UNITED STATES GOVERNMENT
MEMORANDUM

May 22, 2018

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

Subject: Public Information copy of plan

Control # - S-07893
Type - Supplemental Exploration Plan
Lease(s) - OCS-G19409 Block - 815 Alaminos Canyon Area
Operator - Shell Offshore Inc.
Description - Subsea Wells F, G, H, I, J, K, SA005, SA005A, and SA005B
Rig Type - 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.

Madonna Montz
Plan Coordinator

| **Site Type/Name** | **Botm Lse/Area/Blk** | **Surface Location** | **Surf Lse/Area/Blk** |
|---|---|---|---|
| WELL/F | G19409/AC/815 | 1057 FNL, 1128 FEL | G19409/AC/815 |
| WELL/G | G19409/AC/815 | 2021 FNL, 2670 FEL | G19409/AC/815 |
| WELL/H | G19409/AC/815 | 2396 FNL, 2618 FEL | G19409/AC/815 |
| WELL/I | G19409/AC/815 | 2970 FNL, 1380 FEL | G19409/AC/815 |
| WELL/J | G19409/AC/815 | 5088 FNL, 3378 FEL | G19409/AC/815 |
| WELL/K | G19409/AC/815 | 5900 FNL, 2780 FEL | G19409/AC/815 |
| WELL/SA005 | G19409/AC/815 | 7819 FSL, 7443 FEL | G19409/AC/815 |
| WELL/SA005A | G19409/AC/815 | 7758 FSL, 7462 FEL | G19409/AC/815 |
| WELL/SA005B | G19409/AC/815 | 7720 FSL, 7174 FEL | G19409/AC/815 |

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**Public Information**

April 13, 2018

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

Attn: Plans Group GM 235D

SUBJECT: Supplemental Exploration Plan
OCS-G 19409, Alaminos Canyon (AC) Block 815
AC 859 Unit No. 754307006
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 Supplemental Exploration Plan to drill nine (9) wells on Alaminos Canyon (AC) Block 815. One of the nine wells SA005 was previously approved in SDOCD S-07662 on October 26, 2015 and we are now revising the surface location and adding two back up locations.

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 is attached to the proprietary copy of the plan.

Should you require additional information, please contact Tracy Albert at 504.425.4652 or tracy.albert@shell.com.

Sincerely,

Sylvia A Bellone

Sylvia A. Bellone

Enclosure

# SHELL OFFSHORE INC.

# SUPPLEMENTAL EXPLORATION PLAN

*for*

## OCS-G 19409, Alaminos Canyon (AC) Block 815

## PUBLIC INFORMATION COPY

## APRIL 2018

**PREPARED BY:**

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

**504.425.4652**

**tracy.albert@shell.com**

# REVISIONS TABLE:

| Date of Request | Plan Section | What was Corrected | Date Resubmitted |
|---|---|---|---|
| 5/9/2018 | Section 8 AQR | Spreadsheet calculation | 5/9/2018 |
| | | | |
| | | | |

# SUPPLEMENTAL EXPLORATION PLAN
OCS-G 19409, Alaminos Canyon (AC) Block 815
Offshore, Texas

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# SECTION 1: PLAN CONTENTS

## A. DESCRIPTION, OBJECTIVES & SCHEDULE

Shell Offshore Inc. (Shell) is supplementing the initial exploration plan N-9899, approved October 19, 2015, to add new subsea wells to the following lease:

OCS-G 19409, Alaminos Canyon (AC) Block 815

This supplemental EP is for the drilling and completion of eight new subsea wells: Wells F, G, H, I, J, K, SA005 Alt A, and SA005 AltB, as well as one revised well, SA005, which was previously approved but not drilled under DOCD S-07762, approved October 26, 2015. Shell plans to drill one or two wells in 2018 and depending on the outcome of this drilling, the other locations will be drilled in subsequent years. Only one MODU will be used for this proposed drilling. If the wells are unsuccessful, they will be permanently plugged and abandoned in accordance with BSEE regulations.

Wells on AC 815 were previously developed under plans N-9102, R-4806 and R-4946. Wells SA001, SA002 (producing) and SA003 (PA'd) have been drilled. SA004 was drilled and abandoned in 2016.

There are plans to perform a drill stem/flowback test, and if performed, we will utilize the drilling rig and a transport vessel. The well effluent will flow from the wing valve on the surface tree then through the hydraulic choke manifold. After leaving the choke the flow will be routed through a heat exchanger where the well effluent will be heated to further aid in breaking the gas out of solution. The flow will then be routed through a multi-phase flow meter where oil, water, gas and solids rates will be measured. The flow will then be directed to a 3-phase separator the well effluent will undergo 3-phase separation, the gas will immediately be routed to gas scrubber then to the flare boom. The water will exit the separator via the water leg and flow into a surge tank and the oil will exit the separator via the oil leg and flow to another surge tanks. Turbine flow meters will be inline on the oil and water legs of the separator to measure the water and oil rates to back up the multi-phase flowmeter, a gas meter will also be installed on the gas line as a secondary gas measurement to the multi-phase meter as well. Once the surge tanks reach 80% capacity the tanks will be pumped into a 500 bbl atmospheric tanks to allow for additional retention time prior to pumping the oil and water to a barge or tanker. The oil will then be pumped from the 500bbl tanks to the barge or tanker.

The timeframe to complete the initial drilling activities is an estimate based on the best available information regarding downhole conditions likely to be encountered while drilling each well and are not intended to be a limitation. The well(s) will be drilled/completed and will remain shut-in until they are developed under a future DOCD. If any wells are unsuccessful, they will be permanently plugged and abandoned in accordance with the Bureau of Safety and Environmental Enforcement (BSEE) regulations.

The lease area is 147 statute miles from the nearest shoreline, 347 statute miles from the onshore support base at Port Fourchon, Louisiana and 217 statute miles from the helicopter base at Galveston, Texas. Water depths at the well sites range from ~9,000' to ~9,200' (Attachment 1A).

The proposed rig will be either a dynamically positioned (DP) semi-submersible (Noble Jim Day 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 rigs will comply with the requirements in the Interim Final Rules. 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 1C through 1K).

## C. RIG SAFETY AND POLLUTION FEATURES

The rig, the Noble Jim Day (or similar) or Noble Don Taylor (or similar), 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. This is part of initiative to be good stewards of 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 – Noble Jim Day 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<br>80% fill in all hull tanks | Drilling Rig | 3,597 | 1 | | Marine Diesel (0.91 SG) |
| Diesel Tank in stbd 2 | Drilling Rig | 2,713 | 1 | | Marine Diesel (0.91 SG) |
| Diesel Tank in stbd 3 | Drilling Rig | 3,456 | 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 | 2,090 | 1 | | Marine Diesel (0.91 SG) |
| Diesel Tank in port 2 | Drilling Rig | 1,366 | 1 | | Marine Diesel (0.91 SG) |
| Diesel Tank in port 3 | Drilling Rig | 4,787 | 1 | | Marine Diesel (0.91 SG) |
| Diesel Tank in port 4 | Drilling Rig | 3,456 | 1 | | Marine Diesel (0.91 SG) |
| Total storage in hull tanks | Drilling Rig | | | 22,118 | 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) |
| Total engine room diesel | Drilling Rig | | | 970 | 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) |

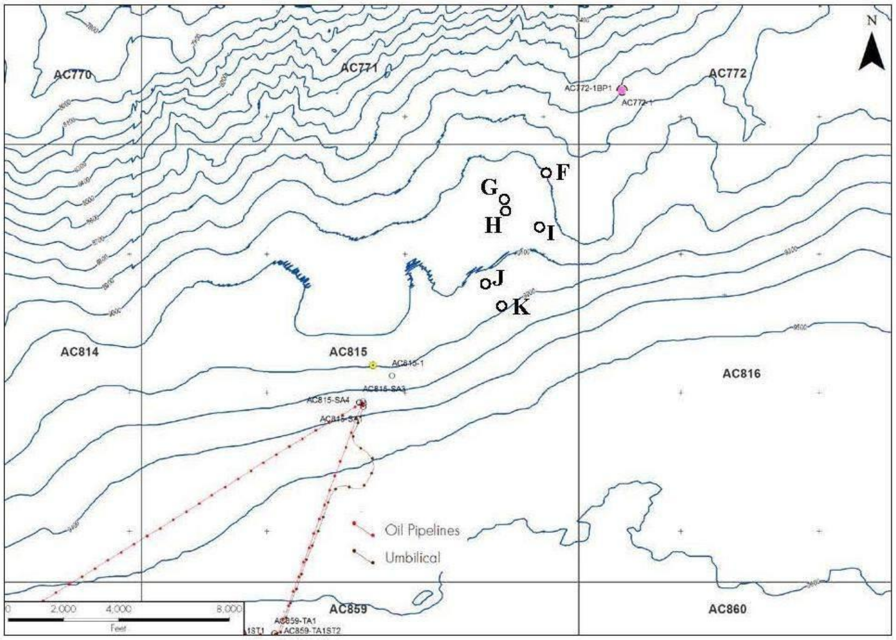
## E. Pollution Prevention Measures

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.

# Attachment 1A - Surface location and Bathymetry



Note: Coordinates are based on the universal Transverse Mercator Grid System, Zone 15N (ft US), NAD27

CI = 100'

## ATTACHMENT 1A
## Surface Hole Locations and Bathymetry

EXPLORATION PLAN

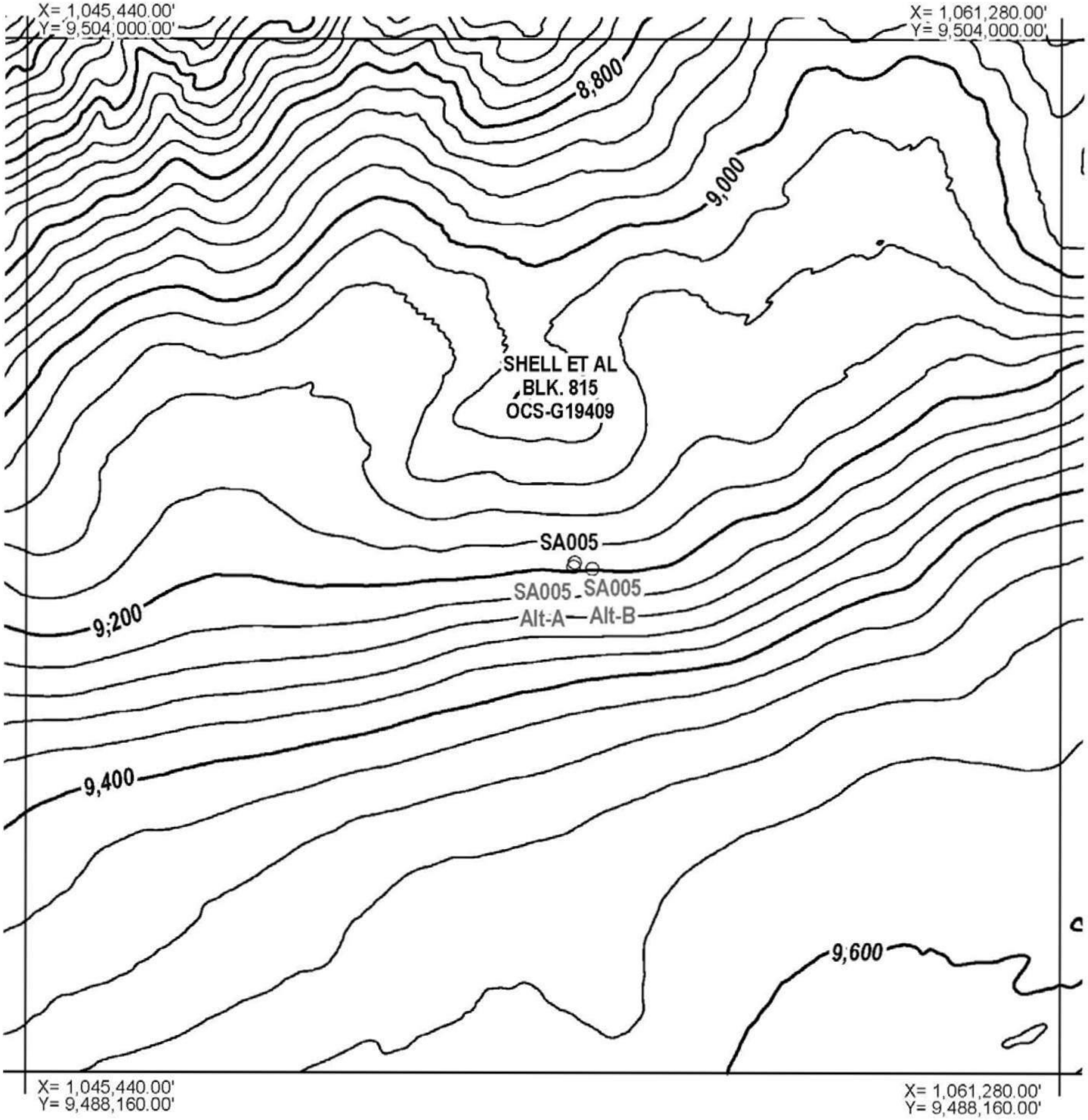
SHELL OCS-G19409, ALAMINOS CANYON BLOCK 815

ALAMINOS CANYON AREA
OFFSHORE TEXAS

○ Proposed Surface Hole Locations

| | | | |
|---|---|---|---|
| **F** | 1,128.05' FEL & 1,056.67' FNL OF BLOCK AC815 | X=1,060,151.95 | Y=9,502,943.33 |
| **G** | 2,670.00' FEL & 2,021.00' FNL OF BLOCK AC815 | X=1,058,610.00 | Y=9,501,979.00 |
| **H** | 2,618.00' FEL & 2,396.00' FNL OF BLOCK AC815 | X=1,058,662.00 | Y=9,501,604.00 |
| **I** | 1,380.00' FEL & 2,970.00' FNL OF BLOCK AC815 | X=1,059,900.00 | Y=9,501,030.00 |
| **J** | 3,377.97' FEL & 5,087.60' FNL OF BLOCK AC815 | X=1,057,902.03 | Y=9,498,912.40 |
| **K** | 2,780.00' FEL & 5,900.00' FNL OF BLOCK AC815 | X=1,058,500.00 | Y=9,498,100.00 |

## Attachment 1A Continued - Surface location and Bathymetry



Coordinate System: NAD 1927 BLM Zone 15N (ftUS)

N

○ PROPOSED SURFACE LOCATIONS

SA005 7,443.00' FEL & 7,819' FSL OF BLK. AC 815
X=1,053,837.00' Y=9,495,979.00'

SA005-Alt-A 7,462.00' FEL & 7,758.00' FSL OF BLK. AC 815
X=1,053,818.00' Y=9,495,918.00'

SA005-Alt-B 7,173.60' FEL & 7,720.30' FSL OF BLK. AC 815
X=1,054,106.40' Y=9,495,880.30'

ATTACHMENT
SHELL
PROPOSED SURFACE LOCATIONS
D.O.C.D.
SHELL ET AL, OCS-G19409, ALAMINOS CANYON BLK. 815
ALAMINOS CANYON AREA
OFFSHORE TEXAS

0 500 1,000 2,000 3,000 4,000
Feet

G:\30_Project\CAD_NewOrleans\Maps\Permit Plats\Silvertip\Silvertip SA005 Proposed Well Location.mxd

## Attachment 1B – Bottom Hole Locations

Omitted from Public Informaiton Copies.

