Monitoring Information, Incidental takes

Section 12, Environmental Mitigation Measures Information, Incidental takes

Section 18, Environmental Impact Assessment



## **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	"NTL 2012-Joint-G02 "Implementation of Seismic Survey Mitigation Measures & Protected Species Observer Program"



### **SECTION 13: RELATED FACILITIES AND OPERATIONS INFORMATION**

Information regarding Related Facilities and Operations Information, transportation systems & produced liquid hydrocarbon transportation vessels are not included in this EP as such information is only necessary in the case of DOCDs.



## **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

### **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 424

### **C. Drilling Fluids Transportation**

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

### **D. Solid and Liquid Wastes Transportation**

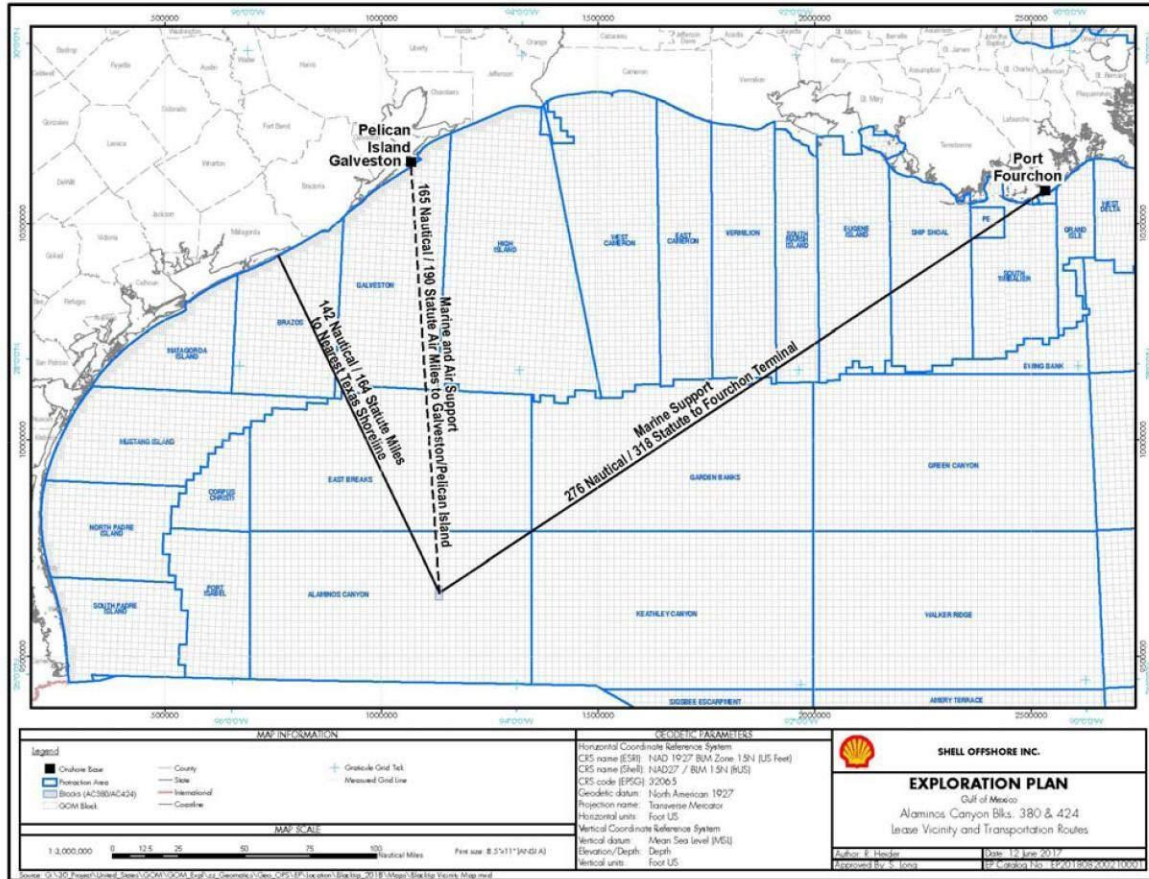
See Section 7, Table 7B.

### **E. Vicinity Map**

See Attachment 14A for Vicinity Map.



## Attachment 14A – Vicinity Map





## **SECTION 15: ONSHORE SUPPORT FACILITIES INFORMATION**

### **A. General**

<b>Name</b>	<b>Location</b>	<b>Existing/New/Modified</b>
Fourchon	Port Fourchon, LA	Existing
Galveston Heliport	Galveston, TX	Existing

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**

This does not apply to this EP as Shell does not plan to construct a new onshore support base or expand an existing one to accommodate the activities proposed in this EP.

### **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**

Alimos Canyon Block 380, OCS-G 32954, received Louisiana and Texas CZM concurrence in StatOil Gul of Mexico's Initial EP N-9666 in 2012.

Alimos Canyon Block 424, OCS-G 32964, received Louisiana and Texas CZM concurrence in StatOil Gulf of Mexico's Initial EP N-9862 in 2015.

Supplemental EP's are not required to receive additional CZM concurrence from the States of Louisiana and Texas.



**SECTION 18: ENVIRONMENTAL IMPACT ANALYSIS (EIA)**

**Supplemental Exploration Plan**

**Alaminos Canyon Block 380 (OCS-G 32954)  
Alaminos Canyon Block 424 (OCS-G 32964)**

Offshore Texas

August 2018

**Prepared for:**

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## Acronyms and Abbreviations

AC	Alaminos Canyon	NPDES	National Pollutant Discharge Elimination System
ac	acre	NRC	National Research Council
ADIOS	Automated Data Inquiry for Oil Spills	NRDC	Natural Resources Defense Council
AQR	Air Quality Emissions Report	NTL	Notice to Lessees and Operators
bbl	barrel	NWR	National Wildlife Refuge
BOEM	Bureau of Ocean Energy Management	OCS	Outer Continental Shelf
BSEE	Bureau of Safety and Environmental Enforcement	OCSLA	Outer Continental Shelf Lands Act
CFR	Code of Federal Regulations	OSAT	Operational Science Advisory Team
CH <sub>4</sub>	methane	OSRA	Oil Spill Risk Analysis
CO	carbon monoxide	OSRP	Oil Spill Response Plan
CO <sub>2</sub>	carbon dioxide	PAH	polycyclic aromatic hydrocarbon
dB re 1 µPa	decibels relative to 1 micropascal	PM	particulate matter
dB re 1 µPa m	decibels relative to 1 micropascal at 1 meter	SBF	synthetic-based fluids
dB re 1 µPa <sup>2</sup> ·s	decibels relative to 1 micropascal squared seconds	SBM	synthetic-based mud
DP	dynamically positioned	Shell	Shell Offshore Inc.
DPS	distinct population segment	SO <sub>x</sub>	sulfur oxides
EEZ	exclusive economic zone	USCG	U.S. Coast Guard
EFH	Essential Fish Habitat	USDOJ	U.S. Department of the Interior
EIA	Environmental Impact Analysis	USEPA	U.S. Environmental Protection Agency
EIS	Environmental Impact Statement	USFWS	U.S. Fish and Wildlife Service
EP	Exploration Plan	VOC	volatile organic compound
ESA	Endangered Species Act	WBM	water-based drilling muds
FAD	fish-aggregating device	WCD	worst case discharge
FR	Federal Register	WMA	Wildlife Management Area
GMFMC	Gulf of Mexico Fishery Management Council		
H <sub>2</sub> S	hydrogen sulfide		
ha	hectare		
HAPC	Habitat Area of Particular Concern		
Hz	hertz		
IPF	impact-producing factor		
kHz	kilohertz		
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 <sub>x</sub>	nitrogen oxides		



# Introduction

## Project Summary

Shell Offshore Inc. (Shell) is submitting an Exploration Plan (EP) for Alaminos Canyon (AC) Blocks 380 and 424 for eight wells in AC 380 (AC 380-E, AC 380-F, AC 380-G, AC 380-EE, AC 380-FF, AC 380-GG, AC 380-FFF, and AC 380-GGG) and nine wells in AC 424 (AC 424-A, AC 424-D, AC 424-E, AC 424-AA, AC 424-DD, AC 424-EE, AC 424-AAA, AC 424-DDD, and AC 424-EEE). This Environmental Impact Analysis (EIA) provides information on potential impacts to environmental resources that could be affected by Shell's proposed activities in the lease area under this EP.

The lease area is in the Western Planning Area, approximately 164 miles (264 km) from the nearest shoreline (Texas), 318 miles (512 km) from the onshore support base at Port Fourchon, Louisiana, and 190 miles (306 km) from the helicopter base in Galveston, Texas. Estimated water depths at the proposed wellsites range from approximately 6,447 to 7,251 ft (1,965 to 2,210 m). All distances are in statute miles.

Drilling operations are expected to require 61 days in 2018, and 220 days per year from 2019 to 2035. A mobile offshore drilling unit (MODU), which will be either a dynamically positioned (DP) drillship or a DP semisubmersible rig, will be selected for this project. Each well is estimated to take ~220 days for drilling. The EIA addresses the environmental impacts from the proposed EP activities.

## 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 §§ 1331-1356 as well as regulations including 30 Code of Federal Regulations (CFR) 550.212 and 550.227. The EIA is a project- and site-specific analysis of Shell's planned activities under this EP.

The EIA presents data, analyses, and conclusions to support the Bureau of Ocean Energy Management (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 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 (EIS) for the Outer Continental Shelf (OCS) Oil and Gas Leasing Program (BOEM, 2016a) and in multisale EISs for the Western and Central Gulf of Mexico Planning Areas (BOEM, 2012a, b, 2013, 2014, 2015, 2016c, 2017a).

The most recent multisale EISs update environmental baseline information in light of the Macondo (*Deepwater Horizon*) incident and address potential impacts of a catastrophic spill (BOEM, 2012a, b, 2013, 2014, 2015, 2016c, 2017a). Numerous technical studies have also been conducted to address the impacts of the incident. The findings of the post-Macondo 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-Macondo incident studies, where applicable, to provide BOEM and other regulatory agencies with the necessary information to evaluate Shell's EP 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 in its Final Programmatic EIS for the OCS Oil and Gas Leasing Program for 2017 to 2022 (BOEM, 2016a). Under the OCSLA, the U.S. Department of the Interior (USDIO) is responsible for the administration of mineral exploration and development of the OCS. Within the USDIO, 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 authority to comment on permitting documents under their jurisdiction 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 regulations (e.g., the ESA, MMPA, Coastal Zone Management Act of 1972, and the Magnuson-Stevens Fishery Conservation and Management Act) establish the consultation and coordination processes with federal, state, and local agencies.

In addition, Notices to Lessees and Operators (NTLs) are formal documents issued by BOEM and BSEE that provide clarification, description, or interpretation of pertinent regulations or standards. **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), ordered from most recent to oldest.

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 to avoid striking protected species; and requires operators to report sightings of any injured or dead protected species.
BSEE-2015-G03	Marine Trash and Debris Awareness and Elimination	Instructs operators to exercise caution in the handling and disposal of small items and packaging materials; requires the posting of placards at prominent locations on offshore vessels and structures; and mandates a yearly marine trash and debris awareness training and certification process.
BOEM-2015-N02	Elimination of Expiration Dates on Certain Notice to Lessees and Operators Pending Review and Reissuance	Eliminates the expiration dates on past or upcoming expiration dates from NTLs currently posted on the Bureau of Ocean Energy Management website.



Table 1. (Continued).

NTL	Title	Summary
BOEM-2015-N01	Information Requirements for Exploration Plans, Development and Production Plans, and Development Operations Coordination Documents on the Outer Continental Shelf (OCS) for Worst Case Discharge (WCD) Blowout Scenarios	Provides guidance regarding information required in WCD descriptions and blowout scenarios.
BOEM-2014-G04	Military Warning and Water Test Areas	Provides contact links to individual command headquarters for the military warning and water test areas in the Gulf of Mexico.
BSEE-2014-N01	Elimination of Expiration Dates on Certain Notices to Lessees and Operators Pending Review and Reissuance	Eliminates expiration dates (past or upcoming) of all NTLs currently posted on the Bureau of Safety and Environmental Enforcement website.
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 or surface blowout preventers on floating facilities that applications for well permits must include a statement signed by an authorized company official stating that the operator will conduct all activities in compliance with all applicable regulations, including the increased safety measures regulations (75 <i>Federal Register</i> 63346). Informs operators that the Bureau of Ocean Energy Management 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.



Table 1. (Continued).

NTL	Title	Summary
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 OCS.
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 Endangered Species Act and the Marine Mammal Protection Act.
2005-G07	Archaeological Resource Surveys and Reports	Provides guidance on regulations regarding archaeological discoveries, specifies requirements for archaeological resource surveys and reports, and outlines options for protecting archaeological resources.