# Attachment C

## 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: P. O. Box 61933 | Contact Person: Tracy Albert |
| Room 2418 | Phone Number: 504 425 4652 |
| New Orleans, LA 70161-1933 | E-Mail Address: Tracy.Albert@shell.com |

| | | | | |
|---|---|---|---|---|
| If a service fee is required under 30 CFR 550.125(a), provide the | Amount paid | $25,711 | Receipt Nos, 75463878538, 75463873574, 75464445231 | |

## Project and Worst Case Discharge (WCD) Information

| | | | |
|---|---|---|---|
| Lease(s): OCS-G 19409 | Area: Alaminos Canyon | Block(s) 815 | Project Name (If Applicable): NA |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Objective(s) | X | Oil | | Gas | | Sulphur | | Salt | Onshore Support Base(s): Fourchon & Galveston |

| | | |
|---|---|---|
| Platform / Well Name: C | Total Volume of WCD: 71,000 | API Gravity: 39.1 |

| | |
|---|---|
| Distance to Closest Land (Miles): 148 | Volume from uncontrolled blowout:4.51 MMBO |

| | | | | |
|---|---|---|---|---|
| Have you previously provided information to verify the calculations and assumptions for your WCD? | X | Yes | | No |
| If so, provide the Control Number of the EP or DOCD with which this information was provided | N-09899 | | | |
| 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 |
|---|---|---|---|
| Exploration drilling | See Attached | | |
| Development drilling | | | |
| Well completion | | | |
| Well test flaring (for more than 48 hours) | | | |
| Installation or modification of structure | | | |
| Installation of production facilities | | | |
| Installation of subsea wellheads and/or manifolds | | | |
| 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 | | Guyed tower |
| X | DP Semisubmersible | | Other (Attach description) | | Floating production system | NA | Other (Attach description) |
| Drilling Rig Name (If known): Noble Don Taylor or Jim Day or similar | | | | | | | |

## Description of Lease Term Pipelines

| From (Facility/Area/Block) | To (Facility/Area/Block) | Diameter (Inches) | Length (Feet) |
|---|---|---|---|
| NA | | | |
| | | | |
| | | | |

## Proposed Schedule

| Proposed Activity | Start Date | End Date | No. of Days |
|---|---|---|---|
| Drill and complete SA5 | 6/13/2018 | 12/20/2018 | 190 |
| Perform Drill Stem Test | 12/21/2018 | 12/31/2018 | 10 |
| Drill and complete Well F | 6/13/2019 | 12/20/2019 | 190 |
| Perform Drill Stem Test | 12/21/2019 | 12/31/2019 | 10 |
| Drill and complete SA5 ALT A | 6/13/2020 | 12/20/2020 | 190 |
| Perform Drill Stem Test | 12/21/2020 | 12/31/2020 | 10 |
| Drill and complete Well G | 6/13/2021 | 12/20/2021 | 190 |
| Perform Drill Stem Test | 12/21/2021 | 12/31/2021 | 10 |
| Drill and complete SA5 ALT B | 6/13/2022 | 12/20/2022 | 190 |
| Perform Drill Stem Test | 12/21/2022 | 12/31/2022 | 10 |
| Drill and complete Well H | 6/13/2023 | 12/20/2023 | 190 |
| Perform Drill Stem Test | 12/21/2023 | 12/31/2023 | 10 |
| Drill and complete Well I | 6/13/2024 | 12/20/2024 | 190 |
| Perform Drill Stem Test | 12/21/2024 | 12/31/2024 | 10 |
| Drill and complete Well J | 6/13/2025 | 12/20/2025 | 190 |
| Perform Drill Stem Test | 12/21/2025 | 12/31/2025 | 10 |
| Drill and complete Well K | 6/13/2026 | 12/20/2026 | 190 |
| Perform Drill Stem Test | 12/21/2026 | 12/31/2026 | 10 |

# Attachment 1D

## 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 No. | |

| | | | | |
|---|---|---|---|---|
| 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 blowout (Bbls/Day): 71,000 | For structures, volume of all storage and pipelines (Bbls): | API Gravity of fluid | 39.1° |

| | **Surface Location** | **Bottom-Hole Location (For Wells)** | **Completion (For multiple completions, enter separate lines)** |
|---|---|---|---|
| **Lease No.** | OCS-G 19409 | OCS-G 19409 | OCS<br>OCS |
| **Area Name** | Alaminos Canyon | Alaminos Canyon | |
| **Block No.** | 815 | 815 | |
| **Blockline Departures (in feet)** | N/S Departure 1057’ FNL | | N/S Departure F __ L<br>N/S Departure F __ L<br>N/S Departure F __ L |
| | E/W Departure 1128’ FE L | | E/W Departure F __ L<br>E/W Departure F __ L<br>E/W Departure F __ L |
| **Lambert X-Y coordinates** | X: 1,060,151.95 | | X:<br>X:<br>X: |
| | Y: 9,502,943.33 | | Y:<br>Y:<br>Y: |
| **Latitude/ Longitude** | Latitude 26° 10' 42.900" | | Latitude<br>Latitude<br>Latitude |
| | Longitude 94° 46' 11.126" | | Longitude<br>Longitude<br>Longitude |

| | | | | |
|---|---|---|---|---|
| Water Depth (Feet): 9,000’ | | | MD (Feet):<br>MD (Feet):<br>MD (Feet): | TVD (Feet):<br>TVD (Feet):<br>TVD (Feet): |
| Anchor Radius (if applicable) in feet: NA | | | | |

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

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

## Attachment 1E

### 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 No. | |

| | | | | |
|---|---|---|---|---|
| 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 blowout (Bbls/Day): 71,000 | For structures, volume of all storage and pipelines (Bbls): | API Gravity of fluid | 39.1° |

| | **Surface Location** | **Bottom-Hole Location (For Wells)** | **Completion (For multiple completions, enter separate lines)** |
|---|---|---|---|
| **Lease No.** | OCS-G 19409 | OCS-G 19409 | OCS<br>OCS |
| **Area Name** | Alaminos Canyon | Alaminos Canyon | |
| **Block No.** | 815 | 815 | |
| **Blockline Departures (in feet)** | N/S Departure 2021' FN L | | N/S Departure F __ L<br>N/S Departure F __ L<br>N/S Departure F __ L |
| | E/W Departure 2670' FEL | | E/W Departure F __ L<br>E/W Departure F __ L<br>E/W Departure F __ L |
| **Lambert X-Y coordinates** | X: 1,058,610.00 | | X:<br>X:<br>X: |
| | Y: 9,501,979.00 | | Y:<br>Y:<br>Y: |
| **Latitude/ Longitude** | Latitude 26° 10' 33.141" | | Latitude<br>Latitude<br>Latitude |
| | Longitude 94° 46' 27.905" | | Longitude<br>Longitude<br>Longitude |

| | | | | |
|---|---|---|---|---|
| Water Depth (Feet): 9,050' | | | MD (Feet):<br>MD (Feet):<br>MD (Feet): | TVD (Feet):<br>TVD (Feet):<br>TVD (Feet): |
| Anchor Radius (if applicable) in feet: | | | | |

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

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

## Attachment 1F

## Proposed Well/Structure Location

|  |  |  |  |  |  |
|---|---|---|---|---|---|
| Well or Structure Name/Number (If renaming well or structure, reference previous name): H | 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 No. |  |

|  |  |  |  |  |
|---|---|---|---|---|
| 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 blowout (Bbls/Day): 71,000 | For structures, volume of all storage and pipelines (Bbls): | API Gravity of fluid | 39.1° |

|  | **Surface Location** | **Bottom-Hole Location (For Wells)** | **Completion (For multiple completions, enter separate lines)** |
|---|---|---|---|
| **Lease No.** | OCS-G 19409 | OCS-G 19409 | OCS<br>OCS |
| **Area Name** | Alaminos Canyon | Alaminos Canyon |  |
| **Block No.** | 815 | 815 |  |
| **Blockline Departures (in feet)** | N/S Departure 2396' FN L |  | N/S Departure F __ L<br>N/S Departure F __ L<br>N/S Departure F __ L |
|  | E/W Departure 2618' FEL |  | E/W Departure F __ L<br>E/W Departure F __ L<br>E/W Departure F __ L |
| **Lambert X-Y coordinates** | X: 1,058,662.00 |  | X:<br>X:<br>X: |
|  | Y: 9,501,604.00 |  | Y:<br>Y:<br>Y: |
| **Latitude/ Longitude** | Latitude 26° 10' 29.434" |  | Latitude<br>Latitude<br>Latitude |
|  | Longitude 94° 46' 27.278" |  | Longitude<br>Longitude<br>Longitude |

|  |  |  |  |  |
|---|---|---|---|---|
| Water Depth (Feet): 9,050' |  |  | MD (Feet):<br>MD (Feet):<br>MD (Feet): | TVD (Feet):<br>TVD (Feet):<br>TVD (Feet): |
| Anchor Radius (if applicable) in feet: |  |  |  |  |

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

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

# Attachment 1G

## Proposed Well/Structure Location

| | | | | | |
|---|---|---|---|---|---|
| Well or Structure Name/Number (If renaming well or structure, reference previous name): I | 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 No. | |

| | | | | |
|---|---|---|---|---|
| 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 blowout (Bbls/Day): 71,000 | For structures, volume of all storage and pipelines (Bbls): NA | API Gravity of fluid | 39.1 |

| | **Surface Location** | **Bottom-Hole Location (For Wells)** | **Completion (For multiple completions, enter separate lines)** |
|---|---|---|---|
| **Lease No.** | OCS-G 19409 | OCS-G 19409 | OCS<br>OCS |
| **Area Name** | Alaminos Canyon | Alaminos Canyon | |
| **Block No.** | 815 | 815 | |
| **Blockline Departures (in feet)** | N/S Departure 2970' FN L | | N/S Departure F __ L<br>N/S Departure F __ L<br>N/S Departure F __ L |
| | E/W Departure 1380' FEL | | E/W Departure F __ L<br>E/W Departure F __ L<br>E/W Departure F __ L |
| **Lambert X-Y coordinates** | X: 1,059,900.00 | | X:<br>X:<br>X: |
| | Y: 9,501,030.00 | | Y:<br>Y:<br>Y: |
| **Latitude/ Longitude** | Latitude 26° 10' 23.917" | | Latitude<br>Latitude<br>Latitude |
| | Longitude 94° 46' 13.605" | | Longitude<br>Longitude<br>Longitude |

| | | | | |
|---|---|---|---|---|
| Water Depth (Feet): 9,050 | | | MD (Feet):<br>MD (Feet):<br>MD (Feet): | TVD (Feet):<br>TVD (Feet):<br>TVD (Feet): |
| Anchor Radius (if applicable) in feet: | | | | |

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

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

## Attachment 1H

## Proposed Well/Structure Location

| | | | | | |
|---|---|---|---|---|---|
| Well or Structure Name/Number (If renaming well or structure, reference previous name): J | 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 No. | |

| | | | | |
|---|---|---|---|---|
| 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 blowout (Bbls/Day): 71,000 | For structures, volume of all storage and pipelines (Bbls): | API Gravity of fluid | 39.1° |

| | | | |
|---|---|---|---|
| | **Surface Location** | **Bottom-Hole Location (For Wells)** | **Completion (For multiple completions, enter separate lines)** |
| **Lease No.** | OCS-G 19409 | OCS-G 19409 | OCS<br>OCS |
| **Area Name** | Alaminos Canyon | Alaminos Canyon | |
| **Block No.** | 815 | 815 | |
| **Blockline Departures (in feet)** | N/S Departure 5087.60' FN L | | N/S Departure F __ L<br>N/S Departure F __ L<br>N/S Departure F __ L |
| | E/W Departure 3377.97' FEL | | E/W Departure F __ L<br>E/W Departure F __ L<br>E/W Departure F __ L |
| **Lambert X-Y coordinates** | X: 1,057,902.03 | | X:<br>X:<br>X: |
| | Y: 9,498,912.40 | | Y:<br>Y:<br>Y: |
| **Latitude/ Longitude** | Latitude 26° 10' 02.675" | | Latitude<br>Latitude<br>Latitude |
| | Longitude 94° 46' 35.215" | | Longitude<br>Longitude<br>Longitude |

| | | | | |
|---|---|---|---|---|
| Water Depth (Feet): 9,150' | | | MD (Feet):<br>MD (Feet):<br>MD (Feet): | TVD (Feet):<br>TVD (Feet):<br>TVD (Feet): |
| Anchor Radius (if applicable) in feet: | | | | |

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

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

## Attachment 1I

### Proposed Well/Structure Location

| | | | | | |
|---|---|---|---|---|---|
| Well or Structure Name/Number (If renaming well or structure, reference previous name): K | 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 No. | |

| | | | | |
|---|---|---|---|---|
| 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 blowout (Bbls/Day): 71,000 | For structures, volume of all storage and pipelines (Bbls): | API Gravity of fluid | 39.1° |

| | **Surface Location** | **Bottom-Hole Location (For Wells)** | **Completion (For multiple completions, enter separate lines)** |
|---|---|---|---|
| **Lease No.** | OCS-G 19409 | OCS-G 19409 | OCS<br>OCS |
| **Area Name** | Alaminos Canyon | Alaminos Canyon | |
| **Block No.** | 815 | 815 | |
| **Blockline Departures (in feet)** | N/S Departure 5900' FN L | | N/S Departure F __ L<br>N/S Departure F __ L<br>N/S Departure F __ L |
| | E/W Departure 2780' FEL | | E/W Departure F __ L<br>E/W Departure F __ L<br>E/W Departure F __ L |
| **Lambert X-Y coordinates** | X: 1,058,500.00 | | X:<br>X:<br>X: |
| | Y: 9,498,100.00 | | Y:<br>Y:<br>Y: |
| **Latitude/ Longitude** | Latitude 26° 09' 54.710" | | Latitude<br>Latitude<br>Latitude |
| | Longitude 94° 46' 28.531" | | Longitude<br>Longitude<br>Longitude |

| | | | | |
|---|---|---|---|---|
| Water Depth (Feet): 9,200' | | | MD (Feet):<br>MD (Feet):<br>MD (Feet): | TVD (Feet):<br>TVD (Feet):<br>TVD (Feet): |
| Anchor Radius (if applicable) in feet: | | | | |

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

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

## Attachment 1J

## Proposed Well/Structure Location

| | | | | | |
|---|---|---|---|---|---|
| Well or Structure Name/Number (If renaming well or structure, reference previous name): SA005 | Previously reviewed under an approved EP or DOCD? | X | Yes | | No |

| | | | | | | |
|---|---|---|---|---|---|---|
| Is this an existing well or structure? | | Yes | X | No | If this is an existing well or structure, list the Complex ID or API No. | S-07762 |

| | | | | |
|---|---|---|---|---|
| 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 blowout (Bbls/Day): 71,000 | For structures, volume of all storage and pipelines (Bbls): | API Gravity of fluid | 39.1° |

| | **Surface Location** | **Bottom-Hole Location (For Wells)** | **Completion (For multiple completions, enter separate lines)** |
|---|---|---|---|
| **Lease No.** | OCS-G 19409 | OCS-G 19409 | OCS<br>OCS |
| **Area Name** | Alaminos Canyon | Alaminos Canyon | |
| **Block No.** | 815 | 815 | |
| **Blockline Departures (in feet)** | N/S Departure 7819' FS L | | N/S Departure F __ L<br>N/S Departure F __ L<br>N/S Departure F __ L |
| | E/W Departure 7443' FEL | | E/W Departure F __ L<br>E/W Departure F __ L<br>E/W Departure F __ L |
| **Lambert X-Y coordinates** | X: 1,053,837.00 | | X:<br>X:<br>X: |
| | Y: 9,495,979.00 | | Y:<br>Y:<br>Y: |
| **Latitude/ Longitude** | Latitude 26° 09' 33.071" | | Latitude<br>Latitude<br>Latitude |
| | Longitude 94° 47' 19.383" | | Longitude<br>Longitude<br>Longitude |

| | | | | |
|---|---|---|---|---|
| Water Depth (Feet): 9,184' | | | MD (Feet):<br>MD (Feet):<br>MD (Feet): | TVD (Feet):<br>TVD (Feet):<br>TVD (Feet): |
| Anchor Radius (if applicable) in feet: | | | | |

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

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

## Attachment 1K

### Proposed Well/Structure Location

| | | | | | |
|---|---|---|---|---|---|
| Well or Structure Name/Number (If renaming well or structure, reference previous name): SA005 Alt A | Previously reviewed under an approved EP or DOCD? | | Yes | X | No |

| | | | | | | |
|---|---|---|---|---|---|---|
| Is this an existing well or structure? | | Yes | X | No | If this is an existing well or structure, list the Complex ID or API No. | |

| | | | | |
|---|---|---|---|---|
| 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 blowout (Bbls/Day): 71,000 | For structures, volume of all storage and pipelines (Bbls): | API Gravity of fluid | 39.1° |

| | **Surface Location** | **Bottom-Hole Location (For Wells)** | **Completion (For multiple completions, enter separate lines)** |
|---|---|---|---|
| **Lease No.** | OCS-G 19409 | OCS-G 19409 | OCS<br>OCS |
| **Area Name** | Alaminos Canyon | Alaminos Canyon | |
| **Block No.** | 815 | 815 | |
| **Blockline Departures (in feet)** | N/S Departure 7,758' FS L | | N/S Departure F __ L<br>N/S Departure F __ L<br>N/S Departure F __ L |
| | E/W Departure 7462' FEL | | E/W Departure F __ L<br>E/W Departure F __ L<br>E/W Departure F __ L |
| **Lambert X-Y coordinates** | X: 1,053,818.00 | | X:<br>X:<br>X: |
| | Y: 9,495,918.00 | | Y:<br>Y:<br>Y: |
| **Latitude/ Longitude** | Latitude 26° 09' 32.464" | | Latitude<br>Latitude<br>Latitude |
| | Longitude 94° 47' 19.582" | | Longitude<br>Longitude<br>Longitude |

| | | | | |
|---|---|---|---|---|
| Water Depth (Feet): 9200' | | | MD (Feet):<br>MD (Feet):<br>MD (Feet): | TVD (Feet):<br>TVD (Feet):<br>TVD (Feet): |
| Anchor Radius (if applicable) in feet: | | | | |

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

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

## Attachment 1L

## Proposed Well/Structure Location

| | | | | | |
|---|---|---|---|---|---|
| Well or Structure Name/Number (If renaming well or structure, reference previous name): SA005 Alt B | Previously reviewed under an approved EP or DOCD? | | Yes | X | No |

| | | | | | | |
|---|---|---|---|---|---|---|
| Is this an existing well or structure? | | Yes | X | No | If this is an existing well or structure, list the Complex ID or API No. | |

| | | | | |
|---|---|---|---|---|
| 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 blowout (Bbls/Day): 71,000 | For structures, volume of all storage and pipelines (Bbls): | API Gravity of fluid | 39.1° |

| | **Surface Location** | **Bottom-Hole Location (For Wells)** | **Completion (For multiple completions, enter separate lines)** |
|---|---|---|---|
| **Lease No.** | OCS-G 19409 | OCS-G 19409 | OCS<br>OCS |
| **Area Name** | Alaminos Canyon | Alaminos Canyon | |
| **Block No.** | 815 | 815 | |
| **Blockline Departures (in feet)** | N/S Departure 7,720.30’ FSL | | N/S Departure F __ L<br>N/S Departure F __ L<br>N/S Departure F __ L |
| | E/W Departure 7, 173.60’ FEL | | E/W Departure F __ L<br>E/W Departure F __ L<br>E/W Departure F __ L |
| **Lambert X-Y coordinates** | X: 1,054,106.40 | | X:<br>X:<br>X: |
| | Y: 9,495,880.30 | | Y:<br>Y:<br>Y: |
| **Latitude/ Longitude** | Latitude 26° 09' 32.130" | | Latitude<br>Latitude<br>Latitude |
| | Longitude 94° 47' 16.412" | | Longitude<br>Longitude<br>Longitude |

| | | | | |
|---|---|---|---|---|
| Water Depth (Feet): 8,830’ | | | MD (Feet):<br>MD (Feet):<br>MD (Feet): | TVD (Feet):<br>TVD (Feet):<br>TVD (Feet): |
| Anchor Radius (if applicable) in feet: | | | | |

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

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

# SECTION 2: GENERAL INFORMATION

## A. Application and Permits

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

## B. Drilling Fluids

See Section 7, Table 7A for a list of 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 256, Subpart I-Bonding; NTL No. 2000-G16, "Guideline for General Lease Surety Bonds" and additional security under 30 CFR 256.53(d) and National NTL No. 2016-N01.

## 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 EP according to 30 CFR Parts 250 and 253 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

### Summary

The below was submitted and accepted by BOEM in plan N-9899, approved on October 19, 2015. The wells proposed in this Supplemental EP do not exceed this amount. The following is provided for your convenience and remains as previously accepted (updated NTL number only).

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 "C" 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) | 71,000 bbl oil |
| Uncontrolled blowout rate (first 30 days average daily rate) | 53,300 BOPD |
| Duration of flow (days) based on relief well | 140 Days |
| Total volume of spill (bbls) until relief well drilled | 4.51 mmbbl oil |

*Table 1: Worst Case Discharge Summary*

## Project Overview

AC 815 is located in the Gulf of Mexico (GOM), approximately 148 miles southwest of New Orleans, Louisiana, in water depths of approximately 8,800 to 9,100 (ft) across the block. The C well is only 4 miles from the Tobago host (AC859#TA1 OCS G-20871) and 2.5 miles from the Silvertip discovery (AC815#1 OCS G-19409). The Whale prospect is structurally updip of these producing fields.

## 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 five 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 Whale "C" (AC772) deviated well with a bottom hole location on the crest of the Whale structure represents the highest 30 day average well flow potential. The Whale "C" well (AC772) will be drilled through the reservoirs as outlined in the Geological and Geophysical Information Section of the Whale EP 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 reservoirs. 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) | AC-772 |
| Facility Designation | DP |
| Distance to Nearest Shoreline (miles) | 148 statute miles |
| Uncontrolled blowout volume (first day) | 71,000 BBL |
| Uncontrolled blowout volume (first 30 day average daily rate) | 53,300 BOPD |

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

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

| | |
|---|---|
| Duration of flow (days) | 140 |
| Total volume of spill (mmbbls) | 4.51 |

*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 and calculations used in determining the worst-case discharge for AC 815/AC 772

**(Proprietary data)**

### 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. 2015-N01, Shell will provide additional information regarding our containment capabilities in a subsequent filing.

### g) Availability of a rig to drill a relief well, rig package constraints and drilling from platform

Blowout intervention can be conducted from an ROV equipped vessel, the existing drilling rig or from another drilling rig. The location of this lease prevents the ability to drill the relief well from a platform. 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 Whale water depths and reservoir depths without technical constraints are shown in the table below.

| **Rig Name** | **Rig Type** |
|---|---|
| DW Proteus | Dynamically Positioned Drill ship |
| Noble Don Taylor | Dynamically Positioned Drill ship |
| DW Thalassa | Dynamically Positioned Drill ship |
| DW Poseidon | 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 14 days to safely secure the well that the rig is working on; up to the point the rig departs location, and a further 3 days transit to mobilize to the relief well site depending on distance to travel. The relief well will take approximately 90 days to drill down to the last casing string above the blowout zone plus approximately 33 days for precision ranging activity to intersect the blowout well bore. Total time to mobilize and drill a relief well would be approximately 140 days for this well.

If a moored rig is chosen to conduct the relief well operations, anchor handlers would be prioritized 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. Shell has deep water anchor handlers on long term contract to support its moored rigs.

### 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 at Whale. 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 2018-2027 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.

## M) 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 reports were used for our analysis:

- Archaeological Assessment, Block 815 (OCS-G-19409) & Vicinity, Alaminos Canyon Area, Gulf of Mexico, C&C Technologies, Project No. 150440, May 2015.
- Geohazard Assessment Block 815 (OCS G-19409) and Portion of Block 859 (OCS G-20871), Alaminos Canyon Area, Gulf of Mexico, GEMS, Project No. 0606-1210b, April 2007
- Geologic and Stratigraphic Assessment, Blocks 815 and 859, Alaminos Canyon Area, Gulf of Mexico, GEMS, Project No. 0703-694, September 2003.
- Berger Geosciences, LLC, (Berger, 2015) "Shallow Hazards Assessment, Benthic Communities Evaluation, and Archaeological Resource Assessment, Alaminos Canyon Area, Blocks 771, 772, 815, and 816, Gulf of Mexico" (Berger Project No. 14-10-08)

### f. Shallow Hazards Assessment
See Section 6 for a detailed Shallow Hazards assessment of the wells proposed in this plan.

### H. Geochemical Information
This information is not required for plans submitted in the GOM Region.

### I. Future G&G Activities
This information is not required for plans submitted in the GOM Region.

## SECTION 4: HYDROGEN SULFIDE ($H_2S$)

### A. Concentration

0 ppm

### B. Classification

Based on 30 CFR 550.215, Shell requests that the Regional Supervisor, Field Operations, classify the area in the proposed drilling operations as an area where the absence of $H_2S$ is confirmed.

### C. $H_2S$ Contingency Plan

Shell is not required to provide an $H_2S$ Contingency Plan with the Application for Permit to Drill before conducting the proposed exploration activities.

### D. Modeling Report

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

## SECTION 5: MINERAL RESOURCE CONSERVATION INFORMATION

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 Clearances

### Proposed Wellsite SA005, SA005-ALT-A, and SA005-ALT-B, Alaminos Canyon 815 (OCS-G-19409)

This addresses specific seafloor and subsurface conditions around the proposed SA005 location. The SA005-ALT A and SA005-ALT B surface hole locations (SHLs) are within 500 ft of the primary SA005 SHL.