## 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 drilling program that certifies Shell's capability to respond to the maximum extent practicable to a WCD (30 CFR 254.2) (see **EP Section 9**). The OSRP demonstrates Shell's capability to rapidly and effectively manage oil spills that may result from drilling operations. 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 that increase 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, 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 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 requirements of 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 a certain resource, and a dash (–) indicates no impact or negligible impact. Where there may be an effect, an analysis is provided in **Section C**. Potential IPFs for the proposed activities are listed below and briefly discussed in the following sections.

- MODU 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 on the resource; dash (--) = no impact or negligible impact on the resource.

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	Small Fuel Spill	Large Oil Spill
<b>Physical/Chemical Environment</b>										
Air quality	--	--	X(5)	--	--	--	--	--	X(6)	X(6)
Water quality	--	--	--	X	--	--	--	--	X(6)	X(6)
<b>Seafloor Habitats and Biota</b>										
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)	--	--	--	--	--	--
<b>Threatened, Endangered, and Protected Species and Critical Habitat</b>										
Sperm whale (endangered)	X(8)	--	--	--	--	--	--	X(8)	X(6,8)	X(6,8)
West Indian manatee (endangered)	--	--	--	--	--	--	--	X(8)	--	X(6,8)
Non-endangered marine mammals (protected)	X	--	--	--	--	--	--	X	X(6)	X(6)
Sea turtles (endangered/threatened)	X(8)	--	--	--	--	--	--	X(8)	X(6,8)	X(6,8)
Piping Plover (threatened)	--	--	--	--	--	--	--	--	--	X(6)
Whooping Crane (endangered)	--	--	--	--	--	--	--	--	--	X(6)
Oceanic whitetip shark (threatened)	X	--	--	--	--	--	--	--	--	X(6)
Gulf sturgeon (threatened)	--	--	--	--	--	--	--	--	--	X(6)
Beach mice (endangered)	--	--	--	--	--	--	--	--	--	X(6)
Threatened coral species	--	--	--	--	--	--	--	--	--	X(6)
<b>Coastal and Marine Birds</b>										
Marine and pelagic birds	X	--	--	--	--	--	--	X	X(6)	X(6)
Shorebirds and coastal nesting birds	--	--	--	--	--	--	--	X	--	X(6)
<b>Fisheries Resources</b>										
Pelagic communities and ichthyoplankton	X	--	--	X	X	--	--	--	X(6)	X(6)
Essential Fish Habitat	X	--	--	X	X	--	--	--	X(6)	X(6)
<b>Archaeological Resources</b>										
Shipwreck sites	--	--(7)	--	--	--	--	--	--	--	X(6)
Prehistoric archaeological sites	--	--(7)	--	--	--	--	--	--	--	X(6)
<b>Coastal Habitats and Protected Areas</b>										
Barrier beaches and dunes	--	--	--	--	--	--	--	X	--	X(6)
Wetlands and seagrass beds	--	--	--	--	--	--	--	X	--	X(6)
Coastal wildlife refuges and wilderness areas	--	--	--	--	--	--	--	--	--	X(6)
<b>Socioeconomic and Other Resources</b>										
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. MODU = mobile offshore drilling unit.



## 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 surrounding the Flower Garden Banks, or the 3-mile zone of Stetson Bank;
  - (b) 1,000-m, 1-mile, or 3-mile zone of any topographic feature (submarine bank) protected by the Topographic Features Stipulation attached to an Outer Continental Shelf (OCS) lease;
  - (c) Essential Fish Habitat (EFH) criteria of 500 ft from any no-activity zone; or
  - (d) Proximity of any submarine bank (500-ft buffer zone) with relief greater than 2 m that is not protected by the Topographic Features Stipulation attached to an OCS lease.
    - None of these conditions (a through d) are applicable. The lease is not within the given range (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 lease 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 lease area.
- (4) *Activities on blocks designated by the Bureau of Ocean Energy Management (BOEM) as being in water depths 300 m or greater.*
  - No impacts on high-density deepwater benthic communities are anticipated. A wellsite assessment 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 locations (Geoscience Earth & Marine Services Inc., 2017a, b, c, d, e).
- (5) *Exploration or production activities where hydrogen sulfide (H<sub>2</sub>S) concentrations greater than 500 parts per million might be encountered.*
  - Alaminos Canyon Blocks 380 and 424 were classified as H<sub>2</sub>S absent under a previously approval Initial Exploration Plan submitted to BOEM by Anadarko Petroleum Corporation.
- (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 lease area is not on BOEM's list of archaeology survey blocks (BOEM, 2011), and the locations of the proposed activities are well beyond the 197 ft (60 m) depth contour used by BOEM as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. A dynamically positioned mobile offshore drilling unit (MODU) will be used; therefore, seafloor disturbances due to anchoring will not occur. Three unidentified side-scan sonar targets were noted within 2,000 ft (610 m) of the location of the proposed wellsites; however, they are not recommended for archaeological avoidance or investigation (Geoscience Earth & Marine Services Inc., 2017a, b, c, d, e).
- (8) *All activities that 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 mobile offshore drilling unit 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 MODU Presence (including noise and lights)

The MODU to be used for the wells will be either a DP drillship or a DP semisubmersible drilling rig that will be on site for an estimated 61 days in 2018 and 220 days per year from 2019 to 2035. DP MODUs are self-propelled and maintain position using a global positioning system, specific computer software, and sensors in conjunction with a series of thrusters or azimuth propellers. Potential impacts to marine resources from the MODU include the physical presence of the MODU in the ocean, increased light from working and safety lighting on the vessel, and noise audible above and below the water surface.

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

The MODU will maintain exterior lighting for working at night and navigational and aviation safety in accordance with federal navigation and aviation safety regulations (International Regulations for Preventing Collisions at Sea, 1972 [72 COLREGS], Part C). 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 1 micropascal at 1 m (dB re 1  $\mu$ Pa m) from the source, with a primary frequency below 600 hertz (Hz) (Blackwell and Greene Jr., 2003, McKenna et al., 2012a, 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  $\mu$ Pa m (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  $\mu$ Pa m (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  $\mu$ Pa m (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

The wells will be drilled using a DP MODU. Therefore, there will be minimal disturbance to the seafloor and soft bottom communities during positioning of the wellbore and blowout preventers. Physical disturbance of the seafloor will be limited to the proximal area where the wellbore penetrates the substrate and where mud and drill cuttings will be deposited.



### A.3 Air Pollutant Emissions

Estimates of air pollutant emissions are provided in **EP Section 8**. Offshore air pollutant emissions will result from operations of the MODU as well as service vessels and helicopters. These emissions occur mainly from combustion of diesel. Primary air pollutants typically associated with OCS activities are suspended particulate matter (PM), sulfur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOCs), and carbon monoxide (CO).

The project 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 **EP 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.

### A.4 Effluent Discharges

Effluent discharges from drilling operations are summarized in **EP Section 7**. Discharges from MODUs are required to comply with the National Pollutant Discharge Elimination System (NPDES) General Permit for Oil and Gas Activities (Permit No. GMG290103). Support vessel discharges are expected to be in accordance with USCG regulations.

Water-based drilling muds (WBM) 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.

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 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 **EP Section 7**.

Other effluent discharges from the MODU and support vessels are expected to include treated sanitary and domestic wastes, deck drainage, non-contaminated well treatment and completion fluids, desalination unit discharge, blowout preventer fluid, ballast water, bilge water, cement slurry, fire water, hydrate inhibitor, and non-contact cooling water. All discharges shall comply with the NPDES General Permit and/or USCG regulations, as applicable.

### 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 MODU (**EP 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 impacts 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 cooling water intake structures



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 MODU selected for this project meets the described applicability for new facilities, and the vessel's 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 **EP Section 7**. Used SBMs and additives will be transported to shore for recycling, reconditioning, or deep well injection at Halliburton Drilling Fluids, MiSwaco, Ecoserv, R360 Environmental Solutions, or FCC Environmental 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, R360 Environmental Solutions, or FCC Environmental in Port Fourchon, Louisiana. Completion fluids will be transported to shore for recycling or deep well injection at Halliburton, Baker Hughes, Tetra, Superior, Ecoserv, R360 Environmental Solutions, or FCC Environmental 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.

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 Hammond, 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 materials (e.g., trash and debris) into the marine environment, and BSEE regulation 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, manifesting trash sent to shore, and using special precautions such as covering outside trash bins to prevent accidental loss of solid waste. Shell will comply 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 informational placards at prominent locations on offshore vessels and



structures, and mandates a yearly marine trash and debris awareness training and certification process. Compliance with these requirements is expected to result in either no or negligible impacts from this factor.

## **A.8 Support Vessel and Helicopter Traffic**

Shell will use existing shore-based facilities at Port Fourchon, Louisiana, for onshore support of vessels and at Galveston, Texas, for air transportation support. 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 drilling activities. 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 lease area when air traffic and weather conditions permit. Helicopters typically maintain a minimum altitude of 700 ft (213 m) while in transit offshore; 1,000 ft (305 m) over unpopulated areas or across coastlines; and 2,000 ft (610 m) over populated areas and sensitive habitats such as wildlife refuges and park properties. Additional guidelines and regulations specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals (BOEM, 2017a).

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., 2012b). 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 m (Richardson et al., 1995, Hildebrand, 2009, McKenna et al., 2012b).

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 (dB re 1  $\mu$ Pa) 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

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 exploration and development 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 **EP 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**.

The lease sale EISs (BOEM, 2012a, 2015, 2016c, 2017a) discuss other types of accidents: loss of well control, pipeline failures, vessel collisions, chemical and drilling fluid spills, and H<sub>2</sub>S 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.

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.

Shell has a robust system in place to prevent loss of well control. Included in this EP 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 **EP Sections 2j** and **9b** for further information.

Pipeline Failures. Pipeline failures can result from mass sediment movements and mudslides, impacts from anchor drops, and accidental excavation in the case that the exact location of a pipeline is uncertain (BOEM, 2012a, 2013, 2015). The project area has been evaluated through geologic and geohazard surveys and found to be geologically suitable for the proposed exploration drilling (Geoscience Earth & Marine Services Inc., 2017a, b, c, d, e).

Vessel Collisions. 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 lease 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 (2017d), 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.

Chemical Spills. Chemicals are stored and used for pipeline hydrostatic testing, and during drilling and in well completion operations. The relative quantities of their use is reflected in the largest volumes spilled (BOEM, 2017d). 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).

Drilling Fluid Spills. There is the potential for drilling fluids, specifically synthetic-based fluids (SBFs) to be spilled due to an accidental riser disconnect (BOEM, 2017a). SBFs are relatively nontoxic to the marine environment and have the potential to biodegrade (BOEM, 2014). The majority of SBF 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 SBF spill, there could be short-term localized impacts on water quality and the potential for localized benthic impacts due to SBF deposition on the seafloor. Benthic impacts would be similar to those described in **Section C.2.1**. The potential for riser disconnect SBF spills will be minimized by adhering to the requirements of applicable regulations.

H<sub>2</sub>S Release. AC 380 and AC 424 are classified as H<sub>2</sub>S absent based on a previously approved Initial EP submitted to BOEM by Anadarko Petroleum Commission. See **EP Section 4** for more details.

### **A.9.1 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 lease area would depend on meteorological and oceanographic conditions at the time of the spill as well as the effectiveness of spill response activities. However, given the open ocean location of the lease area and 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). Adherence to suspended sediments is not 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 acres (ac) (0.5 to 5 hectares [ha]), depending on sea state and weather conditions.

The ADIOS 2 model results, coupled with spill trajectory information discussed in the next section regarding large spills, indicate that a small fuel spill would not affect coastal or shoreline resources. The lease area is 160 miles (258 km) from the nearest shoreline (Texas). Slicks from fuel 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 from shore of these potential spills 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. **EP Section 9b** provides a detailed discussion of Shell's oil spill response.

## **A.9.2 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 **EP Section 2j**. Blowouts are rare events, and most well control incidents do not result in oil spills (BOEM, 2016a). According to ABS Consulting Inc. (2016), the spill rate for spills >1,000 bbl is 0.22 spills per billion barrels.

Spill Size. Shell has calculated the WCD for this EP using the requirements prescribed by NTL 2015-N01. The calculated initial release volume is 125,000 bbl of oil during the first day, and the calculated 30-day average WCD rate is 125,000 barrels of oil per day. The total potential spill volume along with a detailed analysis of this calculation can be found in **EP Section 2j**. The WCD scenario for this EP has a low probability of being realized. Some of the factors that are likely to reduce rates and volumes, which are not incorporated 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. 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, can be found in **EP Sections 2j** and **9b**. Shell will also comply with NTL 2010-N10 and applicable drilling regulations in 30 CFR Part 250, Subpart D, which specify additional safety measures for OCS activities.



Spill Trajectory. The fate of a large oil spill in the lease 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 in the Gulf of Mexico.