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 in the vicinity of any of the proposed wellsites. There is a low probability of encountering significantly over-pressured sands within the depth limit of investigation. There is a low to moderately-low probability for shallow gas at the proposed locations based on seismic attributes and amplitude analysis

**Geohazard and Archaeological Assessments.**
The following geohazard discussions are based on the findings provided within the following geohazard reports:

- Archaeological Assessment, Block 815 (OCS-G-19409) & Vicinity, Alaminos Canyon Area, Gulf of Mexico, C&C Technologies, Project No. 150440, May 2015.
- Geohazard Assessment Block 815 (OCS G-19409) and Portion of Block 859 (OCS G-20871), Alaminos Canyon Area, Gulf of Mexico, GEMS, Project No. 0606-1210b, April 2007
- Geologic and Stratigraphic Assessment, Blocks 815 and 859, Alaminos Canyon Area, Gulf of Mexico, GEMS, Project No. 0703-694, September 2003.

**Available Data**
This assessment is based on the analysis of: a) 2D high-resolution geophysical datasets collected by C & C Technologies, Inc., (C&C) in 2015 using AUV (Autonomous Underwater Vehicles) that covered most of AC 815 and portions of surrounding blocks. The AUV data included 1-5 kHz subbottom profiler, 120-410-kHz side-scan sonar, and 3-meter bin multibeam bathymetry data; b) reprocessed exploration 3D seismic data volume and; c) offset well data including logs and drilling events.

**Oil Field Infrastructure and Military Warning Areas**
The nearest existing well, AC 815 001 G19409 (PA), is located approximately 775 ft east-southeast of the proposed wellsite area. The closest producing well, AC 815 SA002 G19409, is located approximately 1,390 ft to the south-southwest. Pursuant to public information obtained from the BOEM database (2015a), there is existing infrastructure associated with the Silvertip Development approximately 1,390 ft to the south-southwest within the proposed wellsite area. The Development area is within Military Warning Area W-602.

### Proposed Wellsite SA005, SA005-ALT-A, and SA005-ALT-B, Alaminos Canyon 815 (OCS-G-19409)

**Proposed Well Location**
The surface locations for the Proposed Exploration Wellsite SA005, SA005-ALT-A, and SA005-ALT-B lies near the center of AC 815 (Illustration SA005-A-0). Proposed locations for wellsites SA005, SA005-ALT-A, and SA005-ALT-B are within 290 ft. of each other and will be discussed together. Table A-1 proposed locations coordinates:

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

| Well Name | Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North | | Line Reference |
|---|---|---|---|
| SA005 | X: 1053837.0 ft. | Y: 9495979.0 ft. | Inline 3151 Crossline 7919 |
| SA005-ALT-A | X: 1053818.0 ft. | Y: 9495918.0 ft. | Inline 3148 Crossline 7918 |
| SA005-ALT-B | X: 1054106.4 ft. | Y: 9495880.3 ft. | Inline 3146 Crossline 7932 |

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 SA005-A-1).

**Wellsite Conditions**

The wellsite is located within the lower continental slope between the Alaminos and Perdido Canyons. The subsurface is strongly influenced by local salt tectonics and the Perdido Fold and Thrust Belt. Seafloor slopes are variable throughout the region but average 2.8°. Furrows dominate the seafloor texture in the area, resulting in a pattern of northeast-southwest oriented ridges.

**Water Depth and Seafloor Conditions**

The water depth at the proposed surface location is -9,184 ft and the seafloor slopes about 6.5° to the southeast. Furrows dominate the seafloor texture in the area, resulting in a pattern of northeast-southwest oriented ridges. The well locations avoid the steepest slopes associated with these furrows. The sub-bottom profiler data shows the base of the furrowed zone and generally parallel stratification in the near surface. Several buried minor near-seafloor faults are evident within the sub-bottom profiler data. These do not penetrate seafloor, are limited in extent, and are interpreted to be inactive.

**Deepwater Benthic Communities.** High-density deepwater benthic communities are not expected at the proposed wellsite. The Amplitude-Enhanced Surface Rendering (Illustration SA005-A-2) and the Side-Scan Sonar Mosaic, (C&C, 2015) data don't show areas of higher reflectivity. There are no features or areas that could support significant, high-density, benthic communities within 2,000 ft of the proposed location (Illustrations SA005-A-2). There are no BOEM seismic water bottom anomalies within 2000 ft of the proposed SA005, SA005-ALT-A, and SA005-ALT-B locations.

**Stratigraphy.** Stratigraphic conditions from the seabed to the FR10 horizon are shown on the Tophole Prognosis Chart (Illustration SA005-A-3). The FR08 horizon is estimated to be 3,883 ft BML or -13,067 ft below sea level (BSL). The stratigraphic framework has been modified from the previous reports (GEMS 2007, 2009) to better integrate more recent subsurface interpretation from newer propriety 3D seismic data.

<u>Near-Surface Sediments.</u>

The near-surface sediments are affected by seafloor furrows. The furrows are slope-parallel bed formed by bottom currents. The sub-bottom profiler data image the upper 125 ft of sediments, which consist of parallel stratified sediments and thin mass transport deposits. Minor offset near-seafloor faults are visible in the sub-bottom profiler data near the well location. The faults in the SA005 area do not reach seafloor and are interpreted to be inactive. They are not visible in the 3D seismic data.

<u>Unit 1 (Seafloor to Event 10).</u> Unit 1 beneath the proposed Wellsite SA005 is 512 ft thick (Illustration SA005-A-3). The unit consists of predominantly muds with occasional possible thin sands. The stratigraphy is discontinuously layered.

<u>Unit 2 (Event 10 to Event 20).</u> Unit 2 beneath the proposed Wellsite SA005 is 116 ft thick (Illustration SA005-A-3). The unit consists of predominantly muds. The stratigraphy is discontinuously layered.

<u>Unit 3 & 4 (Event 20 to Sediment Wedge Base).</u> Units 3 & 4 beneath the proposed Wellsite SA005 is 1401 ft thick (Illustration SA005-A-3). Within the wedge, beds may be steeply dipping and may have sub-seismic faults. The unit consists of predominantly muds with occasional possible thin sands. The stratigraphy is chaotic to sub-parallel.

Unit 5 (Sediment Wedge Base to Event 49). Unit 5 beneath the proposed Wellsite SA005 is 532 ft thick (Illustration SA005-A-3). The unit consists of predominantly muds with occasional possible sands. The stratigraphy is chaotic.

Unit 6 (Event 49 to FR10). Unit 6 beneath the proposed Wellsite SA005 is 1322 ft thick (Illustration SA005-A-3). The unit consists of predominantly muds with occasional possible thin ash beds. The unit may have marls and occasional thin sands near lower half of the unit. The stratigraphy is parallel to sub-parallel.

**Faults.** The well location is in close proximity to multiple sub-seismic buried near-seafloor faults. The planned wellbore beneath the proposed SA005 location will drill through a mapped thrusted shale wedge from 722-2029 ft BML (Illustration SA005-A-3). One seismically visible fault will be penetrated at 12262 ft TVD below the depth of the riserless interval.

**Shallow Gas and Shallow Water Flow.** Significant shallow gas is not expected at this proposed wellsite. The potential for shallow water flow at this well location is low.

**Shallow Gas.** There are no apparent subsurface high-amplitude anomalies directly below the proposed wellsite. The potential for encountering minor amounts of gas within sand-lenses is low within the riserless interval.

**Shallow Water Flow.** The potential for shallow water flow at this well location from the seafloor to 3,783 ft BML is low. There have been no reports of shallow water flow from offset wells within AC 815.

### Archaeological Assessment

The archaeological assessments of side-scan sonar AUV data covering AC 815 and the surrounding area (C&C, 2015) identified 18 sonar contacts with within 2000 ft of the proposed SA005 primary wellsite. All sonar contacts are interpreted to be modern debris or are natural in origin. There are no sonar contacts of archaeological significance identified within the 2015 C&C report.

### Concluding Remarks

The Proposed Wellsite SA005, SA005-ALT-A and SA005-ALT-B, Alaminos Canyon 815 (OCS-G-19409), appears suitable for exploration drilling operations. There are no potential sites for high-density benthic communities within 2,000 ft and no sonar targets of archaeological significance were identified. Engineers should be aware of the potential for consolidated sediments near surface, low probability of over pressured sand lenses and shallow gas in the riserless section.

## Proposed Wellsites F, G, H, I, J, and K in AC 815 (OCS-G-19409)

This report addresses seafloor and subsurface conditions specific to the following proposed well locations and complies with BOEM NTL 2008-G05 (Shallow Hazards Program), NTL 2008-G04 (Information Requirements for EPs and DOCDs), NTL 2009-G40 (Deepwater Benthic Communities), and NTL 2005-G07 and Joint 2011-G01 (Archaeological Resource Surveys and Reports).

**Geohazards and Archaeological Assessment.** The following summary of the geohazards and archaeological assessment is based on the findings provided within the following detailed reports, which were submitted concurrently with this exploration plan:

- Berger Geosciences, LLC, (Berger, 2015) “Shallow Hazards Assessment, Benthic Communities Evaluation, and Archaeological Resource Assessment, Alaminos Canyon Area, Blocks 771, 772, 815, and 816, Gulf of Mexico” (Berger Project No. 14-10-08)

These assessments address the seafloor and subsurface conditions within a 2,000-ft radius around the proposed wellsite locations, to the base of the carbonate section or one second below mudline (BML).

**Available Data.** Assessments are based on the analysis of the data from AUV (Autonomous Underwater Vehicle) geophysical survey data (sub-bottom profiler, side-scan sonar and multi-beam echo-sounder), and 3D seismic data volumes. All data were provided by Shell.

**Existing Infrastructure and Shipping Activity.** Five existing wells, two oil pipelines, and one umbilical are located in the center of AC 815. Block AC 815 is located within a military warning area (W-602). No portion of the block AC 815 is in a shipping fairway or in known dump sites.

**Proposed Wellsite AC 815-F Alaminos Canyon Block 815 (OCS-G-19409)**

The surface location of the proposed wellsite is located in the northeast corner of AC 815.

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

| Proposed Well AC 815-F | | | |
|---|---|---|---|
| Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North | | Line Reference | Block Calls (AC 815) |
| X: 1,060,151.95 ft | Latitude: 26.178583375266° N | Inline 1011 | 1,128.05 ft FEL |
| Y: 9,502,943.33 ft | Longitude: -94.769757315871° W | Crossline 4955 | 1,056.67 ft FNL |

**Water Depth and Seafloor Conditions.** Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 8,997 ft, and the seafloor slopes at 4.74° down to the southwest.

The wellsite is located near the base of the Sigsbee Escarpment in a broad area of relatively gradual slope between two low ridges.

An interpreted 10-ft thick drape of undisturbed sediment occurs at the seabed, and is inferred to consist of very soft, high water content hemipelagic clays. The presence of this thin drape suggests that the slopes at the proposed wellsite are probably stable at present, under natural conditions.

**Deepwater Benthic Communities.** There are no potential for high-density benthic communities and no water bottom anomalies as defined by the BOEM (BOEM, 2016) within 2,000 ft of the proposed location. The seafloor amplitudes from 3D seismic data, the sidescan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seabed with no indications of hardground or fluid expulsion features. The BOEM water bottom anomaly corresponds with the top of a ridge and sediment transport gullies extending to the north and image areas where erosion has exposed slightly more consolidated sediment at the seafloor.

**Stratigraphy.** Stratigraphic conditions from the seabed to the Base of Carbonate are shown on the Tophole Prognosis Chart. Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit 1 (Seafloor to Horizon 20). Unit 1 is about 578-ft thick at the proposed wellbore. An interpreted 10-ft thick drape of undisturbed sediment occurs at the seabed, and the drape is inferred to consist of very soft, high water-content, hemipelagic clays. The drape overlies interpreted turbidites and mass transport deposits, consisting of silts and clays.

Unit 2 (Horizon 20 to Shallow Unconformity). Unit 2, between 578 ft and 1,262 ft BML (684-ft thick) is interpreted as turbidites and mass transport deposits interbedded with silts and clays, and possible thin (<20-ft thick) discontinuous sands.

Unit 3 (Shallow Unconformity to Top of Carbonate). Unit 3, between about 1,262 ft and 2,570 ft BML (1,308-ft thick), is interpreted as mass transport deposits and reworked strata, consisting of silts and clays, with possible thin (<20-ft thick) discontinuous sands. Unit 3 contains a portion of the rafted block of sediments, encompassing all of the unconformable sediments from the Shallow Unconformity to the Top of the Carbonate Section. Sediments beneath the shallow unconformity are likely to be more compacted than normal for their depth of burial -*i.e.,* overconsolidated.

Unit 4 (Top of Carbonate to Base of Carbonate). Unit 4, between about 2,570 ft and 3,723 ft BML (1,153-ft thick), is interpreted as a salt-rafted carbonate. Sediments are inferred to be shales, possible marls, and possible discontinuous sands. Limestone and other carbonate-rich rocks may be encountered in the lower half of Unit 4. The carbonate is highly fractured and inferred to consist of at least partially lithified rocks (sometimes called a rubble zone). **Loss of drilling mud and/or cement into this formation is possible.**

**Faults.** There are no mapped faults beneath the proposed well to 3,723 ft BML. However, the carbonate section (Unit 4) is interpreted to be highly fractured.

**Gas Hydrates.** A portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. The base of gas hydrate stability (BGHSZ) is estimated to be at 2,135 ft BML. However, sediments above the BGHSZ are predominantly shale with very little sand or other permeable formations for gas hydrate to gather. Therefore, the **potential for significant gas hydrate accumulations is assessed to be negligible.**

**Shallow Gas.** There is little significant accumulation of shallow hydrocarbons in AC 815 (Berger, 2015). There are no high-amplitude anomalies indicative of shallow gas in the predominantly shale-rich sediment directly below the proposed wellsite; therefore, the **potential for encountering significant shallow gas is assessed to be negligible**.