The results for Launch Area 24 (the launch area where AC 380 and AC 424 are located) are presented in **Table 3**. The model predicts a <0.5% chance of shoreline contact within 3 or 10 days. Within 30 days, the model predicts 1% to 8% chance of shoreline contact from Cameron County, Texas, to Vermilion Parish, Louisiana. Matagorda County, Texas, is projected to have the highest probability of shoreline contact within 30 days (8% conditional probability) (**Table 3**). 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 lease area (AC 380 and AC 424) 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 lease area (represented by OSRA Launch Area 24) could contact shoreline segments within 3, 10, or 30 days.

Shoreline Segment	County or Parish, State	Conditional Probability of Contact <sup>1</sup> (%)		
		3 Days	10 Days	30 Days
C01	Cameron, Texas	--	--	3
C02	Willacy, Texas	--	--	1
C03	Kenedy, Texas	--	--	4
C04	Kleberg, Texas	--	--	3
C05	Nueces, Texas	--	--	3
C06	Aransas, Texas	--	--	3
C07	Calhoun, Texas	--	--	4
C08	Matagorda, Texas	--	--	8
C09	Brazoria, Texas	--	--	2
C10	Galveston, Texas	--	--	4
C12	Jefferson, Texas	--	--	2
C13	Cameron, Louisiana	--	--	3
C14	Vermilion, Louisiana	--	--	1

<sup>1</sup> Conditional probability refers to the probability of contact within the stated time period, assuming that a spill has occurred. -- indicates <0.5% probability of contact.

The OSRA model presented by Ji et al. (2004) 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; however, the model 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).

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 of an Application for Permit to Drill. The application will include equipment and services available to Shell through MWCC's near-term containment capabilities and other industry response 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.

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 a launch and recovery system, which enables water sampling and monitoring to water depths of 3,000 m. The two 8 ft x 20 ft containers have been certified for offshore use by Det Norske Veritas and the American Bureau of Shipping. The launch and recovery system 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 **EP Section 9b** for a detailed description of spill response measures.



## B. Affected Environment

The lease area is in the Western Planning Area in Gulf of Mexico, 164 miles (264 km) from the nearest shoreline (Texas), 318 miles (512 km) from the onshore support base for vessels at Port Fourchon, Louisiana, and 190 miles (306 km) from the helicopter base at Galveston, Texas. The water depths at the proposed wellsites range from approximately 6,447 to 7,251 ft (1,965 to 2,210 m).

The wellsites shallow hazards and archaeological assessment did not identify any seafloor anomalies within 2,000 ft (610 m) of the proposed wellsites that would indicate the potential for chemosynthetic or high-density deepwater benthic communities (Geoscience Earth & Marine Services Inc., 2017a, b, c, d, e). In addition, no archaeologically significant potential sonar contacts within 2,000 ft (610 m) of the proposed wellsites were noted during the wellsite assessment (Geoscience Earth & Marine Services Inc., 2017a, b, c, d, e).

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

## C. Impact Analysis

This section analyzes the potential direct and indirect environmental 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, 2014, 2015, 2016c, 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 June 2018, Mississippi, Alabama, and Florida Panhandle coastal counties are in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants. St. Bernard Parish in Louisiana 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. One coastal metropolitan area in Florida (Tampa) is a nonattainment area for lead based on the 2008 Standard (U.S. Environmental Protection Agency, 2018).

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 MODU and associated equipment as well as helicopters and service vessels as described in **Section A.3**. These emissions occur mainly from combustion or burning of diesel and Jet-A aircraft fuel. Primary air pollutants typically associated with OCS activities are suspended PM, SO<sub>x</sub>, NO<sub>x</sub>, 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 by BOEM (BOEM, 2012a, 2013, 2014, 2015, 2016c, 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 380 and AC 424 are 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 AQR (see **EP Section 8**) prepared in accordance with BOEM requirements shows that the projected emissions from sources associated with the proposed activities meet BOEM's exemption criteria. Therefore, this EP is exempt from further air quality review pursuant to 30 CFR 550.303(d).

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 lease area is approximately 379 miles (610 km) from the Breton Wilderness Area. Shell will comply with emissions requirements as directed by BOEM.

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<sub>2</sub>) and methane (CH<sub>4</sub>) 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<sub>2</sub>



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, 2016c, 2017a). **Section A.9.1** discusses the size and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease area, the extent and duration of air quality impacts at the lease area from a small spill would not be significant.

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.9.1**) 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 lease area, the extent and duration of air quality impacts at the lease area from a small spill would not be significant.

A small fuel spill would not affect coastal air quality because the spill would be expected to dissipate prior to making landfall or reaching coastal waters (see **Section A.9.1**).

### Impacts of a Large Oil Spill

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

A large oil spill would likely affect air quality by introducing VOCs into the atmosphere through evaporation from the oil on the water surface. 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<sub>x</sub>, SO<sub>x</sub>, CO, and PM as well as greenhouse gases.

Due to the lease 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 (**Table 3**), coastal areas would not likely be affected within 10 days; however, coastal areas between Cameron County, Texas, and Vermilion Parish, Louisiana, may be affected within 30 days of a spill (1% to 8% conditional probability).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP 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 lease 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 No. GMG290103 establishes permit limits and monitoring requirements for effluent discharges from the MODU and support vessels.

WBM 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 discharge area with little or 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 lease area (BOEM, 2017a). 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 MODU 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 MODU will flow overboard without treatment. However, rainwater that falls on the MODU deck and other areas that may be contaminated with chemicals, such as chemical storage areas or places where equipment is exposed, will be collected and processed to separate oil and water to meet NPDES permit requirements. Negligible impact on water quality is anticipated.

Other effluent discharges from the MODU and support vessels are expected to include non-contaminated well treatment and completion fluids, desalination unit discharge, blowout preventer fluid, ballast water, bilge water, cement slurry, fire water, hydrate inhibitor, and non-contact cooling water. The MODU 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, 2016c, 2017a). **Section A.9.1** discusses the size



and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease 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 to 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.9.1**). 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 lease 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 (**Section A.9.1**).

### **Impacts of a Large Oil Spill**

Potential impacts of a large oil spill on water quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016c, 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 Macondo spill 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 Macondo spill have confirmed that the application of subsurface dispersants resulted in subsurface hydrocarbon plumes (Spier et al., 2013). A report by Kujawinski et al. (2011) indicates that chemical components of subsea dispersants used during the Macondo spill persisted for up to 2 months and were 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 Macondo spill, 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 Macondo spill, large volumes of CH<sub>4</sub> 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<sup>-1</sup>) (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 lease area's 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 (**Table 3**), coastal areas would not likely be affected within 10 days; however, coastal areas between Cameron County, Texas, and Vermilion Parish, Louisiana, may be affected within 30 days (1% to 8% conditional probability).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce any resultant impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on water quality are expected.

## C.2 Seafloor Habitats and Biota

The water depths at the proposed wellsites range from approximately 6,447 to 7,251 ft (1,965 to 2,210 m). See **EP Section 6a** for further information.

According to BOEM (2016c, 2017a), existing information for the deepwater Gulf of Mexico indicates that the seafloor is composed primarily of soft sediments; exposed hard substrate habitats and associated biological communities are rare. Geoscience Earth & Marine Services Inc. (2017a, b, c, d, e) conducted shallow hazard and archeological assessment survey of AC 380 and



AC 424. No features or areas that could support significant, high-density benthic communities were found within 2,000 ft (610 m) of the proposed wellsites.

### C.2.1 Soft Bottom Benthic Communities

There are no site-specific benthic community data from the lease 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 could be present in vicinity of the proposed wellsites. **Table 4** summarizes data from two stations in the vicinity of the proposed wells. Sediments at these two stations were similar, predominantly clay (60% at Station AC1 and 64% at Station RW5) and silt (35% at Station AC1 and 28% at Station RW5) (Rowe and Kennicutt, 2009).

Table 4. Baseline benthic community data from stations near to the lease 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 <sup>-2</sup> )	Macrofauna (individuals m <sup>-2</sup> )	Megafauna (individuals ha <sup>-1</sup> )
AC1	5 mi (8 km)	2,555	129,974	637	1,620
RW5	28 mi (45 km)	1,628	170,663	1,372	576

Meiofaunal and megafaunal abundance from Rowe and Kennicutt (2009); macrofaunal abundance from Wei (2006).

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 lease area ranged from approximately 130,000 to 171,000 individuals m<sup>-2</sup> (Rowe and Kennicutt, 2009). Nematodes, nauplii, and harpacticoid copepods were the three dominant groups in the meiofauna, accounting for approximately 90% of total abundance.

The benthic macrofauna is characterized by small mean individual sizes and low densities, both of which reflect the intrinsically low primary production in surface waters of the Gulf of Mexico continental slope (Wei, 2006). Densities decrease exponentially with water depth (Carvalho et al., 2013). Based on an equation presented by Wei (2006), the macrofaunal density in the water depth of the proposed wellsites is expected to range approximately between 1,323 to 1,586 individuals m<sup>-2</sup>; however, actual densities at the proposed wellsites are unknown and often highly variable.

Polychaetes are typically the most abundant macrofaunal 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 lease area is located in Zone 3W, which includes 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 *Levinsonia uncinata*, *Paraonella monilaris*, and *Tachytrypa* sp.; the bivalve *Heterodonta* sp.; and the isopod *Macrostylis* sp.



Megafaunal density at stations in the vicinity of the proposed wellsites ranged from 576 to 1,620 individuals  $\text{ha}^{-1}$  (**Table 4**). Common megafauna included motile groups such as decapods, holothurians, and demersal fishes as well as sessile groups such as sponges, gorgonians, and alcyonaria (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). In deep-sea sediments, Main et al. (2015) observed that microbial oxygen consumption rates increased and bacterial biomass decreased with hydrocarbon contamination. Bacterial biomass at the depth range of the lease area typically is approximately 1 to 2 grams of carbon per square meter ( $\text{g C m}^{-2}$ ) 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 lease area, DP MODUs 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 areal extent of these impacts will be small compared to the lease 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. 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 MODU 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<sup>-1</sup>, 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<sub>2</sub>S 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, 2016c, 2017a). Impacts from a subsea blowout could likely 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 wellsites. Sediments at these two stations were similar, predominantly clay (60% at Station AC1 and 64% at Station RW5) and silt (35% at Station AC1 and 28% at Station RW5) (Rowe and Kennicutt, 2009).

Previous analyses by (BOEM, 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. During the Macondo spill, 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 Macondo spill 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 Macondo spill extended 2 miles (3 km) from the wellhead in all directions, covering an area of approximately 9 miles<sup>2</sup> (24 km<sup>2</sup>). 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<sup>2</sup> (148 km<sup>2</sup>). NOAA (2016b) documented a footprint of over 772 miles<sup>2</sup> (2,000 km<sup>2</sup>) of impacts to benthic habitats surrounding



the Macondo spill site. The analysis also identified a larger area of approximately 3,552 miles<sup>2</sup> (9,200 km<sup>2</sup>) 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<sup>2</sup> (6.5 km<sup>2</sup>).

While the behavior and impacts of subsurface oil plumes are not well known, the Macondo findings indicate that benthic impacts likely extend beyond the immediate vicinity of the wellsite, depending on the extent, trajectory, and persistence of the plume. 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 Macondo spill. 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. (2014) 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will minimize potential impacts. **EP 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 (Brooke and Schroeder, 2007, CSA International, 2007, Brooks et al., 2012). These communities occur almost exclusively on exposed authigenic carbonate rock created by a biogeochemical (microbial) process, 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, 2006, Neff et al., 2005). The nearest known high-density deepwater benthic communities are found in AC 645, approximately 13 miles (20 km) south of the lease area (BOEM, nd).

No features or areas that could support significant, high-density benthic communities were found within 2,000 ft (610 m) of the proposed wellsite locations (Geoscience Earth & Marine Services Inc., 2017a, b, c, d, e). As a result, high-density deepwater benthic communities are not expected to be present.

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 disturbances and



effluent discharges 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 from the sea surface.

### **Impacts of a Large Oil Spill**

The wellsite assessment did not identify high-density deepwater benthic communities within 2,000 ft (610 m) of the proposed wellsites (Geoscience Earth & Marine Services Inc., 2017a, b, c, d, e).

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, 2016c). During the Macondo spill, subsurface plumes were reported at a water depth of approximately 3,600 ft (1,100 m), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface plumes apparently resulted from the use of subsea dispersants at the wellhead (NOAA, 2011c). Chemical components of subsea dispersants used during the Macondo spill 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) (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, 2016c).

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, 2016c, 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 by 130 ft (15 by 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 Macondo spill. 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. (2014b) reported two additional coral areas affected by the Macondo spill; one 4 miles (6 km) south of the Macondo wellsite, and the other 14 miles (22 km) to the southeast. Prouty et al. (2016) found evidence that corals located northeast of the Macondo spill 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., 2014a).