**Shallow Water Flow.** The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon. Shallow water flow potential is generally much lower in Alaminos Canyon. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Alaminos Canyon. Interpretation of the 3D seismic data indicates there are no continuous permeable sand accumulations directly below the proposed wellsite. Discontinuous sands less than about 20-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent thick mass transport deposits at the wellsite. The older thick mass transport deposits in Units 2 and 3 are deeply incised by erosional unconformities (Horizon 20 and the Deep Unconformity). If overpressured sands ever existed in these deposits it is likely that time has allowed pressures to decrease to hydrostatic conditions. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and the **potential for shallow water flow at this well is assessed to be negligible**.

**Archaeological Assessment.** There are no archaeologically significant sonar contacts within AC 815, and there is one sonar contact reported within 1,000 ft of the proposed well. Contact no. 52 is located about 234 ft northeast of the proposed location and is assessed as modern debris or natural in origin. No archeological avoidance is recommended.

**Proposed Wellsite AC 815-F Concluding Remarks.** Seafloor conditions appear favorable at the vicinity of the proposed surface location. There are no potential sites for deepwater benthic communities within 2,000 ft and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (3,723 ft BML).

There is potential for drilling mud and/or cement losses in the interpreted hard and fractured sediments that comprise the carbonate section (Unit 4) between about 2,570 ft and 3,723 ft BML.

## Proposed Wellsite AC 815-G Alaminos Canyon Block 815 (OCS-G-19409)

The surface location of the proposed wellsite is located in the northeast corner of AC 815.

**Table B-1. Proposed Well Location Coordinates**

| Proposed Well AC 815-G | | | |
|---|---|---|---|
| Spheroid & Datum: Clarke 1866<br>NAD27 Projection: UTM Zone 15 North | | Line Reference | Block Calls<br>(AC 815) |
| X: 1,058,610.00 ft | Latitude: 26.175872574372° N | Inline 999 | 2,670.00 ft FEL |
| Y: 9,501,979.00 ft | Longitude: -94.774418150220° W | Crossline 4993 | 2,021.00 ft FNL |

**Water Depth and Seafloor Conditions.** Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,055 ft, and the seafloor slopes at 2.07° down to the southwest.

The wellsite is located near the base of the Sigsbee Escarpment in a broad area of relatively gradual slope between two low ridges.

An interpreted 20-ft thick drape of undisturbed sediment occurs at the seabed, and is inferred to consist of very soft, high water content hemipelagic clays. The presence of this thin drape suggests that the slopes at the proposed wellsite are probably stable at present, under natural conditions.

**Deepwater Benthic Communities.** There are no potential for high-density benthic communities and no water bottom anomalies as defined by the BOEM (BOEM, 2016) within 2,000 ft of the proposed location. The seafloor amplitudes from 3D seismic data, the sidescan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seabed with no indications of hardground or fluid expulsion features. The BOEM water bottom anomaly corresponds with the top of a ridge and sediment transport gullies extending to the north and image areas where erosion has exposed slightly more consolidated sediment at the seafloor.

**Stratigraphy.** Stratigraphic conditions from the seabed to the Base of Carbonate are shown on the Tophole Prognosis Chart. Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit 1 (Seafloor to Horizon 20). Unit 1 is about 637-ft thick at the proposed wellbore. An interpreted 20-ft thick drape of undisturbed sediment occurs at the seabed, and the drape is inferred to consist of very soft, high water-content, hemipelagic clays. The drape overlies interpreted turbidites and mass transport deposits, consisting of silts and clays.

Unit 2 (Horizon 20 to Shallow Unconformity). Unit 2, between 637 ft and 1,423 ft BML (786-ft thick) is interpreted as turbidites and mass transport deposits interbedded with silts and clays, and possible thin (<20-ft thick) discontinuous sands.

Unit 3 (Shallow Unconformity to Top of Carbonate). Unit 3, between about 1,423 ft and 2,691 ft BML (1,268-ft thick), is interpreted as mass transport deposits and reworked strata, consisting of silts and clays, with possible thin (<20-ft thick) discontinuous sands. Unit 3 contains a portion of the rafted block of sediments, encompassing all of the unconformable sediments from the Shallow Unconformity to the Top of the Carbonate Section. Sediments beneath the shallow unconformity are likely to be more compacted than normal for their depth of burial -*i.e.,* overconsolidated.

Unit 4 (Top of Carbonate to Base of Carbonate). Unit 4, between about 2,691 ft and 3,212 ft BML (521-ft thick), is interpreted as a salt-rafted carbonate. Sediments are inferred to be shales, possible marls, and possible discontinuous sands. Limestone and other carbonate-rich rocks may be encountered in the lower half of Unit 4. The carbonate is highly fractured and inferred to consist of at least partially lithified rocks (sometimes called a rubble zone). **Loss of drilling mud and/or cement into this formation is possible.**

**Faults.** There are no mapped faults beneath the proposed well to 3,212 ft BML. However, the carbonate section (Unit 4) is interpreted to be highly fractured.

**Gas Hydrates.** A portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. The base of gas hydrate stability (BGHSZ) is estimated to be at 2,139 ft BML. However, sediments above the BGHSZ are predominantly shale with very little sand or other permeable formations for gas hydrate to gather. Therefore, the **potential for significant gas hydrate accumulations is assessed to be negligible.**

**Shallow Gas.** There is little significant accumulation of shallow hydrocarbons in AC 815 (Berger, 2015). There are no high-amplitude anomalies indicative of shallow gas in the predominantly shale-rich sediment directly below the proposed wellsite; therefore, the **potential for encountering significant shallow gas is assessed to be negligible**.

**Shallow Water Flow.** The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon. Shallow water flow potential is generally much lower in Alaminos Canyon. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Alaminos Canyon. Interpretation of the 3D seismic data indicates there are no continuous permeable sand accumulations directly below the proposed wellsite. Discontinuous sands less than about 20-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent thick mass transport deposits at the wellsite. The older thick mass transport deposits in Units 2 and 3 are deeply incised by erosional unconformities (Horizon 20 and the Deep Unconformity). If overpressured sands ever existed in these deposits it is likely that time has allowed pressures to decrease to hydrostatic conditions. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and the **potential for shallow water flow at this well is assessed to be negligible**.

**Archaeological Assessment.** There are no archaeologically significant sonar contacts within AC 815, and no sonar contact reported within 1,000 ft of the proposed well.

**Proposed Wellsite AC 815-G Concluding Remarks.** Seafloor conditions appear favorable at the vicinity of the proposed surface location. There are no potential sites for deepwater benthic communities within 2,000 ft and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (3,212 ft BML).

There is potential for drilling mud and/or cement losses in the interpreted hard and fractured sediments that comprise the carbonate section (Unit 4) between about 2,691 ft and 3,212 ft BML.

## Proposed Wellsite AC 815-H Alaminos Canyon Block 815 (OCS-G-19409)

The surface location of the proposed wellsite is located in the northeast corner of AC 815.

**Table C-1. Proposed Well Location Coordinates**

| Proposed Well AC 815-H | | | |
|---|---|---|---|
| Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North | | Line Reference | Block Calls (AC 815) |
| X: 1,058,662.00 ft | Latitude: 26.174842892638° N | Inline 995 | 2,618.00 ft FEL |
| Y: 9,501,604.00 ft | Longitude: -94.774243997478° W | Crossline 4992 | 2,396.00 ft FNL |

**Water Depth and Seafloor Conditions.** Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,065 ft, and the seafloor slopes at 2.95° down to the southwest.

The wellsite is located near the base of the Sigsbee Escarpment in a broad area of relatively gradual slope between two low ridges.

An interpreted 15-ft thick drape of undisturbed sediment occurs at the seabed, and is inferred to consist of very soft, high water content hemipelagic clays. The presence of this thin drape suggests that the slopes at the proposed wellsite are probably stable at present, under natural conditions.

**Deepwater Benthic Communities.** There are no potential for high-density benthic communities and no water bottom anomalies as defined by the BOEM (BOEM, 2016) within 2,000 ft of the proposed location. The seafloor amplitudes from 3D seismic data, the sidescan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seabed with no indications of hardground or fluid expulsion features. The BOEM water bottom anomaly corresponds with the top of a ridge and sediment transport gullies extending to the north and image areas where erosion has exposed slightly more consolidated sediment at the seafloor.

**Stratigraphy.** Stratigraphic conditions from the seabed to one second BML are shown on the Tophole Prognosis Chart. Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit 1 (Seafloor to Horizon 20). Unit 1 is about 632-ft thick at the proposed wellbore. An interpreted 15-ft thick drape of undisturbed sediment occurs at the seabed, and the drape is inferred to consist of very soft, high water-content, hemipelagic clays. The drape overlies interpreted turbidites and mass transport deposits, consisting of silts and clays.

Unit 2 (Horizon 20 to Shallow Unconformity). Unit 2, between 632 ft and 1,369 ft BML (737-ft thick) is interpreted as turbidites and mass transport deposits interbedded with silts and clays, and possible thin (<20-ft thick) discontinuous sands.

Unit 3 (Shallow Unconformity to Deep Unconformity). Unit 3, between about 1,369 ft and 1,957 ft BML (588-ft thick), is interpreted as mass transport deposits and reworked strata, consisting of silts and clays, with possible thin (<20-ft thick) discontinuous sands. Unit 3 contains a portion of the rafted block of sediments, encompassing all of the unconformable sediments from the Shallow Unconformity to the Deep Unconformity. Sediments beneath the shallow unconformity are likely to be more compacted than normal for their depth of burial -*i.e.,* overconsolidated.

Unit 4 (Deep Unconformity to Investigation Limit). Unit 4, between about 1,957 ft and 3,535 ft BML (1,578-ft thick), is composed of fine-grained turbidites. Sediments are inferred to be shales and possible discontinuous sands.

**Faults.** There are no mapped faults beneath the proposed well to 3,535 ft BML.

**Gas Hydrates.** A portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. The base of gas hydrate stability (BGHSZ) is estimated to be at 2,143 ft BML. However, sediments above the BGHSZ are predominantly shale with very little sand or other permeable formations for gas hydrate to gather. Therefore, the **potential for significant gas hydrate accumulations is assessed to be negligible.**

**Shallow Gas.** There is little significant accumulation of shallow hydrocarbons in AC 815 (Berger, 2015). There are no high-amplitude anomalies indicative of shallow gas in the predominantly shale-rich sediment directly below the proposed wellsite; therefore, the **potential for encountering significant shallow gas is assessed to be negligible**.

**Shallow Water Flow.** The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon. Shallow water flow potential is generally much lower in Alaminos Canyon. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Alaminos Canyon. Interpretation of the 3D seismic data indicates there are no continuous permeable sand accumulations directly below the proposed wellsite. Discontinuous sands less than about 20-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent thick mass transport deposits at the wellsite. The older thick mass transport deposits in Units 2 and 3 are deeply incised by erosional unconformities (Horizon 20 and the Deep Unconformity). If overpressured sands ever existed in these deposits it is likely that time has allowed pressures to decrease to hydrostatic conditions. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and the **potential for shallow water flow at this well is assessed to be negligible**.

**Archaeological Assessment.** There are no archaeologically significant sonar contacts within AC 815, and no sonar contact reported within 1,000 ft of the proposed well.

**Proposed Wellsite AC 815-H Concluding Remarks.** Seafloor conditions appear favorable at the vicinity of the proposed surface location. There are no potential sites for deepwater benthic communities within 2,000 ft and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (3,535 ft BML).

## Proposed Wellsite AC 815-I Alaminos Canyon Block 815 (OCS-G-19409)

The surface location of the proposed wellsite is located in the northeast corner of AC 815.

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

| Proposed Well AC 815-I | | | |
|---|---|---|---|
| Spheroid & Datum: Clarke 1866<br>NAD27 Projection: UTM Zone 15 North | | Line Reference | Block Calls<br>(AC 815) |
| X: 1,059,900.00 ft | Latitude: 26.173310284679° N | Inline 988 | 1,380.00 ft FEL |
| Y: 9,501,030.00 ft | Longitude: -94.770445909910° W | Crossline 4961 | 2,970.00 ft FNL |

**Water Depth and Seafloor Conditions.** Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,044 ft, and the seafloor slopes at 3.38° down to the southwest.

The wellsite is located near the base of the Sigsbee Escarpment in a broad area of relatively gradual slope between two low ridges.

An interpreted 20-ft thick drape of undisturbed sediment occurs at the seabed, and is inferred to consist of very soft, high water content hemipelagic clays. The presence of this thin drape suggests that the slopes at the proposed wellsite are probably stable at present, under natural conditions.

**Deepwater Benthic Communities.** There are no potential for high-density benthic communities and no water bottom anomalies as defined by the BOEM (BOEM, 2016) within 2,000 ft of the proposed location. The seafloor amplitudes from 3D seismic data, the sidescan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seabed with no indications of hardground or fluid expulsion features. The BOEM water bottom anomaly corresponds with the top of a ridge and sediment transport gullies extending to the north and image areas where erosion has exposed slightly more consolidated sediment at the seafloor.

**Stratigraphy.** Stratigraphic conditions from the seabed to one second BML are shown on the Tophole Prognosis Chart. Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit 1 (Seafloor to Horizon 20). Unit 1 is about 508-ft thick at the proposed wellbore. An interpreted 20-ft thick drape of undisturbed sediment occurs at the seabed, and the drape is inferred to consist of very soft, high water-content, hemipelagic clays. The drape overlies interpreted turbidites and mass transport deposits, consisting of silts and clays.

Unit 2 (Horizon 20 to Shallow Unconformity). Unit 2, between 508 ft and 1,359 ft BML (851-ft thick) is interpreted as turbidites and mass transport deposits interbedded with silts and clays, and possible thin (<20-ft thick) discontinuous sands.