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 bottom communities, their comparatively low surface area, and the 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on Shell's 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 project location is not within or near a designated topographic feature or a no-activity zone as identified in NTL 2009-G39. The nearest designated topographic feature stipulation block is East Breaks Block 165, located approximately 82 miles (132 km) north of the lease area. There are no IPFs associated with either routine operations or accidents that could cause impacts to designated topographic features due to their distance from the lease area.

### **C.2.4 Pinnacle Trend Area Live Bottoms**

The lease area is not covered by the Live Bottom (Pinnacle Trend) Stipulation. As defined in NTL 2009-G39, the nearest pinnacle trend block is located approximately 410 miles (660 km) east-northeast of the lease 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 lease area.

### C.2.5 Eastern Gulf Live Bottoms

The lease area is not covered by the Live Bottom (Low-Relief) Stipulation, which pertains to seagrass communities and low-relief hard bottom 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 453 miles (729 km) east-northeast of the lease 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 lease 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, threatened, and candidate species potentially present in the lease area and along the northern Gulf Coast.

Species	Scientific Name	Status	Potential Presence		Critical Habitat Designated in Gulf of Mexico
			Lease Area	Coastal	
Marine Mammals					
Sperm whale	<i>Physeter macrocephalus</i>	E	X	--	None
Bryde's whale	<i>Balaenoptera edeni</i> <sup>a</sup>	P	X	--	None
West Indian manatee	<i>Trichechus manatus</i> <sup>b</sup>	E	--	X	Florida (Peninsular)
Sea Turtles					
Loggerhead turtle	<i>Caretta caretta</i>	T, E <sup>c</sup>	X	X	Nesting beaches and nearshore reproductive habitat in Mississippi, Alabama, and Florida; <i>Sargassum</i> habitat including most of the central and western Gulf of Mexico
Green turtle	<i>Chelonia mydas</i>	T	X	X	None
Leatherback turtle	<i>Dermochelys coriacea</i>	E	X	X	None



Table 5. (Continued).

Species	Scientific Name	Status	Potential Presence		Critical Habitat Designated in Gulf of Mexico
			Lease Area	Coastal	
Hawksbill turtle	<i>Eretmochelys imbricata</i>	E	X	X	None
Kemp's ridley turtle	<i>Lepidochelys kempii</i>	E	X	X	None
Birds					
Piping Plover	<i>Charadrius melodus</i>	T	--	X	Coastal Texas, Louisiana, Mississippi, Alabama, and Florida
Whooping Crane	<i>Grus americana</i>	E	--	X	Coastal Texas (Aransas National Wildlife Refuge)
Sharks and Fishes					
Oceanic whitetip shark	<i>Carcharhinus longimanus</i>	T	X	--	None
Gulf sturgeon	<i>Acipenser oxyrinchus desotoi</i>	T	--	X	Coastal Louisiana, Mississippi, Alabama, and Florida
Invertebrates					
Elkhorn coral	<i>Acropora palmata</i>	T	--	X	Florida Keys and the Dry Tortugas
Lobed star coral	<i>Orbicella annularis</i>	T	--	X	None
Mountainous star coral	<i>Orbicella faveolata</i>	T	--	X	None
Boulder star coral	<i>Orbicella franksi</i>	T	--	X	None
Terrestrial Mammals					
Beach mice (subspecies: Alabama, Choctawhatchee, Perdido Key, St. Andrew)	<i>Peromyscus polionotus</i>	E	--	X	Alabama and Florida (Panhandle) beaches

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

- a Gulf of Mexico Bryde's whales are protected by the Marine Mammal Protection Act . There is currently a proposed rule to list this stock as 'endangered' under the Endangered Species Act.
- b There are two subspecies of West Indian manatee: the Florida manatee (*T. m. latirostris*), which ranges from the northern Gulf of Mexico to Virginia, and the Antillean manatee (*T. m. manatus*), which ranges from northern Mexico to eastern Brazil. Only the Florida manatee subspecies is likely to be found in the northern Gulf of Mexico.
- c The Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead turtles is designated as threatened (76 *Federal Register* [FR] 58868). NMFS and USFWS 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)

In 2007, NMFS and the USFWS issued a Biological Opinion in response to ESA consultations with MMS for previous EISs (NMFS, 2007). Following the Macondo spill on July 30, 2010, BOEM reinitiated ESA consultation with NMFS and the USFWS. BOEM, NMFS, and USFWS are currently in the process of collecting and awaiting additional information being gathered as part of the Natural Resource Damage Assessment process, in order to update the environmental baseline information as needed for the reinitiated Section 7 consultation. Consultation is ongoing, and BOEM is acting as lead agency, with BSEE involvement, in the reinitiated consultation with BOEM (2015, 2016c). BOEM and BSEE have developed an interim coordination and review process with



NMFS and USFWS for specific activities leading up to or resulting from upcoming lease sales. The purpose of this coordination is to ensure that NMFS and USFWS have the opportunity to review post-lease exploration, development, and production activities prior to BOEM's approval. The reviews ensure that all approved plans and permits contain all necessary measures to avoid jeopardizing the existence of ESA-listed species and implementation of reasonable and prudent alternative measures. This interim coordination program remains in place while formal consultation and the development of a Biological Opinion are ongoing (BOEM, 2015, 2016c).

Coastal endangered or threatened species that may occur along the U.S. Gulf Coast include the West Indian manatee, Piping Plover, Whooping Crane, Gulf sturgeon, and four subspecies of beach mouse. Critical habitat has been designated for all of these species as indicated in **Table 5** and discussed in individual sections. Two other coastal bird species (Bald Eagle and Brown Pelican) are no longer federally listed as endangered or threatened; these are discussed in **Section C.4.2**.

Five sea turtle species, the sperm whale, and the oceanic whitetip shark are the only endangered or threatened species likely to occur within the lease area. The listed sea turtles include the leatherback turtle, Kemp's ridley turtle, hawksbill turtle, loggerhead turtle, and green turtle (Pritchard, 1997). Effective 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.3.4**). 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 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, more specifically in the waters of the DeSoto Canyon and therefore not likely to occur within the lease area (Waring et al., 2016).

Five endangered mysticete whales (blue whale, fin whale, humpback whale, North Atlantic right whale, and sei whale) have been reported from the Gulf of Mexico but are considered rare or extralimital and therefore, are not considered further in the EIA (Würsig et al., 2000). These species are not included in the most recent NMFS stock assessment reports (Waring et al., 2015, Hayes et al., 2017) nor in the most recent BOEM multisale EIS (BOEM, 2017a); therefore, they are not considered further in the EIA.

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

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



### C.3.1 Sperm Whale (Endangered)

The only endangered marine mammal likely to be present at or near the project area is the sperm whale (*Physeter macrocephalus*). 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., 2015). 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).

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

The distribution of sperm whales in the Gulf of Mexico is correlated with mesoscale physical features such as eddies associated with the Loop Current (Jochens et al., 2008). Sperm whale populations in the north-central Gulf of Mexico are present there throughout the year (Davis et al., 2000a). 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 lease area. Movements of satellite-tracked individuals suggest that this area of the Gulf 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 noise; support vessel strikes; 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. Compliance with BSEE NTL 2015-G03 will minimize the potential for marine debris-related impacts on sperm whales.

### **Impacts of MODU Presence, Noise, and Lights**

Some sounds produced by the 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 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 approximately 190 dB re 1  $\mu$ Pa m (Hildebrand, 2005).

NMFS (2016a) 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. Sperm whale sounds generally consist of clicks that have a bandwidth of 100 Hz to 30 kHz (Erbe et al., 2017). 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 (Weilgart and Whitehead, 1993, Goold and Jones, 1995, Møhl et al., 2003, Erbe et al., 2017), with source levels up to 236 dB re 1  $\mu$ Pa m (Møhl et al., 2003, Mathias et al., 2013).

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 sound pressure levels of 120 dB re 1  $\mu$ Pa 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 installation vessel operations), permanent threshold shifts are estimated to occur when the mammal has received a cumulative exposure level of 198 decibels relative to 1 micropascal squared seconds (dB re 1  $\mu$ Pa<sup>2</sup>-s) over a 24-hour period (NMFS, 2016a). Similarly, temporary threshold shifts are estimated to occur when the mammal has received a cumulative noise exposure level of 178 dB re 1  $\mu$ Pa<sup>2</sup>-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 sound levels greater than 160 dB re 1  $\mu$ Pa 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 activities, it is not expected that any sperm whales will receive exposure levels necessary for the onset of auditory threshold shifts.

The MODU 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.

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

### **Impacts of Support Vessel and Helicopter Traffic**

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 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 300 ft (91 m) or greater whenever possible. Vessel operators are required to reduce vessel speed to 10 knots or less, when safety permits, when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel. Compliance with this NTL will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing sperm whales.

NMFS (2007) analyzed the potential for vessel strikes and harassment of sperm whales in its Biological Opinion for the Five-Year Oil and Gas Leasing Program in the Central and Western Planning Areas of the Gulf of Mexico. With implementation of the mitigation measures in NTL BOEM-2016-G01, NMFS concluded that the likelihood of collisions between vessels and sperm whales would be reduced to insignificant levels. NMFS also 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 implementation of the vessel strike avoidance measures, NMFS concluded that the potential for harassment of sperm whales would be reduced to discountable levels.

Helicopter traffic also has the potential to disturb sperm whales. Smultea et al. (2008) 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.

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 300 ft (91 m) of marine mammals (BOEM, 2016a, 2017a). Although whales may respond to helicopters, (Smultea et al., 2008) and NMFS (2007) concluded that this altitude would minimize the potential for disturbing sperm whales. Therefore, no significant impacts are expected.

### **Impacts of a Small Fuel Spill**

Potential spill impacts on marine mammals including sperm whales are discussed by NMFS (2007) and BOEM (2012a, 2015, 2016c, 2017a). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990) and by the Marine Mammal Commission (MMC) (2011). For the EIA, 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. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease area and the duration of a small spill, the opportunity for impacts to occur would be very brief.

A small 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.9.1** 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 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, 2016c, 2017a), and NMFS (2007). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990) and by the MMC (2011). For the EIA, there are no unique site-specific issues with respect to spill impacts on sperm whales.

Impacts of oil spills on sperm whales can include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants) (MMC, 2011). Direct physical and physiological effects can include skin irritation,



inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil (and dispersants) directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft. The level of impact of oil exposure depends on the amount, frequency, and duration of exposure; route of exposure; and type or condition of petroleum compounds or chemical dispersants (Hayes et al., 2017). Complications 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 Macondo spill in 2010.

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on sperm whales are expected.

### **C.3.2 West Indian Manatee (Endangered)**

Most of the Gulf of Mexico West Indian manatee (*Trichechus manatus*) population is located in peninsular Florida (USFWS, 2001). Critical habitat has been designated in southwest Florida in Manatee, Sarasota, Charlotte, Lee, Collier, and Monroe Counties. Manatees regularly migrate farther west of Florida in the warmer months (Wilson, 2003) into Alabama and Louisiana coastal environs, with some individuals traveling as far west as Texas (Fertl et al., 2005). A species description is presented in the recovery plan for this species (USFWS, 2001).

IPFs that could potentially affect manatees include support vessel and helicopter traffic and a large oil spill. A small fuel spill in the lease area would be unlikely to affect manatees because the lease area is approximately 164 miles (264 km) from the nearest shoreline (Texas). As explained in **Section A.9.1**, 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 (see **Table 1**) 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 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, 2001). 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. Compliance with NTL BOEM-2016-G01 will minimize the likelihood of vessel strikes, and no significant impacts on manatees are expected.

Helicopter traffic, if present, also has the potential to disturb manatees. Rathbun (1988) reported that manatees were disturbed more by helicopters than by fixed-wing aircraft; however, the helicopter was flown at relatively low altitudes of 66 to 525 ft (20 to 160 m). Helicopters used in support operations maintain a minimum altitude of 700 ft (213 m) while in transit offshore, 1,000 ft (305 m) over unpopulated areas or across coastlines, and 2,000 ft (610 m) over populated areas and sensitive habitats such as wildlife refuges and park properties. In addition, guidelines and regulations issued by NMFS under the authority of the MMPA specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals (BOEM, 2012a, b). This mitigation measure will minimize the potential for disturbing manatees, and no significant impacts are expected.

### **Impacts of a Large Oil Spill**

Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not be affected within 10 days; however, coastal areas between Cameron County, Texas, and Vermilion Parish, Louisiana, may be affected within 30 days (1% to 8% conditional probability). There is no manatee 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on manatees are expected.

### **C.3.3 Non-Endangered Marine Mammals (Protected)**

All marine mammal species are protected under the MMPA. In addition to the two endangered species of marine mammals that were cited in **Sections C.3.1 and C.3.2**, 21 additional species of



marine mammals may be found in the Gulf of Mexico. These include one species of mysticete whale, the dwarf and pygmy sperm whales, four species of beaked whales, and 14 species of delphinid whales and dolphins (see **EP 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).

**Bryde's whale.** The Bryde's whale (*Balaenoptera edeni*) is the only year-round resident baleen whale in the northern Gulf of Mexico. In 2014, a petition was submitted to designate the northern Gulf of Mexico population as a DPS and list it as endangered under the ESA (Natural Resources Defense Council [NRDC], 2014). This petition received a 90-day positive finding by NMFS in 2015 and is currently under consideration for listing. The Bryde's whale is sighted most frequently between the 328 ft (100 m) and 3,280 ft (1,000 m) isobaths (Davis and Fargion, 1996, Davis et al., 2000a). Most sightings have been made in the DeSoto Canyon region and off western Florida, although there have been some in the west-central portion of the northeastern Gulf of Mexico. Based on the available data, it is possible that Bryde's whales could occur in the lease area.

**Dwarf and pygmy sperm whales.** At sea, it is difficult to differentiate dwarf sperm whales (*Kogia sima*) from pygmy sperm whales (*Kogia breviceps*), and sightings are often grouped together as *Kogia* spp. Both species have a worldwide distribution in temperate to tropical waters. In the Gulf of Mexico, both species occur primarily along the continental shelf edge and in deeper waters off the continental shelf (Mullin et al., 1991, Mullin, 2007, Waring et al., 2015). Either species could occur in the lease 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., 2000a). Any of these species could occur in the lease area (Waring et al., 2015).

**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*), false killer whale (*Pseudorca crassidens*), Fraser's dolphin (*Lagenodelphis hosei*), killer whale (*Orcinus orca*), 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 lease area (Waring et al., 2015).

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., 2015). The offshore form of the bottlenose dolphin inhabits waters seaward from the 200-m isobath and may occur within the lease 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., 2017).

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 Macondo spill 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. (2014a) reported that 1 year after the Macondo spill, 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 Macondo spill are proposed as a cause.

IPFs that could potentially affect non-endangered marine mammals include MODU 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 MODU 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 21 non-endangered cetaceans found in the Gulf of Mexico (NMFS, 2016). Eighteen of the 20 odontocete species are considered to be in the mid-frequency functional hearing group, two species (*Kogia breviceps* and *K. sima*) are in the high frequency functional hearing group, and one species (Bryde’s whale) is in the low frequency functional hearing group (NMFS, 2016). Thruster and installation noise will affect each group differently depending on the frequency bandwidths produced by operations.



For mid frequency cetaceans exposed to a non-impulsive source (like installation operations), permanent threshold shifts are estimated to occur when the mammal has received a cumulative exposure level of 198 dB re 1  $\mu\text{Pa}^2\cdot\text{s}$  over a 24-hour period. Similarly, temporary threshold shifts are estimated to occur when the mammal has received a cumulative noise exposure level of 178 dB re 1  $\mu\text{Pa}^2\cdot\text{s}$  over a 24-hour period. For low frequency cetaceans, specifically the Brydes whale, permanent and temporary threshold shift onset is estimated to occur at 199 dB re 1  $\mu\text{Pa}^2\cdot\text{s}$  and 179 re 1  $\mu\text{Pa}^2\cdot\text{s}$ , respectively. Based on transmission loss calculations (Urlick, 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 levels greater than 160 dB re 1  $\mu\text{Pa}$  beyond 105 ft (32 m) from the source. Due to the short propagation distance of high sound pressure levels, the transient nature of marine mammals and the stationary nature of the proposed activities, 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 sound pressure levels of 120 dB re 1  $\mu\text{Pa}$  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 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 lease 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.

MODU lighting and presence are not identified as IPFs for marine mammals by BOEM (2016c, 2017a). Therefore, no significant impacts are expected.

### **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 when whales are sighted and 150 ft (45 m) when small cetaceans are sighted. When cetaceans are sighted while a vessel is underway, vessels must attempt to remain parallel to the animal's course and avoid excessive speed or abrupt changes in direction until the cetacean has left the area. Vessel operators are required to reduce vessel speed to 10 knots or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel, when safety permits. Compliance with this NTL will minimize the likelihood of vessel strikes as



well as reduce the chance for disturbing marine mammals, and therefore no significant impacts are expected.

Aircraft traffic also has the potential to disturb marine mammals (Würsig et al., 1998). However, while flying offshore, helicopters maintain altitudes above 700 ft (213 m) during transit to and from the working area. In addition, guidelines and regulations issued by NMFS under the authority of the MMPA specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals (BOEM, 2017a). 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 (2016c, 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. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease area and the duration of a small spill, the opportunity for impacts to occur would be very brief.

A small 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.9.1** 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 (2016c, 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., 2017b); 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 Macondo spill, as analyzed and summarized by NOAA (2016b) indicate the scope of potential impacts from a large spill. Tens of thousands of marine mammals were exposed to oil, where they likely inhaled, aspirated, ingested, physically contacted, and absorbed oil components (NOAA, 2016b, 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 21 species of dolphins and whales that live in the northern Gulf of Mexico had demonstrable, quantifiable injuries. NMFS (2014a) documented 13 dolphins and whales 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. (2014b) 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on marine mammals are expected.

#### **C.3.4 Sea Turtles (Endangered/Threatened)**

As listed in **EP Section 6h**, five species of endangered or threatened sea turtles may be found near the lease area. Endangered species are the leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempii*), and hawksbill (*Eretmochelys imbricata*) turtles. As of May 6, 2016, the entire North Atlantic DPS of the green turtle (*Chelonia mydas*) is listed as threatened (81 *Federal Register* [FR] 20057). The DPS of loggerhead turtle (*Caretta caretta*) 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 lease 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* spp. habitat. The nearest designated nearshore reproductive critical habitat for loggerhead sea turtles is approximately 428 miles (689 km) from the lease 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 one 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).

On February 17, 2010, NOAA Fisheries and the USFWS were jointly petitioned to designate critical habitat for the Kemp's ridley turtle for nesting beaches along the Texas coast and marine habitats in the Gulf of Mexico and Atlantic Ocean (WildEarth Guardians, 2010). As of March 2018, critical habitat has not been designated for the Kemp's ridley sea turtle (NMFS, 2015).

Leatherbacks and loggerheads are the species most likely to be present near the lease area as adults. Green, hawksbill, and Kemp's ridley turtles are typically inner-shelf and nearshore species, unlikely to occur near the lease area as adults. Female Kemp's ridley turtles may be found in the lease area as they transit to and from nesting beaches. Hatchlings or juveniles of any of the sea turtle species may be present in deepwater areas, including the lease area, where they may be associated with *Sargassum* spp. 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.



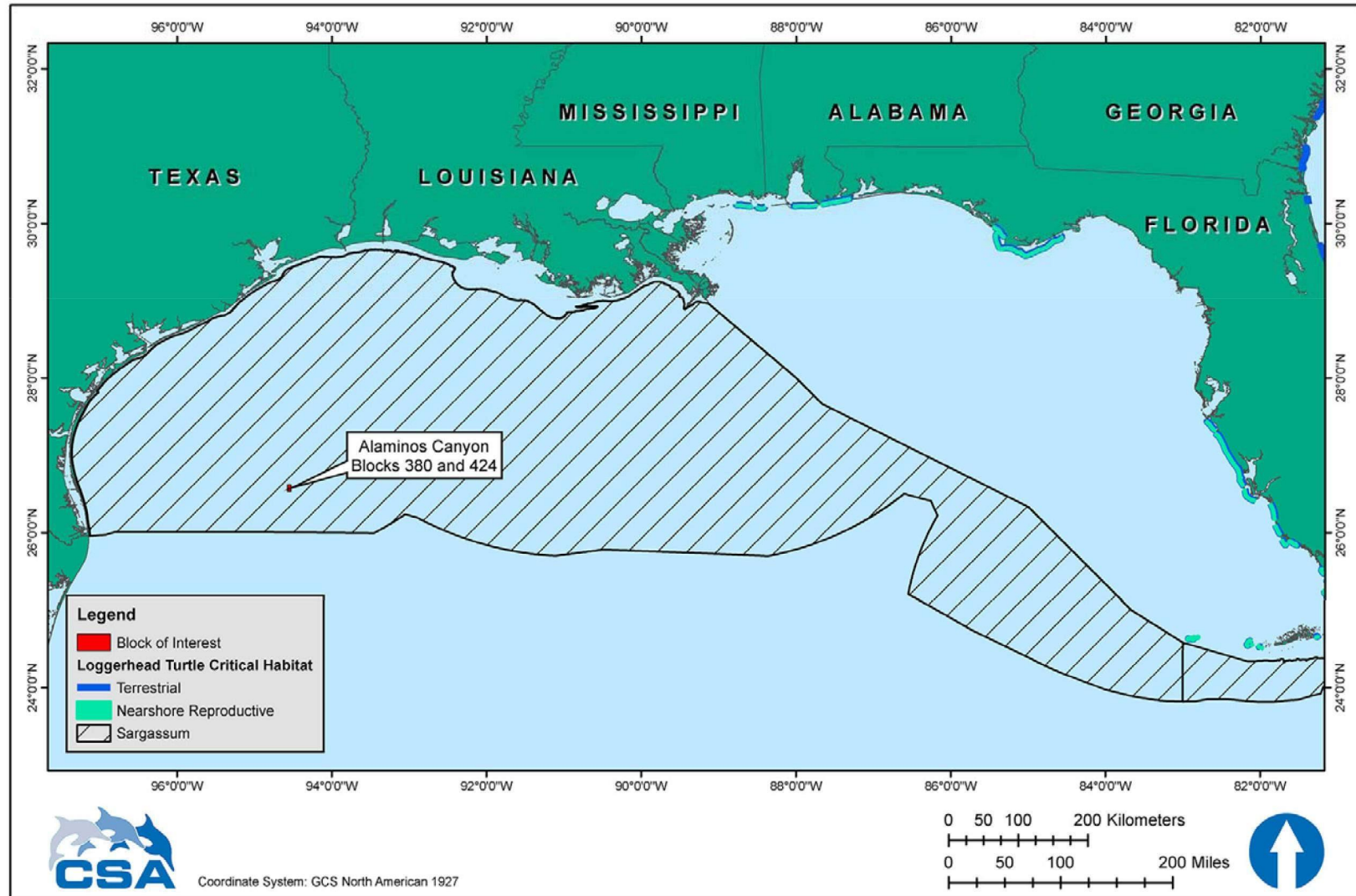


Figure 1. Location of loggerhead turtle critical habitat in the northern Gulf of Mexico in relation to the lease area. The critical habitat includes terrestrial habitat (nesting beaches) and nearshore reproductive habitat in Mississippi, Alabama, and the Florida Panhandle as well as *Sargassum* habitat.



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, 2018a) 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, 2018b, c);
- Kemp’s ridley turtles— The main nesting site is Rancho Nuevo beach in Tamaulipas, Mexico (NMFS et al., 2011). As of August 2018, there have been 248 Kemp’s ridley turtle nests counted on Texas beaches during the 2018 nesting season. In 2017, 353 Kemp’s ridley turtle nests were counted, an increase from the 185 counted in 2016; 159 counted in 2015; and 118 counted in 2014 (Turtle Island Restoration Network, 2018). 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 MODU 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. Compliance with NTL BSEE 2015-G013 (See **Table 1**) will minimize the potential for marine debris-related impacts on sea turtles.

### **Impacts of MODU Presence, Noise, and Lights**

Offshore drilling activities produce a broad array of sounds at frequencies and intensities that may be detected by sea turtles (Samuel et al., 2005, Popper et al., 2014). Sea turtles hear low frequency sounds, mainly below 1,200 Hz (Bartol and Ketten, 2006, Bartol, 2014). Potential impacts may include behavioral disruption and temporary or permanent displacement from the area near the sound source. The currently accepted response estimates are derived from fish hearing data rather than from marine mammal hearing data due to the limited experimental data available (Popper et al., 2014). A NMFS Biological Opinion (NMFS, 2015) lists sea turtle underwater acoustic injury and behavioral thresholds at 207 dB re 1  $\mu$ Pa and 166 dB re 1  $\mu$ Pa, respectively. No distinction is made between impulsive and continuous sources for these thresholds. Based on transmission loss calculations (Urick, 1983), open water propagation of noise produced by typical sources with DP thrusters are not expected to produce received levels greater than 160 dB re 1  $\mu$ Pa beyond 105 ft (32 m) from the source. Certain sea turtles, especially loggerheads, may be attracted to offshore structures (Lohofener et al., 1990, Gitschlag et al., 1997) and, thus, may be more susceptible to impacts from sounds produced during routine operations. The most likely impacts would be short-term behavioral changes such as diving and evasive swimming, disruption of activities, or departure from the area. Due to the small impact area around the wellsites, limited number of sources, and short duration of activities, these short-term impacts are not expected to be biologically significant to sea turtle populations.