Unit 3 (Shallow Unconformity to Deep Unconformity). Unit 3, between about 1,359 ft and 1,866 ft BML (507-ft thick), is interpreted as mass transport deposits and reworked strata, consisting of silts and clays, with possible thin (<20-ft thick) discontinuous sands. Unit 3 contains a portion of the rafted block of sediments, encompassing all of the unconformable sediments from the Shallow Unconformity to the Deep Unconformity. Sediments beneath the shallow unconformity are likely to be more compacted than normal for their depth of burial -*i.e.,* overconsolidated.

Unit 4 (Deep Unconformity to Investigation Limit). Unit 4, between about 1,866 ft and 3,535 ft BML (1,669-ft thick), is composed of fine-grained turbidites. Sediments are inferred to be shales and possible discontinuous sands.

**Faults.** There are no mapped faults beneath the proposed well to 3,535 ft BML.

**Gas Hydrates.** A portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. The base of gas hydrate stability (BGHSZ) is estimated to be at 2,139 ft BML. However, sediments above the BGHSZ are predominantly shale with very little sand or other permeable formations for gas hydrate to gather. Therefore, the **potential for significant gas hydrate accumulations is assessed to be negligible.**

**Shallow Gas.** There is little significant accumulation of shallow hydrocarbons in AC 815 (Berger, 2015). There are no high-amplitude anomalies indicative of shallow gas in the predominantly shale-rich sediment directly below the proposed wellsite; therefore, the **potential for encountering significant shallow gas is assessed to be negligible**.

**Shallow Water Flow.** The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon. Shallow water flow potential is generally much lower in Alaminos Canyon. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Alaminos Canyon. Interpretation of the 3D seismic data indicates there are no continuous permeable sand accumulations directly below the proposed wellsite. Discontinuous sands less than about 20-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent thick mass transport deposits at the wellsite. The older thick mass transport deposits in Units 2 and 3 are deeply incised by erosional unconformities (Horizon 20 and the Deep Unconformity). If overpressured sands ever existed in these deposits it is likely that time has allowed pressures to decrease to hydrostatic conditions. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and the **potential for shallow water flow at this well is assessed to be negligible**.

**Archaeological Assessment.** There are no archaeologically significant sonar contacts within AC 815, and no sonar contact reported within 1,000 ft of the proposed well.

**Proposed Wellsite AC 815-I Concluding Remarks.** Seafloor conditions appear favorable at the vicinity of the proposed surface location. There are no potential sites for deepwater benthic communities within 2,000 ft and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (3,535 ft BML).

## Proposed Wellsite AC 815-J Alaminos Canyon Block 815 (OCS-G-19409)

The surface location of the proposed wellsite is located in the northeast corner of AC 815.

**Table E-1. Proposed Well Location Coordinates**

| Proposed Well AC 85-J | | | |
|---|---|---|---|
| Spheroid & Datum: Clarke 1866<br>NAD27 Projection: UTM Zone 15 North | | Line Reference | Block Calls (AC 815) |
| X: 1,057,902.03 ft | Latitude: 26.167409636277° N | Inline 962 | 3,377.97 ft FEL |
| Y: 9,498,912.40 ft | Longitude: -94.776448627058° W | Crossline 5010 | 5,087.60 ft FNL |

**Water Depth and Seafloor Conditions.** Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,118 ft, and the seafloor slopes at 2.76° down to the southeast.

The wellsite is located near the base of the Sigsbee Escarpment in a broad area of relatively gradual slope between two low ridges.

An interpreted 20-ft thick drape of undisturbed sediment occurs at the seabed, and is inferred to consist of very soft, high water content hemipelagic clays. The presence of this thin drape suggests that the slopes at the proposed wellsite are probably stable at present, under natural conditions.

**Deepwater Benthic Communities.** There are no potential for high-density benthic communities and no water bottom anomalies as defined by the BOEM (BOEM, 2016) within 2,000 ft of the proposed location. The seafloor amplitudes from 3D seismic data, the sidescan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seabed with no indications of hardground or fluid expulsion features. The BOEM water bottom anomaly corresponds with the top of a ridge and sediment transport gullies extending to the north and image areas where erosion has exposed slightly more consolidated sediment at the seafloor.

**Stratigraphy.** Stratigraphic conditions from the seabed to one second BML are shown on the Tophole Prognosis Chart. Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit 1 (Seafloor to Horizon 20). Unit 1 is about 626-ft thick at the proposed wellbore. An interpreted 20-ft thick drape of undisturbed sediment occurs at the seabed, and the drape is inferred to consist of very soft, high water-content, hemipelagic clays. The drape overlies interpreted turbidites and mass transport deposits, consisting of silts and clays.

Unit 2 (Horizon 20 to Shallow Unconformity). Unit 2, between 626 ft and 1,643 ft BML (1,017-ft thick) is interpreted as turbidites and mass transport deposits interbedded with silts and clays, and possible thin (<20-ft thick) discontinuous sands.

Unit 3 (Shallow Unconformity to Deep Unconformity). Unit 3, between about 1,643 ft and 2,171 ft BML (528-ft thick), is interpreted as mass transport deposits and reworked strata, consisting of silts and clays, with possible thin (<20-ft thick) discontinuous sands. Unit 3 contains a portion of the rafted block of sediments, encompassing all of the unconformable sediments from the Shallow Unconformity to the Deep Unconformity. Sediments beneath the shallow unconformity are likely to be more compacted than normal for their depth of burial *-i.e.,* overconsolidated.

Unit 4 (Deep Unconformity to Investigation Limit). Unit 4, between about 2,171 ft and 3,535 ft BML (1,364-ft thick), is composed of fine-grained turbidites. Sediments are inferred to be shales and possible discontinuous sands.

**Faults.** There are no mapped faults beneath the proposed well to 3,535 ft BML.

**Gas Hydrates.** A portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. The base of gas hydrate stability (BGHSZ) is estimated to be at 2,147 ft BML. However, sediments above the BGHSZ are predominantly shale with very little sand or other permeable formations for gas hydrate to gather. Therefore, the **potential for significant gas hydrate accumulations is assessed to be negligible.**

**Shallow Gas.** There is little significant accumulation of shallow hydrocarbons in AC 815 (Berger, 2015). There are no high-amplitude anomalies indicative of shallow gas in the predominantly shale-rich sediment directly below the proposed wellsite; therefore, the **potential for encountering significant shallow gas is assessed to be negligible**.

**Shallow Water Flow.** The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon. Shallow water flow potential is generally much lower in Alaminos Canyon. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Alaminos Canyon. Interpretation of the 3D seismic data indicates there are no continuous permeable sand accumulations directly below the proposed wellsite. Discontinuous sands less than about 20-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent thick mass transport deposits at the wellsite. The older thick mass transport deposits in Units 2 and 3 are deeply incised by erosional unconformities (Horizon 20 and the Deep Unconformity). If overpressured sands ever existed in these deposits it is likely that time has allowed pressures to decrease to hydrostatic conditions. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and the **potential for shallow water flow at this well is assessed to be negligible**.

**Archaeological Assessment.** There are no archaeologically significant sonar contacts within AC 815, and no sonar contact reported within 1,000 ft of the proposed well.

**Proposed Wellsite AC 815-J Concluding Remarks.** Seafloor conditions appear favorable at the vicinity of the proposed surface location. There are no potential sites for deepwater benthic communities within 2,000 ft and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (3,535 ft BML).

**Proposed Wellsite AC 815-K Alaminos Canyon Block 815 (OCS-G-19409)**
The surface location of the proposed wellsite is located in the northeast corner of AC 815.

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

| Proposed Well AC 85-K | | | |
|---|---|---|---|
| Spheroid & Datum: Clarke 1866<br>NAD27 Projection: UTM Zone 15 North | | Line Reference | Block Calls<br>(AC 815) |
| X: 1,058,500.00 ft | Latitude: 26.165197184670° N | Inline 952 | 2,780.00 ft FEL |
| Y: 9,498,100.00 ft | Longitude: -94.774591908619° W | Crossline 4995 | 5,900.00 ft FNL |

**Water Depth and Seafloor Conditions.** Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,175 ft, and the seafloor slopes at 4.22° down to the southeast.

The wellsite is located near the base of the Sigsbee Escarpment in a broad area of relatively gradual slope between two low ridges.

An interpreted 20-ft thick drape of undisturbed sediment occurs at the seabed, and is inferred to consist of very soft, high water content hemipelagic clays. The presence of this thin drape suggests that the slopes at the proposed wellsite are probably stable at present, under natural conditions.

**Deepwater Benthic Communities.** There are no potential for high-density benthic communities and no water bottom anomalies as defined by the BOEM (BOEM, 2016) within 2,000 ft of the proposed location. The seafloor amplitudes from 3D seismic data, the sidescan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seabed with no indications of hardground or fluid expulsion features. The BOEM water bottom anomaly corresponds with the top of a ridge and sediment transport gullies extending to the north and image areas where erosion has exposed slightly more consolidated sediment at the seafloor.

**Stratigraphy.** Stratigraphic conditions from the seabed to one second BML are shown on the Tophole Prognosis Chart. Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit 1 (Seafloor to Horizon 20). Unit 1 is about 637-ft thick at the proposed wellbore. An interpreted 20-ft thick drape of undisturbed sediment occurs at the seabed, and the drape is inferred to consist of very soft, high water-content, hemipelagic clays. The drape overlies interpreted turbidites and mass transport deposits, consisting of silts and clays.

Unit 2 (Horizon 20 to Shallow Unconformity). Unit 2, between 637 ft and 1,485 ft BML (848-ft thick) is interpreted as turbidites and mass transport deposits interbedded with silts and clays, and possible thin (<20-ft thick) discontinuous sands.

Unit 3 (Shallow Unconformity to Deep Unconformity). Unit 3, between about 1,485 ft and 1,885 ft BML (400-ft thick), is interpreted as mass transport deposits and reworked strata, consisting of silts and clays, with possible thin (<20-ft thick) discontinuous sands. Unit 3 contains a portion of the rafted block of sediments, encompassing all of the unconformable sediments from the Shallow Unconformity to the Deep Unconformity. Sediments beneath the shallow unconformity are likely to be more compacted than normal for their depth of burial *-i.e.,* overconsolidated.

Unit 4 (Deep Unconformity to Investigation Limit). Unit 4, between about 1,885 ft and 3,535 ft BML (1,650-ft thick), is composed of fine-grained turbidites. Sediments are inferred to be shales and possible discontinuous sands.

**Faults.** There are no mapped faults beneath the proposed well to 3,535 ft BML.

**Gas Hydrates.** A portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. The base of gas hydrate stability (BGHSZ) is estimated to be at 2,151 ft BML. However, sediments above the BGHSZ are predominantly shale with very little sand or other permeable formations for gas hydrate to gather. Therefore, the **potential for significant gas hydrate accumulations is assessed to be negligible.**

**Shallow Gas.** There is little significant accumulation of shallow hydrocarbons in AC 815 (Berger, 2015). There are no high-amplitude anomalies indicative of shallow gas in the predominantly shale-rich sediment directly below the proposed wellsite; therefore, the **potential for encountering significant shallow gas is assessed to be negligible**.

**Shallow Water Flow.** The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon. Shallow water flow potential is generally much lower in Alaminos Canyon. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Alaminos Canyon. Interpretation of the 3D seismic data indicates there are no continuous permeable sand accumulations directly below the proposed wellsite. Discontinuous sands less than about 20-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent thick mass transport deposits at the wellsite. The older thick mass transport deposits in Units 2 and 3 are deeply incised by erosional unconformities (Horizon 20 and the Deep Unconformity). If overpressured sands ever existed in these deposits it is likely that time has allowed pressures to decrease to hydrostatic conditions. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and the **potential for shallow water flow at this well is assessed to be negligible**.

**Archaeological Assessment.** There are no archaeologically significant sonar contacts within AC 815, and no sonar contact reported within 1,000 ft of the proposed well.

**Proposed Wellsite AC 815-K Concluding Remarks.** Seafloor conditions appear favorable at the vicinity of the proposed surface location. There are no potential sites for deepwater benthic communities within 2,000 ft and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (3,535 ft BML).

## 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, extended by NTL 2014-G03.

## G. Remotely Operated Vehicle (ROV) Monitoring Plan

This information is no longer required by BOEM.