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



concluded that the effects of lighting from offshore structures on sea turtles are insignificant. 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). While adult sea turtles are visible at the surface during the day and in clear weather, they can be difficult to spot from a moving vessel when resting below the water surface, during nighttime, or during periods of inclement weather. To reduce the potential for vessel strikes, BOEM issued NTL BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for sea turtles and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. When sea turtles are sighted, vessel operators and crews are required to attempt to maintain a distance of 150 ft (45 m) or greater whenever possible. Compliance with this NTL will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing sea turtles (NMFS, 2007). 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 (NMFS, 2007, BOEM, 2012a).

### **Impacts of a Small Fuel Spill**

Potential spill impacts on sea turtles are discussed by NMFS (2007) and BOEM (2017a, b). For this EP, there are no unique site-specific issues with respect to spill impacts on sea turtles. **Section A.9.1** discusses the size and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

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). As discussed in **Section A.9.1**, more than 90% of a small diesel spill in offshore waters would evaporate or disperse naturally within 24 hours. Therefore, due to the limited areal extent and short duration of water quality impacts from a small fuel spill, no significant impacts to sea turtles from direct or indirect exposure would be expected.

Loggerhead Critical Habitat – Nesting Beaches. A small fuel spill in the lease area would be unlikely to affect sea turtle nesting beaches because the lease area is 164 miles (264 km) from the nearest shoreline (Texas). Loggerhead turtle nesting beaches and nearshore reproductive habitat designated as critical habitat are located in Mississippi, Alabama, and the Florida Panhandle, at least 158 miles (254 km) from the lease area. As explained in **Section A.9.1**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up.



Loggerhead Critical Habitat – *Sargassum* spp. The lease area is within the *Sargassum* portion of the loggerhead turtle critical habitat (**Figure 1**). A small fuel spill could affect *Sargassum* spp. and juvenile turtles by contaminating this habitat. Juvenile sea turtles could come into contact with or ingest oil, resulting in death, injury, or other sublethal effects. Impacts would be limited to the small area (0.5 to 5 ha [1.2 to 12 ac]) likely to be impacted by a small spill. A 5-ha (12-ac) impact would represent a negligible portion of the 39,164,246 ha (96,776,959 ac) designated *Sargassum* spp. critical habitat for loggerhead turtles in the northern Gulf of Mexico.

### **Impacts of a Large Oil Spill**

Impacts of oil spills on sea turtles can include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes and smoke (e.g., from *in situ* burning of oil); ingestion of oil (and dispersants) directly or via contaminated food; and stress from the activities and noise of response vessels and aircraft. Complications of the above may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat, disruption of social structure, change in food availability and foraging distribution 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. **EP 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, 2007).

Results of the Macondo spill 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 Macondo spill. 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., 2017a) suggests 402,000 turtles were exposed to oil in the aftermath of the Macondo spill, 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 Macondo spill, hundreds of sea turtles were likely killed by response activities such as increased boat traffic, dredging for berm construction, increased lighting at night near nesting beaches, and oil cleanup operations on nesting beaches. 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.

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

Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 10 days; however, coastal areas between Cameron County, Texas, and Vermilion Parish, Louisiana, may be affected within 30 days (1% to 8% conditional probability). The nearest nearshore reproductive critical habitat for loggerhead turtles is 428 miles (689 km) from the lease area.

Loggerhead Critical Habitat – *Sargassum* spp. The lease area is within the *Sargassum* spp. habitat portion of the loggerhead turtle critical habitat (**Figure 1**). Due to the large area covered by the designated *Sargassum* spp. habitat for loggerhead turtles, a large spill could result in oiling of a substantial part of the *Sargassum* spp. habitat in the northern Gulf of Mexico. The catastrophic 2010 Macondo spill affected approximately one-third of the *Sargassum* spp. habitat in the northern Gulf of Mexico (BOEM, 2016c). It is extremely unlikely that the entire *Sargassum* critical habitat would be affected by a large spill. Because *Sargassum* spp. is a floating, pelagic species, it would only be affected by oil that is present near the surface.

The effects of oiling on *Sargassum* spp. vary with severity, but moderate to heavy oiling as could occur during a large spill could cause complete mortality to *Sargassum* spp. and its associated communities (BOEM, 2017a). *Sargassum* spp. 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* spp. The *Sargassum* spp. 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, 2016c). *Sargassum* spp. has a yearly seasonal cycle of growth and a yearly cycle of dispersal 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* spp. community would be expected to take one to two years (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 **EP Section 2j**. 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. **EP Section 9b** provides detail on spill response measures.



### C.3.5 Piping Plover (Threatened)

The Piping Plover (*Charadrius melodus*) is a migratory shorebird that overwinters along the southeastern U.S. and Gulf of Mexico coasts. This threatened species is in decline as a result of hunting, habitat loss and modification, predation, and disease (USFWS, 2003). Critical overwintering habitat has been designated, including beaches in Texas, Louisiana, Mississippi, Alabama, and Florida (**Figure 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 lease 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.9.1**).

#### Impacts of a Large Oil Spill

The lease area is 164 miles (264 km) from the nearest shoreline designated as Piping Plover critical habitat. The 30-day OSRA modeling (**Table 3**) predicts that Piping Plover critical habitat in Matagorda County, Texas, would have an 8% conditional probability of contact within 30 days.

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 Macondo spill, 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 Macondo spill 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on Piping Plovers are expected.



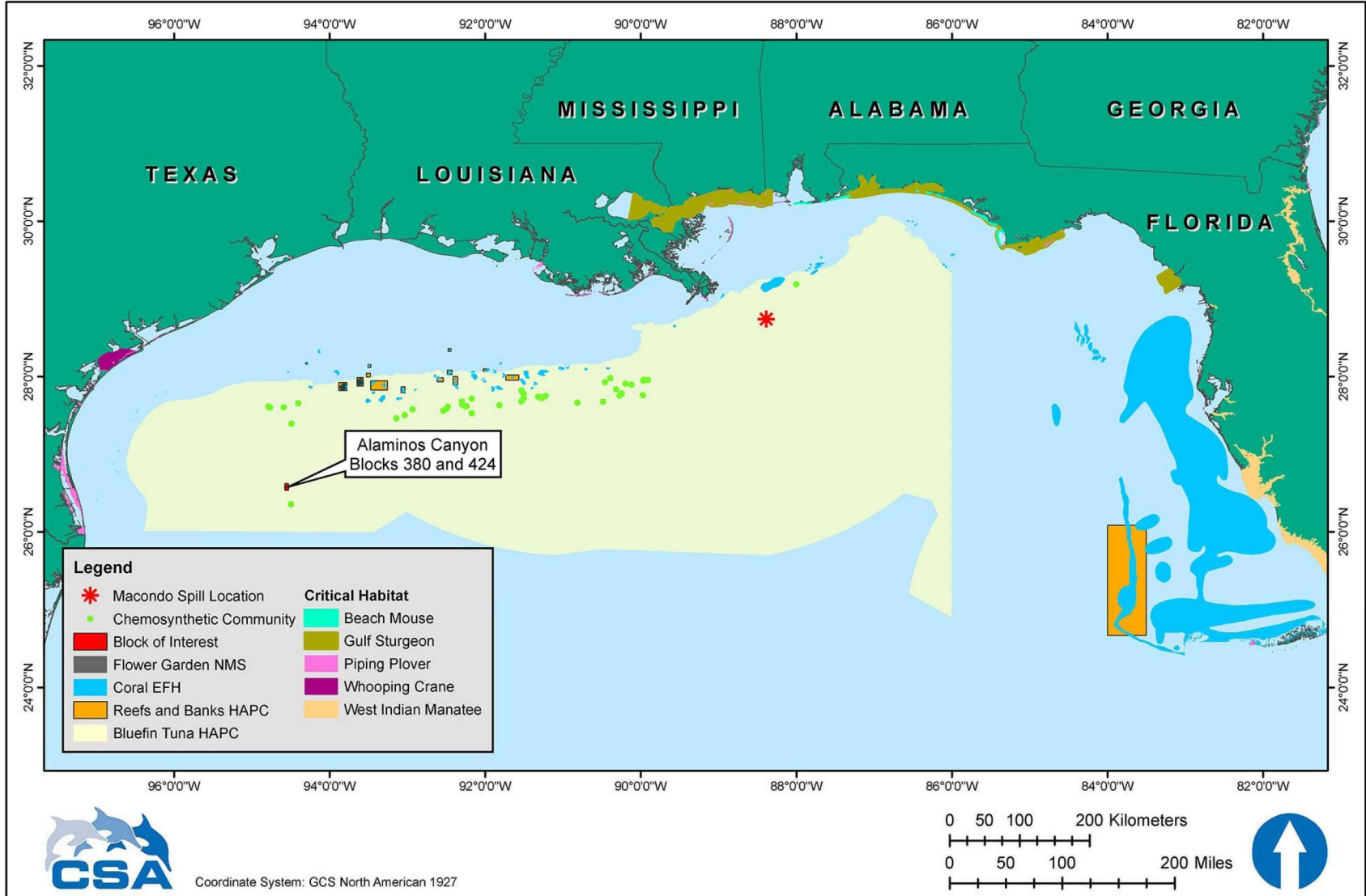


Figure 2. Location of selected environmental features in relation to the lease area. EFH = Essential Fish Habitat; HAPC = Habitat Area of Particular Concern.



### C.3.6 Whooping Crane (Endangered)

The Whooping Crane (*Grus americana*) is a large omnivorous wading bird and a listed 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 431 at Aransas NWR during winter 2016 to 2017 winter (USFWS, 2017). A non-migratory population was reintroduced in central Florida and another reintroduced population summers in Wisconsin and migrates to the southeastern U.S. for the winter (USFWS, 2015a). 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

The 30-day OSRA models (**Table 3**) predict that there is 4% probability that an oil spill in the lease area would reach a shoreline designated as critical habitat for the Whooping Crane in Calhoun or Aransas Counties, Texas, approximately 165 miles (266 km) from the lease area.

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on Whooping Cranes are expected.

### C.3.7 Oceanic Whitetip Shark (Threatened)

The oceanic whitetip shark (*Carcharhinus longimanus*) was listed as threatened under the ESA on January 30, 2018 (effective March 30, 2018) by NMFS (83 FR 4153). Oceanic whitetip sharks are found worldwide in offshore waters between approximately 30° N and 35° S latitude, and have generally been described as one of the most abundant species of oceanic sharks (Compagno, 1984). However, the population trend appears to be decreasing as 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 (2018) 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 MODU presence, noise, and lights, and a large oil spill. A small diesel fuel spill in the lease area 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 lease area.

### **Impacts of MODU Presence, Noise, and Lights**

Offshore drilling activities produce a broad array of sounds at frequencies and intensities that may be detected by sharks including the threatened oceanic whitetip shark. Shark hearing abilities have the highest sensitivity to low frequency sounds between approximately 40 Hz and 800 Hz (Myrberg, 2000). Sharks are most attracted to sounds in broadband frequencies below 80 Hz (Myrberg, 2000), a frequency that overlaps with sound pressure levels associated with drilling activities (typically 10 Hz to 10 kHz) (Hildebrand, 2005). MODU noise could also influence prey 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., 2017b). However, because of the limited propagation distances of high sound pressure levels from the MODU, 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.

## **C.3.8 Gulf Sturgeon (Threatened)**

The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) is a threatened fish species that inhabits major rivers and inner shelf waters from the Mississippi River to the Suwannee River, Florida (Barkuloo, 1988, Wakeford, 2001). The Gulf sturgeon is anadromous, migrating from the sea upstream into coastal rivers to spawn in freshwater. The historic range of the species extended from the Mississippi River to Charlotte Harbor, Florida (Wakeford, 2001). 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 lease 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.9.1**). The large oil spill IPF with potential impacts listed in **Table 2** is discussed below.

### **Impacts of a Large Oil Spill**

Potential spill impacts on Gulf sturgeon are discussed by BOEM (2016c, 2017a) and NMFS (2007). For this EP, there are no unique site-specific issues with respect to this species.

The lease area is approximately 411 miles (661 km) from the nearest Gulf sturgeon critical habitat. The 30-day OSRA modeling (**Table 3**) predicts that a spill in the lease area has a <0.5% conditional probability of contacting any coastal areas containing Gulf sturgeon critical habitat within 30 days of a spill.

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

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

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 **EP Section 2j**. 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. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on Gulf sturgeon are expected.

### **C.3.9 Beach Mouse (Endangered)**

Four subspecies of endangered beach mouse (*Peromyscus polionotus*) occur on the barrier islands of Alabama and the Florida Panhandle: the Alabama, Choctawhatchee, Perdido Key, and St. Andrew beach mouse. Critical habitat has been designated for all four subspecies and is shown combined in **Figure 2**. 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 endangered beach mouse subspecies are discussed by BOEM (2016c, 2017a). For this EP, there are no unique site-specific issues with respect to these species.

The lease area is approximately 466 miles (750 km) from the nearest beach mouse critical habitat. The 30-day OSRA results (**Table 3**) predicts <0.5% conditional probability of oil contact with beach mouse critical habitat within 30 days of a spill.

In the event of oil contacting these beaches, beach mice could experience several types of direct and indirect impacts. Contact with spilled oil could cause skin and eye irritation and subsequent infection; matting of fur; irritation of sweat glands, ear tissues, and throat tissues; disruption of sight and hearing; asphyxiation from inhalation of fumes; and toxicity from ingestion of oil and oiled 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on beach mice are expected.

### C.3.10 Threatened Coral Species

Four threatened coral species are known from the northern Gulf of Mexico: elkhorn coral (*Acropora palmata*), lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), and boulder star coral (*Orbicella franksi*). These species have been reported from the coral cap region of the Flower Garden Banks (NOAA, 2014), but are unlikely to be present as regular residents in the northern Gulf of Mexico because they typically inhabit coral reefs in shallow, clear tropical, or subtropical waters. Other Caribbean coral species evaluated by NMFS in 2014 (79 FR 53852) either do not meet the criteria for ESA listing or are not known from the Flower Garden Banks. Critical habitat has been designated for elkhorn coral in the Florida Keys (Monroe County, Florida), 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 <0.5%. A surface slick would not contact corals on the seafloor. If a subsurface plume were to occur, impacts on the Flower Garden Banks would be unlikely due to the distance and the difference in water depth.

Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and typically would not carry a plume up onto the continental shelf edge. Valentine et al. (2014)



observed the spatial distribution of excess hopane, a crude oil tracer from Macondo spill sediment core samples, to be in the deeper waters and not transported up the shelf, thus confirming near-bottom currents flow along the isobaths.

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

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

## **C.4 Coastal and Marine Birds**

### **C.4.1 Marine and Pelagic 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 shorebirds and coastal nesting 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., 2000b). Hess and Ribic (2000) reported that terns, storm-petrels, shearwaters, and jaegers were the most frequently sighted seabirds in the deepwater area. From these surveys, four ecological categories of seabirds were documented in the deepwater areas of the Gulf: summer migrants (shearwaters, storm-petrels, boobies); summer residents that breed along the Gulf coast (Sooty Tern, Least Tern, Sandwich Tern, Magnificent Frigatebird); winter residents (gannets, gulls, jaegers); and permanent resident species (Laughing Gulls, Royal Terns, Bridled Terns) (Hess and Ribic, 2000). The GulfCet II study did not estimate bird densities; however, seabird densities over the open ocean have been estimated to be 1.6 birds km<sup>-2</sup> (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., 2000b, Hess and Ribic, 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 (Hess and Ribic, 2000).

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



IPFs that could potentially affect marine and pelagic birds include MODU 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 BSEE NTL 2015-G013 (See **Table 1**) will minimize the potential for marine debris-related impacts on birds.

### **Impacts of MODU 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). However, offshore structures may in some cases serve as suitable stopover habitats for trans-Gulf migrant species, particularly in spring (Russell, 2005).

Overall, potential negative impacts to birds from MODU lighting, potential collisions, or other adverse effects are highly localized, temporary in nature, and may be expected to affect only small numbers of birds during migration periods. Therefore, these potential impacts 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 substantially 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 (2016c, 2017a). For this EP, 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 implemented 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. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease 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.9.1** 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 are expected.

### **Impacts of a Large Oil Spill**

Potential spill impacts on marine birds are discussed by BOEM (2016c, 2017a). For this EP, there are no unique site-specific issues with respect to spill impacts on marine and pelagic 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). Haney et al. (2014) indicates that seabird densities over the open ocean typically are approximately 1.6 birds km<sup>-2</sup>. The number of pelagic birds that could be affected in open, offshore waters would depend on the extent and persistence of the oil slick.

Data following the Macondo spill provide relevant information about the species of pelagic birds that may be affected in the event of a large oil spill. Birds that have been treated for oiling include several pelagic species such as the Northern Gannet, Magnificent Frigatebird, and Masked Booby (USFWS, 2011). The Northern Gannet was among the species with the largest numbers of 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 Macondo spill in multiple habitats, including offshore/open waters, island waterbird colonies, barrier islands, beaches, bays, and marshes (NOAA, 2016b). Exposure of marine birds to oil can result in adverse health with severity, depending on the level of oiling. Effects can range from plumage damage and loss of buoyancy 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). It is expected that impacts to marine birds from a large oil spill resulting in the death of individual birds would be adverse but not significant at population levels.

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on marine and pelagic birds are expected.

### **C.4.2 Shorebirds and Coastal Nesting 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 (*Pelecanus occidentalis*) 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., 2000b) indicate that Brown Pelicans do not occur over deep offshore waters (Fritts and Reynolds, 1981, Peake, 1996, Hess and Ribic, 2000). Nearly half the southeastern population of Brown Pelicans lives in the northern Gulf Coast, generally nesting on protected islands (USFWS, 2010).

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

IPFs that could potentially affect shorebirds and coastal nesting birds include support vessel and helicopter traffic and a large oil spill. As explained in **Section A.9.1**, 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 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 drilling activities, any short-term impacts are not expected to be significant to coastal bird populations.

Aircraft traffic can cause some disturbance to birds on shore and off shore. Responses highly depend 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, 2016c). 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). Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 10 days; however, coastal areas may be affected within 30 days based on the model are between Cameron County, Texas, and Vermilion Parish, Louisiana (1% to 8% conditional probability).

Studies concerning the Macondo spill 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP 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 the community was dominated by relatively few families and species.



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

### **Impacts of MODU Presence, Noise, and Lights**

The MODU, as a floating structure in the deepwater environment, will act as a fish-aggregating device (FAD). In oceanic waters, the FAD effect would be most pronounced for epipelagic fishes such as tunas, dolphin, billfishes, and jacks, which are commonly attracted to fixed and drifting surface structures (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 levels of 170 dB re 1  $\mu$ Pa accumulated over a 48-hour period for onset of recoverable injury and 158 dB re 1  $\mu$ Pa 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, Brintjes and Radford, 2013, McLaughlin and Kunc, 2015). Because the MODU is a single, temporary structure, impacts on fish populations, whether beneficial or adverse, are not expected to be significant.

Few data exist regarding the impacts of noise on pelagic larvae and eggs. Generally, it is believed that larval fish will have similar hearing sensitivities as adults, but may be more susceptible to barotrauma injuries associated with impulsive noise (Popper et al., 2014). Larval fish were experimentally exposed to simulated impulsive sounds by Bolle et al. (2012). The controlled playbacks produced cumulative exposures of 206 dB re 1  $\mu$ Pa<sup>2</sup>·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 (Urlick, 1983), 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  $\mu$ Pa 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 WBM- and 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). NPDES permit limits and requirements will be met.

WBM and cuttings will be released at the seafloor during the initial well intervals before the marine riser is set, that allows their return to the surface vessel. Excess cement slurry and blowout preventer fluid will also be released at the seafloor. These discharges could smother or cover



benthic communities in the vicinity of the discharge location. Impacts will be limited to the immediate area of the discharge, with little or no impact to fisheries resources.

Treated sanitary and domestic wastes may have little or no effect on the pelagic environment in the immediate vicinity of these discharges. These wastes may have elevated levels of nutrients, organic matter, and chlorine, but should dilute rapidly to undetectable levels within tens to hundreds of meters from the source. As a result of quick dilution, minimal impacts on water quality, plankton, and nekton are anticipated.

Deck drainage will have little or no impact on the pelagic environment in the immediate vicinity of these discharges. Deck drainage from oily areas will be passed through an oil-and-water separator prior to release, and discharges will be monitored for visible sheen. The discharges may have slightly elevated levels of hydrocarbons but should dilute rapidly to undetectable levels within tens to hundreds of meters from the source. Minimal impacts on water quality, plankton, and nekton are anticipated.

Other effluent discharges from the MODU and support vessels are expected to include desalination unit discharge, non-contaminated well treatment and completion fluids, blowout preventer fluid, ballast water, bilge water, cement slurry, fire water, hydrate inhibitor, and non-contact cooling water. The MODU and support vessel discharges are expected to be in compliance with NPDES permit and USCG regulations, as applicable, and are not expected to cause significant impacts on water quality (BOEM, 2012a).

### **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 MODU (**EP 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.

The MODU selected for this project meets the described applicability for new facilities, and the vessel's 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 (2016c, 2017a). For this EP, there are no unique site-specific issues with respect to spill impacts.

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 pelagic communities, including ichthyoplankton. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small 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 (2016c, 2017a). For this EP, 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, 2014, 2015, 2016c). Adult and juvenile fishes could also be impacted through the ingestion of oiled prey. It is expected that impacts to pelagic communities and ichthyoplankton from a large oil spill resulting in the death of individual fishes would be adverse but not significant at population levels.

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP 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 (GMFMC, 2005). The EFH for most of these GMFMC-managed species is on the continental shelf in waters shallower than 600 ft (183 m). The shelf edge is the outer boundary for coastal migratory pelagic fishes, reef fishes, and shrimps. EFH for corals and coral reefs includes some shelf-edge topographic features located approximately 86 miles (138 km) north-northeast of the lease area.

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

- Bigeye thresher shark (all)
- Blue marlin (juveniles, adults)
- Bluefin tuna (spawning, eggs, larvae, adults)
- Longfin mako shark (all)
- Oceanic whitetip shark (all)
- Longbill spearfish (juveniles, adults)
- Silky shark (all)
- Skipjack tuna (spawning, adults)
- Sailfish (juveniles, adults)
- Swordfish (larvae, juveniles, adults)
- White marlin (juveniles, adults)
- Yellowfin tuna (spawning, juveniles, adults)

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

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



NTLs 2009-G39 and 2009-G40 provide guidance and clarification of regulations for biologically sensitive underwater features and areas and benthic communities that are considered EFH. As part of an agreement between BOEM and NMFS to complete a new programmatic EFH consultation for each new Five-Year Program, an EFH consultation was initiated between BOEM's Gulf of Mexico Region and NOAA's Southeastern Region during the preparation, distribution, and review of BOEM's 2017-2022 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, 2016b).

Other HAPCs have been designated in the Gulf of Mexico Fishery Management Council (2005, 2010). These include the Florida Middle Grounds, Madison-Swanson Marine Reserve, Tortugas North and South Ecological Reserves, Pulley Ridge, and several other reefs and banks of the northwestern Gulf of Mexico (**Figure 2**). The nearest HAPC is West Flower Garden Bank, which is located approximately 92 miles (151 km) north-northeast of the lease area.

Routine IPFs that could potentially affect EFH and fisheries resources include MODU 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 MODU Presence, Noise, and Lights**

The MODU, 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, which are commonly attracted to fixed and drifting surface structures (Holland, 1990, Higashi, 1994, Relini et al., 1994). The FAD effect would possibly enhance feeding of epipelagic predators by attracting and concentrating smaller fish species.

MODU noise could potentially cause acoustic masking for fishes, thereby reducing their ability to hear biologically relevant sounds (Radford et al., 2014). Noise may also influence fish behaviors such as predator avoidance, foraging, reproduction, and intraspecific interactions (Picciulin et al., 2010, Brintjes and Radford, 2013, McLaughlin and Kunc, 2015, Nedelec et al., 2017a). Further discussion on impact to fish from sound and injury criteria are discussed in **Section C.5.1**. Any impacts on EFH for highly migratory pelagic fishes are not expected to be significant.

### **Impacts of Effluent Discharges**

Effluent discharges affecting EFH by diminishing ambient water quality include drilling muds and cuttings, treated sanitary and domestic wastes, deck drainage, and miscellaneous discharges such as desalination unit discharge, blowout preventer fluid, non-contaminated well treatment and completion fluids, ballast water, bilge water, cement slurry, fire water, hydrate inhibitor, and cooling 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 drilling 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 (2016c, 2017a). For this EP, there are no unique site-specific issues with respect to spill impacts.

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 EFH. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small 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 lease 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<sup>2</sup> (300,000 km<sup>2</sup>) 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 or coral reefs; the nearest of which is located approximately 86 miles (138 km) north-northeast of the lease area. A small fuel spill would float and dissipate on the sea surface and would not contact these seafloor 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 (2016c, 2017a). For this EP, 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 (GMFMC, 2005, NMFS, 2009b), 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 lease area is within the HAPC for spawning bluefin tuna (NMFS, 2009b). A large spill could temporarily degrade the HAPC due to increased hydrocarbon concentrations in the water column, with the potential for lethal or sublethal impacts on spawning tuna. Potential impacts would



depend in part on the timing of a spill, as this species migrates to the Gulf of Mexico to spawn in April, May, and June (NMFS, 2009b).