## 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 proposes activities under this plan.

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

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

*Table 6.6 – 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 | *Stenella frontalis* | |
| Blainville's Beaked Whale | *Mesoplodon densirostris* | |
| Blue Whale | *Balaenoptera musculus* | E |
| Bottlenose Dolphin | *Tursiops truncatus* | |
| Bryde's Whale | *Balaenoptera edeni* | |
| Clymene Dolphin | *Stenella clymene* | |
| Cuvier's Beaked Whale | *Ziphius cavirostris* | |
| Dwarf Sperm Whale | *Kogia simus* | |
| False Killer Whale | *Pseudorca crassidens* | |
| Fin Whale | *Balaenoptera physalus* | E |
| Fraser's Dolphin | *Lagenodelphis hosei* | |
| Gervais' Beaked Whale | *Mesoplodon europaeus* | |
| Humpback Whale | *Megaptera novaeangliae* | E |
| Killer Whale | *Orcinus orca* | |
| Melon-headed Whale | *Peponocephala electra* | |
| Minke Whale | *Balaenoptera acutorostrata* | |
| North Atlantic Right Whale | *Eubalaena glacialis* | E |
| Pantropical Spotted Dolphin | *Stenella attenuata* | |
| Pygmy Killer Whale | *Feresa attenuata* | |
| Pygmy Sperm Whale | *Kogia breviceps* | |
| Risso's Dolphin | *Grampus griseus* | |

| | | |
|---|---|---|
| Rough-toothed Dolphin | *Steno bredanensis* | |
| Sei Whale | *Balaenoptera borealis* | E |
| Short-finned Pilot Whale | *Globicephala macrorhynchus* | |
| Sowerby's Beaked Whale | *Mesoplodon bidens* | |
| Sperm Whale | *Physeter macrocephalus* | E |
| Spinner Dolphin (Long-snouted) | *Stenella longirostris* | |
| Striped Dolphin | *Stenella coeruleoalba* | |
| Florida manatee | *Trichechus manatus* | E |

*Table 6.7 – 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. Air and Water Quality Information

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

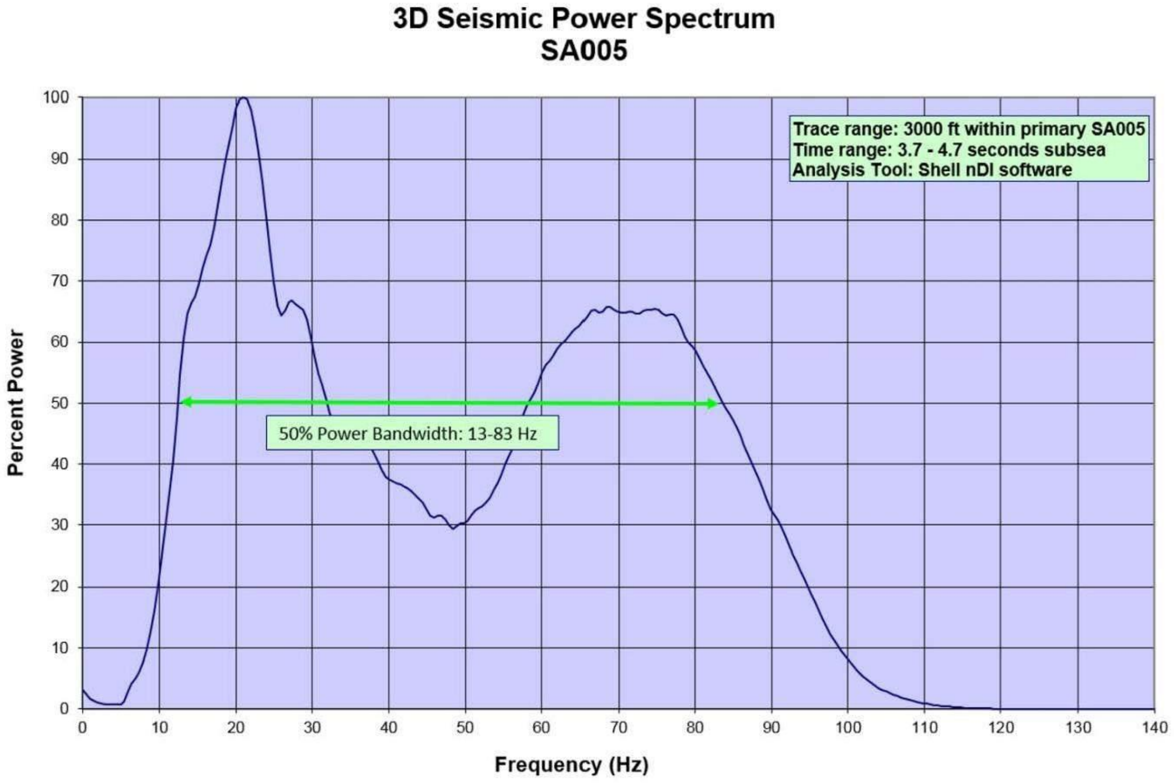
## J. Socioeconomic Information

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.)

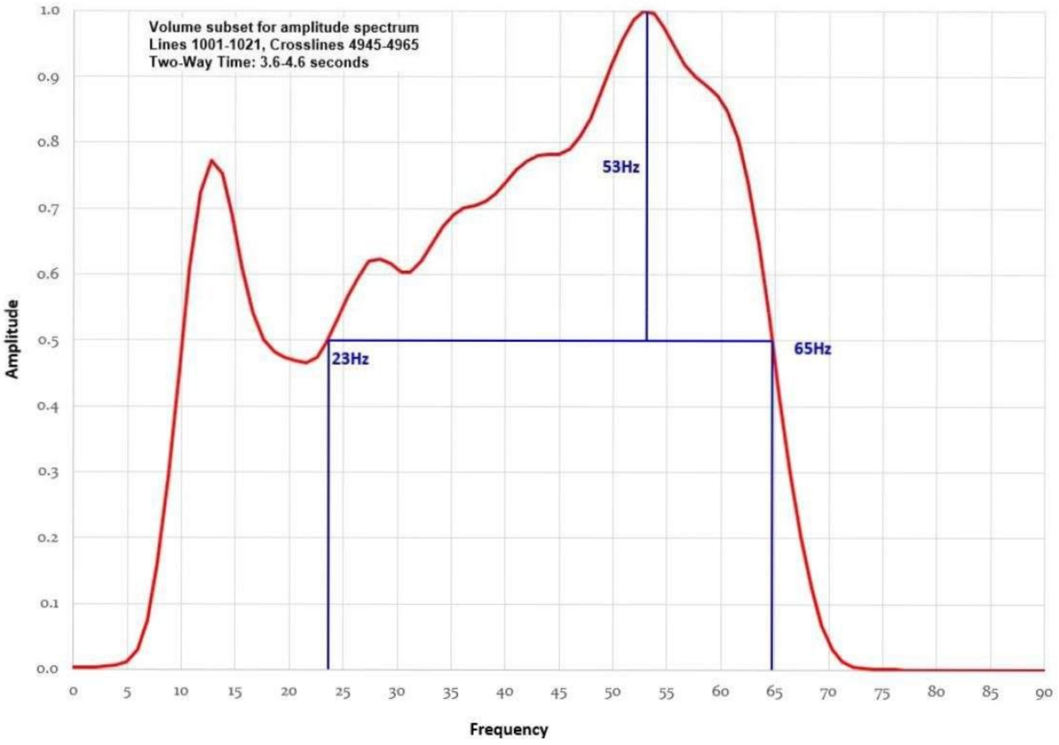
**Attachment 6A – Power Spectrum SA5, SA5AltA & SA5 ALB**



**Attachment 6B – Power Spectrum – Well F**

Project No. 18-03-20

B-geO

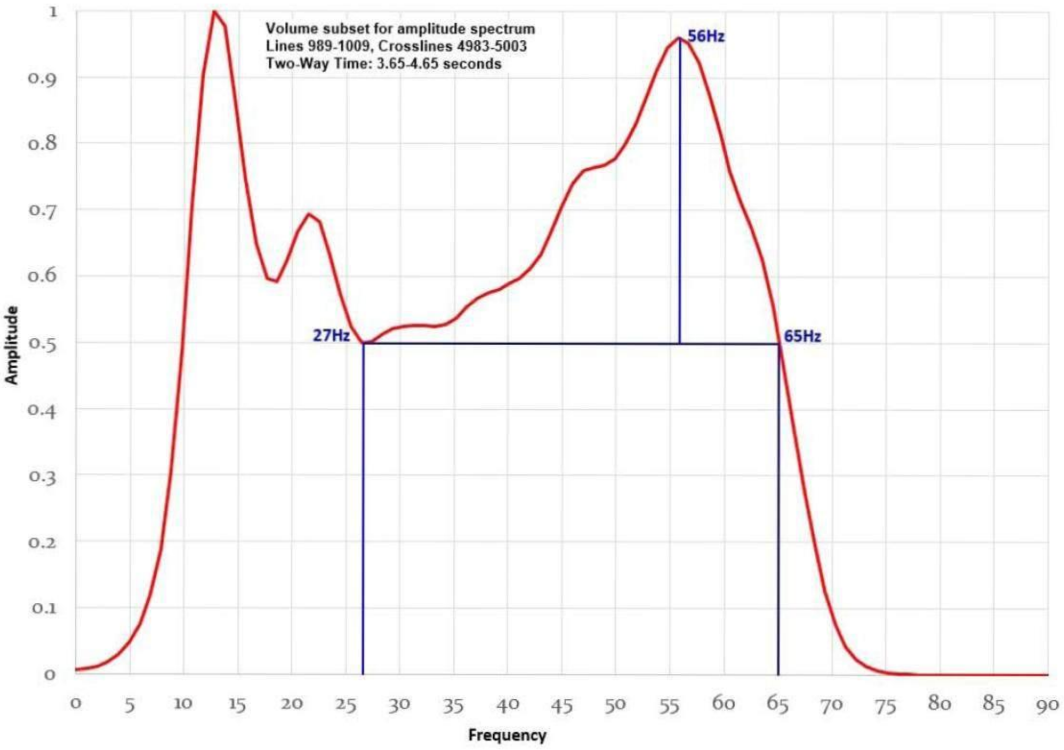


3D Seismic Amplitude Power Spectrum

Illustration AC 815-F- 1

**Attachment 6C – Power Spectrum – Well G**

Project No. 18-03-20



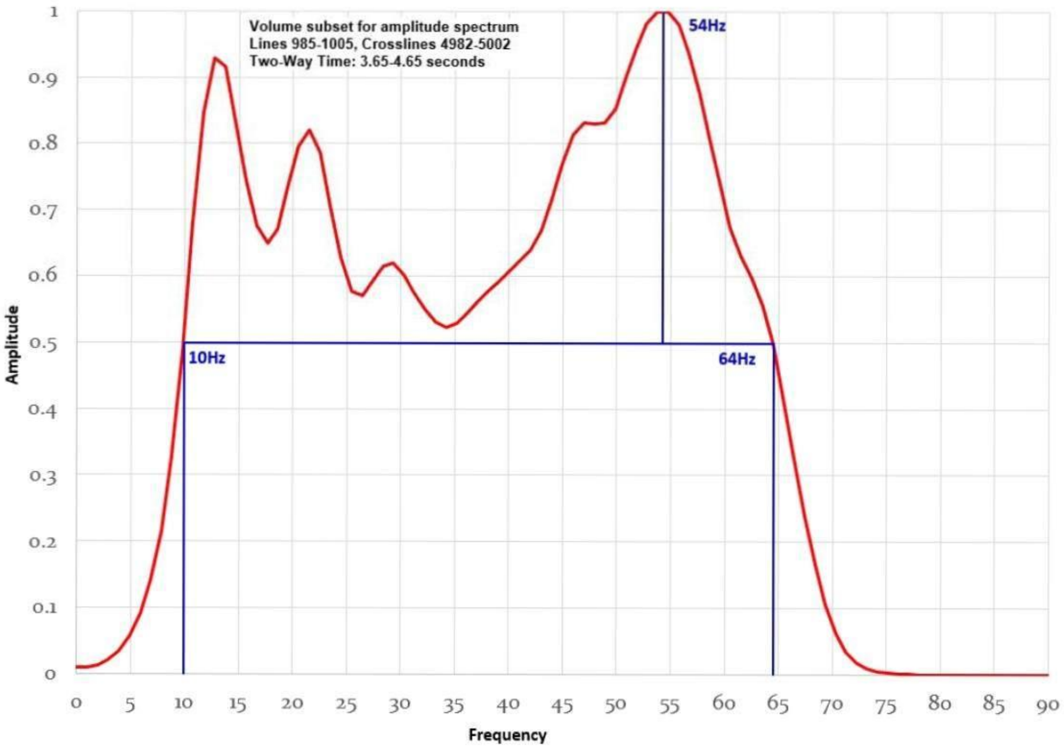
3D Seismic Amplitude Power Spectrum

Illustration AC 815-G- 1

# Attachment 6D – Power Spectrum – Well H

Project No. 17-10-01

B-geO



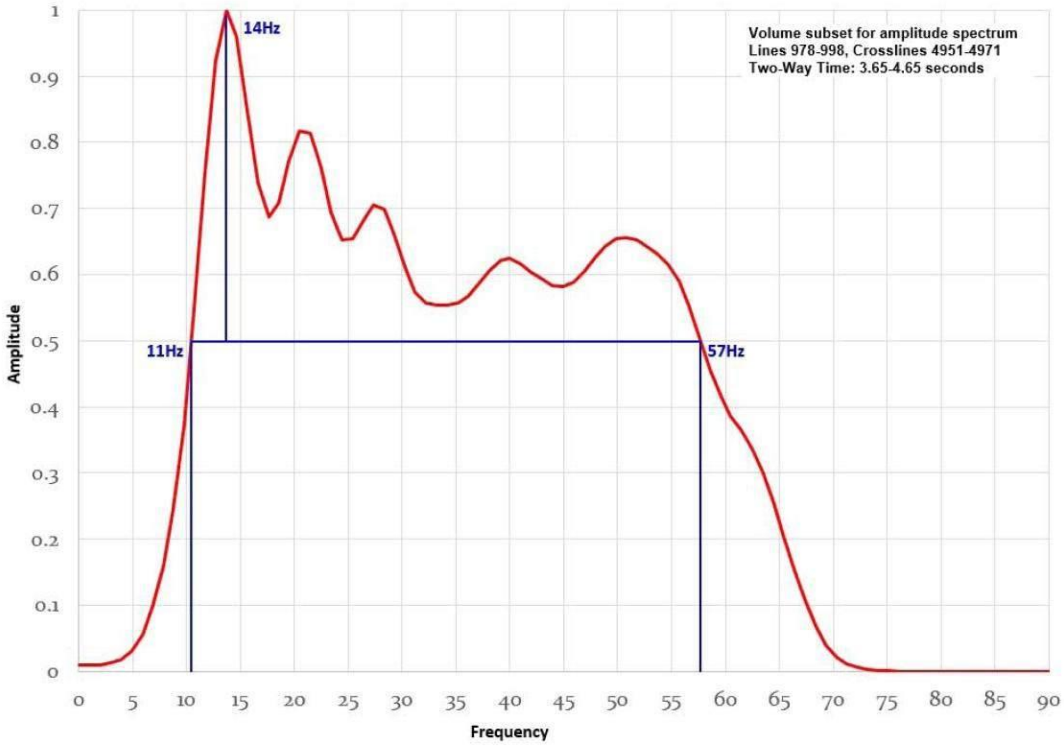
3D Seismic Amplitude Power Spectrum

Illustration AC 772-H- 1

# Attachment 6E – Power Spectrum – Well I

Project No. 18-03-20

B-geO



Volume subset for amplitude spectrum
Lines 978-998, Crosslines 4951-4971
Two-Way Time: 3.65-4.65 seconds