The nearest feature designated as EFH for corals is located 86 miles (138 km) north-northeast of the lease area. An accidental spill could reach or affect this feature, although near-bottom currents in the region are expected to flow along the isobaths (Nowlin et al., 2001, Valentine et al., 2014) and typically would not carry a plume up onto the continental shelf edge.

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on EFH are expected.

## **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 lease areas >200 m (656 ft) 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.

Based on NTL 2011-JOINT-G01, the lease area is not on BOEM's list of archaeological survey blocks determined to have a high potential for containing archaeological properties (BOEM, 2011). The wellsite assessment did not detect any archaeologically significant sonar contacts within 2,000 ft (610 m) of the proposed wellsites (Geoscience Earth & Marine Services Inc., 2017a, b, c, d, e). No archaeological impacts are expected from routine activities in the lease area.

Because no historic shipwreck sites are present in the lease area (see **EP 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 lease 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 as well as alteration of the rates of microbial activity (BOEM, 2017a). During the Macondo spill, subsurface plumes were reported at a water depth of approximately 3,600 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-ft (300-m) radius estimated by BOEM (2012a), depending on its extent, trajectory, and persistence (Spier et al., 2013). If oil from a subsea spill should come in contact with wooden shipwrecks on the seafloor, it could adversely affect their condition or preservation.

A spill entering shallow coastal waters could conceivably contaminate undiscovered or known historic shipwreck sites. Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 10 days; however, coastal areas between Cameron County, Texas, and Vermilion Parish, Louisiana, may be affected within 30 days (1% to 8% conditional probability). The coastal area most likely to be affected is Matagorda County, Texas (8% conditional probability of shoreline contact 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).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP 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 6,447 to 7,251 ft (1,965 to 2,210 m), the lease area is well beyond the 197 ft (60 m) depth contour used by BOEM as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. Because prehistoric archaeological sites are not found in the lease 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 of the water depth and the lack of prehistoric archaeological sites found in the lease 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). Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 10 days; however, coastal areas between Cameron County, Texas, and Vermilion Parish, Louisiana, may be affected within 30 days (1% to 8% conditional probability). The coastal area most likely to be affected is Matagorda County, Texas (8% conditional probability of shoreline contact 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 or 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP 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, 2014, 2015, 2016c, 2017a) and are 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. Most of the northern Gulf of Mexico is fringed by coastal and barrier island beaches, with wetlands, oyster reefs, and submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries.

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

A large oil spill is the only accidental IPF that could affect coastal habitats and protected areas. A small fuel spill in the lease area would be unlikely to affect coastal habitats because the lease area is 164 miles (264 km) from the nearest shoreline. As explained in **Section A.9.1**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion.

### **Impacts of Support Vessel Traffic**

Support operations, including the crew boats and supply boats as detailed in **EP Section 14**, may have a minor incremental impact on coastal and barrier island beaches, wetlands, oyster reefs, and protected habitats. Over time with a large number of vessel trips, vessel wakes can erode shorelines along inlets, channels, and harbors, resulting in localized land loss. Impacts 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, c)

### **Impacts of a Large Oil Spill**

Potential spill impacts on coastal habitats are discussed by BOEM (2016c, 2017a). Coastal habitats inshore of the project area include coastal and barrier island beaches, wetlands, oyster reefs, and submerged seagrass beds. For this EP, there are no unique site-specific issues with respect to coastal habitats.

Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 10 days; however, coastal areas between Cameron County, Texas, and Vermilion Parish, Louisiana, may be affected within 30 days (1% to 8% conditional probability). The coastal areas most likely to be affected is Matagorda County, Texas (8% probability of shoreline contact within 30 days).



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. Based on the 30-day OSRA, coastal and near-coastal wildlife refuges, wilderness areas, and state and national parks within the geographic range of the potential shoreline contacts within 30 days are 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 24 based on the 30-day Oil Spill Risk Analysis (OSRA) model.

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
Cameron County, 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 County, Texas	Laguna Atascosa National Wildlife Refuge
	Laguna Madre Gulf Ecological Management Site
	Padre Island National Seashore
Kenedy County, Texas	Laguna Madre Gulf Ecological Management Site
	Padre Island National Seashore
Kleberg County, Texas	Laguna Madre Gulf Ecological Management Site
	Padre Island National Seashore
Nueces County, 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 County, 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
Calhoun County, 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 County, Texas	Big Boggy National Wildlife Refuge
	Chamber Park
	Matagorda Bay Nature Park
	Oyster Lake Park
	San Bernard National Wildlife Refuge
	West Moring Dock Park
Brazoria County, Texas	Brazoria National Wildlife Refuge
	Christmas Bay Coastal Preserve
	Justin Hurst Wildlife Management Area



County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
	San Bernard National Wildlife Refuge
Galveston County, Texas	Anahuac National Wildlife Refuge
	Apffel Park
	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 County, 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
Vermilion Parish, Louisiana	Paul J. Rainey Wildlife Refuge and Game Preserve
	Rockefeller State Wildlife Refuge and Game Preserve
	State Wildlife Refuge



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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP 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 250 to 550 m (820 to 1,804 ft) (Stiles et al., 2007). Tilefishes (primarily *Lopholatilus chamaeleonticeps*) are caught by bottom longlining in water depths from approximately 165 to 450 m (540 to 1,476 ft) (Continental Shelf Associates, 2002).

Most recreational fishing activity in the region occurs in water depths less than 200 m (656 ft) (Continental Shelf Associates, 1997, 2002, Keithly and Roberts, 2017). In deeper water, the main attraction to recreational fishers is petroleum rigs offshore Texas and Louisiana. Due to the project site's distance from shore, it is unlikely that recreational fishing activity is occurring in the lease area.

The only routine IPF that could potentially affect fisheries (commercial and recreational) is MODU 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 MODU Presence, Noise, and Lights**

There is a slight possibility of pelagic longlines becoming entangled in the MODU. 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 other adverse impacts on fishing activities are anticipated. The presence of the MODU would result in a limited area being unavailable for fishing activity, but this effect is considered negligible. 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. **EP Section 9b** provides details on Shell's spill response measures. Given the open ocean location of the lease area and the short duration of a small spill, the opportunity for impacts to occur would be very brief.

Pelagic longlining activities in the lease 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 lease 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 (**Section A.9.1**).

### **Impacts of a Large Oil Spill**

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

Pelagic longlining activities in the lease area and other fishing activities in the northern Gulf of Mexico could be interrupted in the event of a large oil spill. A spill may or may not result in fishery closures, depending on the duration of the spill, the oceanographic and meteorological conditions at the time, and the effectiveness of spill response measures. Data from the Macondo spill provide information about the maximum potential extent of fishery closures in the event of a large oil spill in the Gulf of Mexico (NMFS, 2010b). At its peak on 12 July 2010, closures encompassed 84,101 miles<sup>2</sup>



(217,821 km<sup>2</sup>), or 34.8% of the U.S. Gulf of Mexico EEZ. BOEM (2012a) notes that fisheries closures from a large spill event could have a negative effect on short-term fisheries catch and marketability.

According to BOEM (2012a, 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, c). An analysis of the effects of the Macondo spill 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP 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, 164 miles (264 km) from the nearest shoreline. 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 MODU maintains a Shipboard Oil Pollution Emergency Plan as required under MARPOL 73/78.

Depending on the spill rate and duration, the physical and 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP 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 drilling 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 and 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 (2016c, 2017a). For this EP, 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 lease area is 164 miles (264 km) from the nearest shoreline. Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 10 days; however, coastal areas between Cameron County, Texas, and Vermilion Parish, Louisiana, may be affected within 30 days (1% to 8% conditional probability). The coastal areas most likely to be affected is Matagorda County, Texas (8% probability of shoreline contact within 30 days).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Considering that a large spill is unlikely, no significant spill impacts on employment and infrastructure are expected.

## **C.8.4 Recreation and Tourism**

For this EP, there are no unique site-specific issues with respect to recreation and tourism. There are no known recreational or tourism uses in the lease 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 MODU and subsequently washing up on beaches. As explained in **Section A.9.1**, 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 lease 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 EP, 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. Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 10 days; however, coastal areas



between Cameron County, Texas, and Vermilion Parish, Louisiana, may be affected within 30 days (1% to 8% conditional probability). The coastal areas most likely to be affected is Matagorda County, Texas (8% probability of shoreline contact within 30 days).

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

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP 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 (2016c, 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 accidental 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 Macondo spill, 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 lease 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 (2016c) states that landfill capacity would probably not be an issue at any phase of an oil spill event or the long-term recovery. In the case of the Macondo spill and response, 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP 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 lease area is not located within any USCG-designated fairway, shipping lane, or military warning area. Shell will comply with BOEM requirements and lease stipulations to avoid impacts on uses of the area by military vessels and aircrafts.

The lease area is not located within any USCG-designated fairway or shipping lane, but is located within Military Warning Area W-602. The site clearance letters for the wellsite where the proposed activities will occur noted no existing infrastructure within 2,000 ft (610 m) of the proposed wellsites (Geoscience Earth & Marine Services Inc., 2017a, b, c, d, e). A large oil spill is the only relevant accident IPF. A small fuel spill would not have impacts on other marine uses because the spill and response activities would be mainly within the lease 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 or shipping lane, but is located within Military Warning Area W-602. 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.

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP 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 EP in several documents. The level and types of activities planned in Shell's EP are within the range of activities described and evaluated by BOEM (2012a, b, 2013, 2014, 2015, 2016a, c, 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, 2014, 2015, 2016c, 2017a).



Cumulative Impacts of Activities in the Exploration Plan. 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 EIA incorporates and builds on these analyses by examining the potential impacts on physical, biological, and socioeconomic resources from the work planned in this EP, 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 EP is limited in geographic scope 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, 2014, 2015, 2016c, 2017a). In addition, the cumulative contribution to visibility impairment is also very small. As mentioned in previous sections, projected emissions meet BOEM's exemption criteria and would not contribute to cumulative impacts on air quality.

Climate Change. CO<sub>2</sub> and CH<sub>4</sub> 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<sub>2</sub> 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 EP 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, deck drainage, desalination unit discharge, blowout preventer fluid, non-contaminated well treatment and completion fluids, ballast water, bilge water, hydrate inhibitor, excess cement slurry, fire water and non-contact cooling water. These effects are expected to be minor (localized to the area within a few hundred meters of the 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 blocks are not on the list of archaeology survey blocks (BOEM, 2011). No known shipwrecks or other archaeological artifacts were identified during the wellsite geohazard assessment (Geoscience Earth & Marine Services Inc., 2017a, b, c, d, e). The lease area is 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. 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, 2014, 2015, 2016a, 2016c, 2017a) has been incorporated into the EIA, where applicable.

### **C.9.2 Cumulative Impacts to Biological Resources**

The work planned in this EP 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 are expected to be minor and limited to a small area. The geophysical survey data did not identify any features that could support high-density deepwater benthic communities within 2,000 ft (610 m) of the proposed drilling locations (Geoscience Earth & Marine Services Inc., 2017a, b, c, d, e).

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, 2014, 2015, 2016c, 2017a).

Threatened, Endangered, and Protected Species. Threatened, endangered, and protected species that could occur in the lease area include one species of marine mammal, one species of shark, and five species of sea turtles. Potential impact sources include MODU 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 BOEM-required mitigation measures, including NTLs BSEE-2015-G013 and BOEM-2016-G01. 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 drilling 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 lease area. The additional effect of the proposed drilling activity would be negligible.

Coastal Habitats. Due to the distance of the wellsites 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 are not in wildlife refuges 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, 2014, 2015, 2016a, 2016c, 2017a) has been incorporated into the EIA, where applicable.



### **C.9.3 Cumulative Impacts to Socioeconomic Resources**

The work planned in this EP 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 lease 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, 2014, 2015, 2016c, 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, 2014, 2015, 2016a, 2016c, 2017a) has been incorporated into the EIA, where applicable.

## **D. Environmental Hazards**

### **D.1 Geologic Hazards**

The wellsite assessment reports prepared by Geoscience Earth & Marine Services Inc. (2017a, 2017b, 2017c, 2017d, 2017e) concluded that wellsite locations are suitable for the proposed exploratory drilling activities and no seafloor obstructions or conditions were found that would constrain the proposed project activities.

See **EP Section 6a** for supporting geological and geophysical information.

### **D.2 Severe Weather**

Under most circumstances, weather is not expected to have any effect on the proposed activities. Extreme weather, including high winds, strong currents, and large waves, was considered in the design criteria for the MODU. 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 MODU 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 MODU. Metocean conditions, such as sea state, 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 MODU. 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 MODU for safety reasons until the storm or weather event passes.

## **E. Alternatives**

No formal alternatives were evaluated in this EP. However, various technical and operational options, including the location of the wellsites and the selection of a MODU, 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 **EP Section 2J**.

## **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:

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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

Geoscience Earth & Marine Services, Inc. (GEMS) Project Number 0817-2703 for Alaminos Canyon 380 and 424.

Shell's Regional OSRP