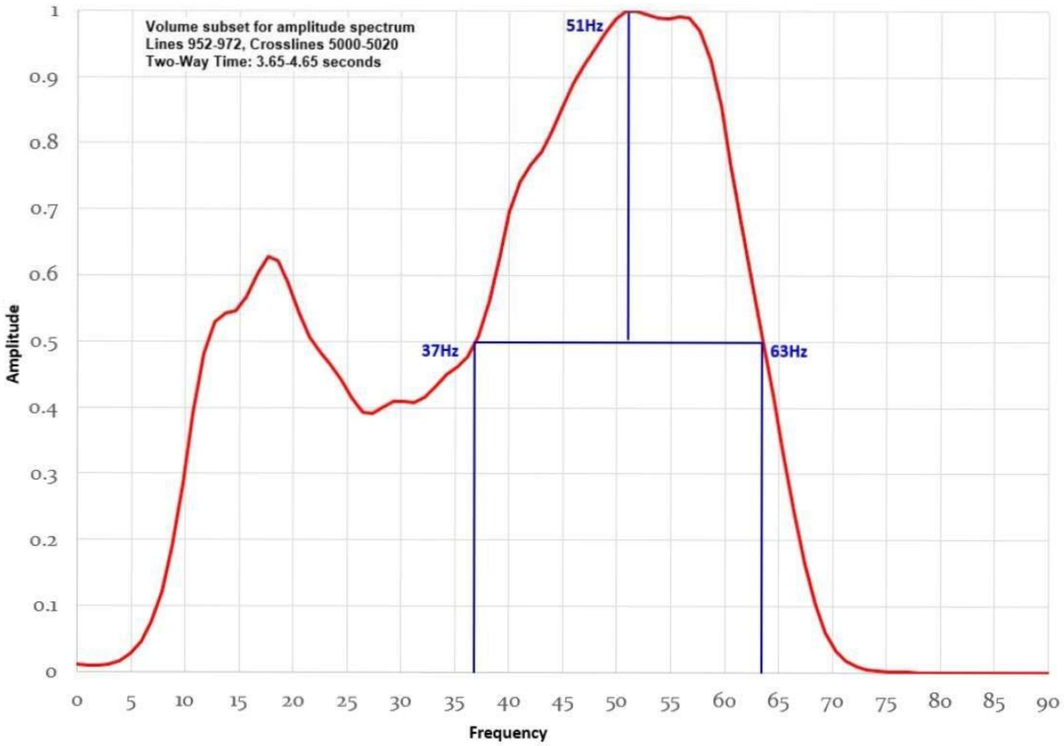
3D Seismic Amplitude Power Spectrum

Illustration AC 815-I- 1

# Attachment 6F – Power Spectrum – Well J

Project No. 18-03-20

B-geO

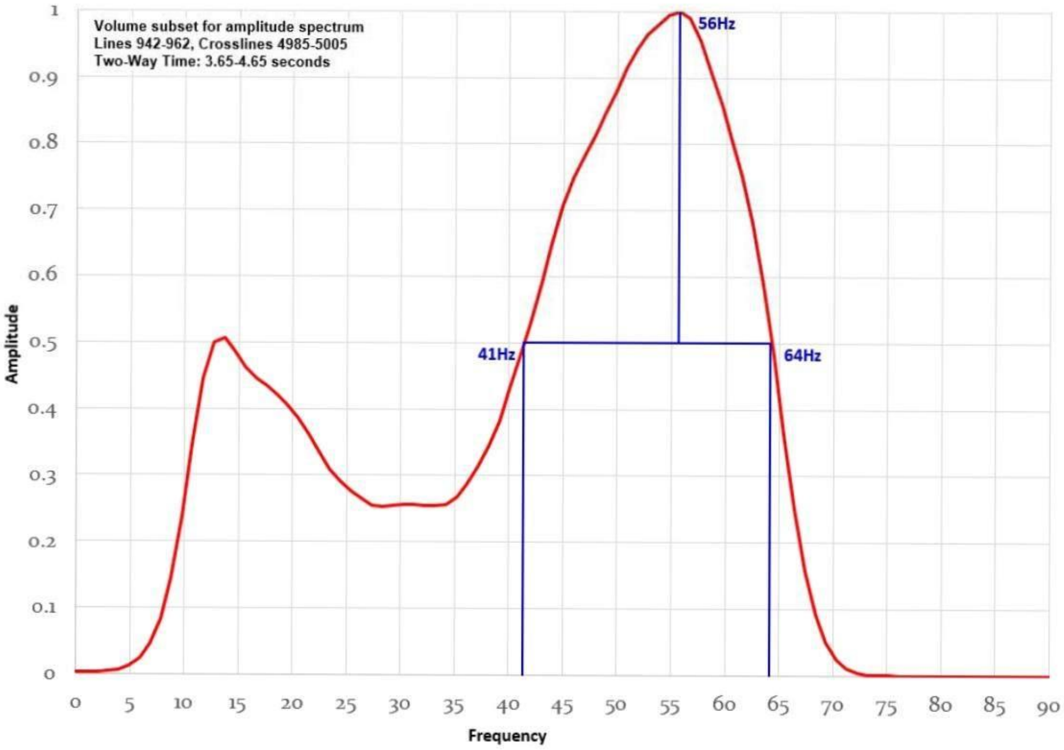


Volume subset for amplitude spectrum
Lines 952-972, Crosslines 5000-5020
Two-Way Time: 3.65-4.65 seconds

3D Seismic Amplitude Power Spectrum

Illustration AC 815-J- 1

# Attachment 6G – Power Spectrum – Well K

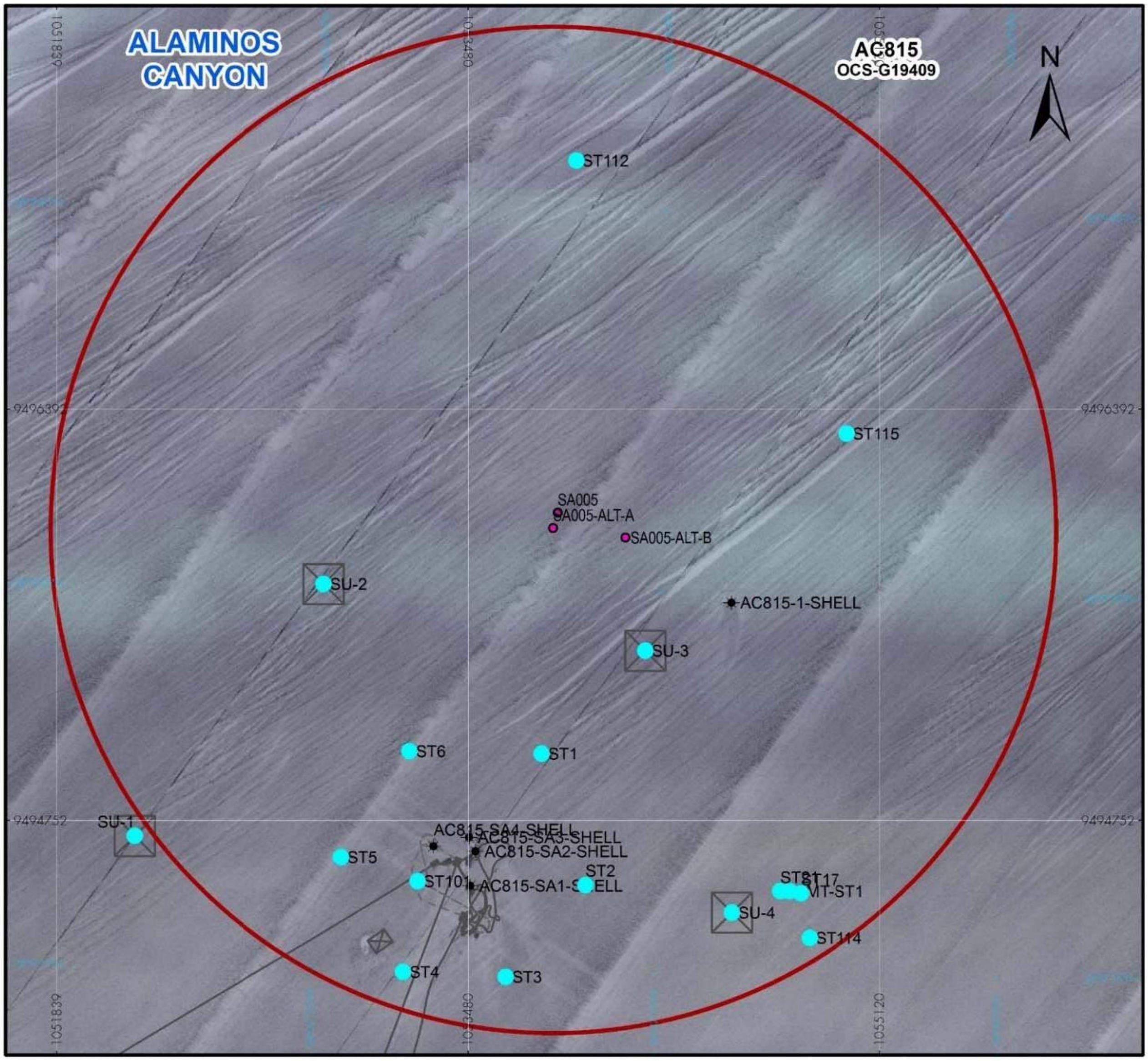


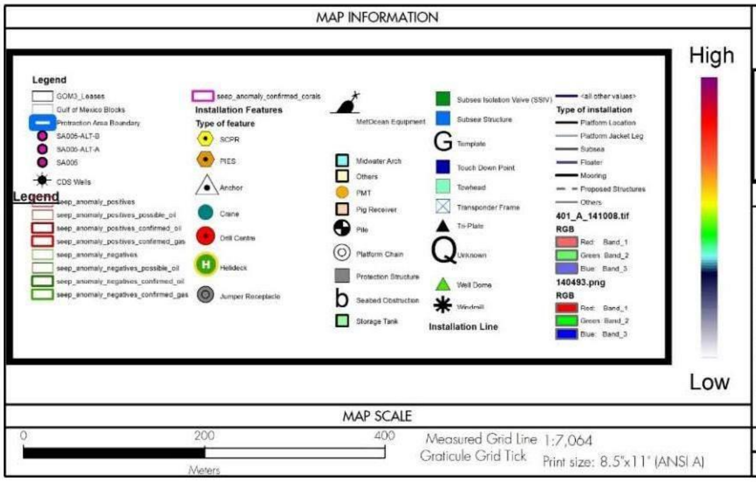
Volume subset for amplitude spectrum
Lines 942-962, Crosslines 4985-5005
Two-Way Time: 3.65-4.65 seconds

3D Seismic Amplitude Power Spectrum

Illustration AC 815-K- 1

# Attachment 6H – ESR – SA005, SA005 ALTA, SA005 ALTB





**SHELL EXPLORATION & PRODUCTION COMPANY**

## Well Locations
## Alamnios Canyon Block 815
## SA005, SA005-ALT-A and SA005-ALT-B
## Surface Amplitude

GEODETIC PARAMETERS

**Horizontal Coordinate Reference System**
CRS name (ESRI): NAD 1927 BLM Zone 15N
CRS name (Shell): [CLICK TO UPDATE]
CRS code (EPSG): [CLICK TO UPDATE]
Geodetic datum: North American 1927
Projection name: Transverse Mercator
Horizontal units: Foot US
**Vertical Coordinate Reference System**
Vertical datum: [CLICK TO UPDATE]
Elevation/Depth: [CLICK TO UPDATE]
Vertical units: [CLICK TO UPDATE]

Author: Update Document Properties
Date: 21 Feb 2018

Name: silvertipwellsitemap

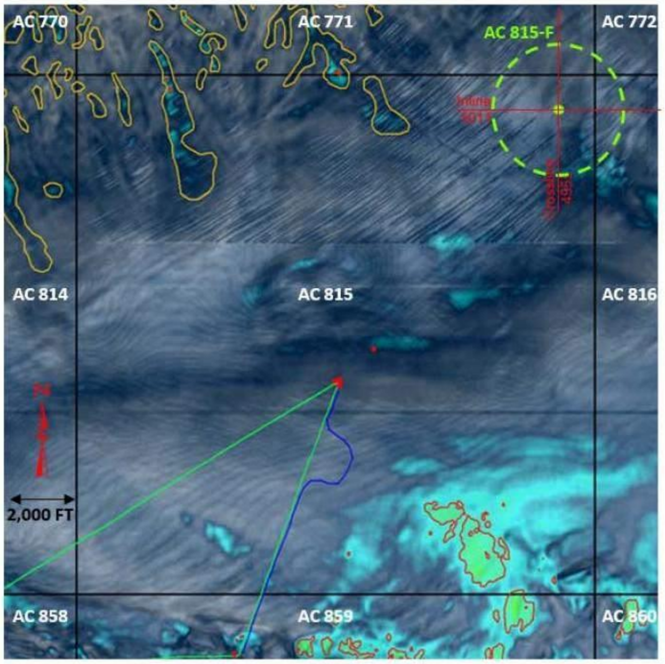
EP Catalog No.: N/A

RESTRICTED

# Attachment 6I – ESR – Well F

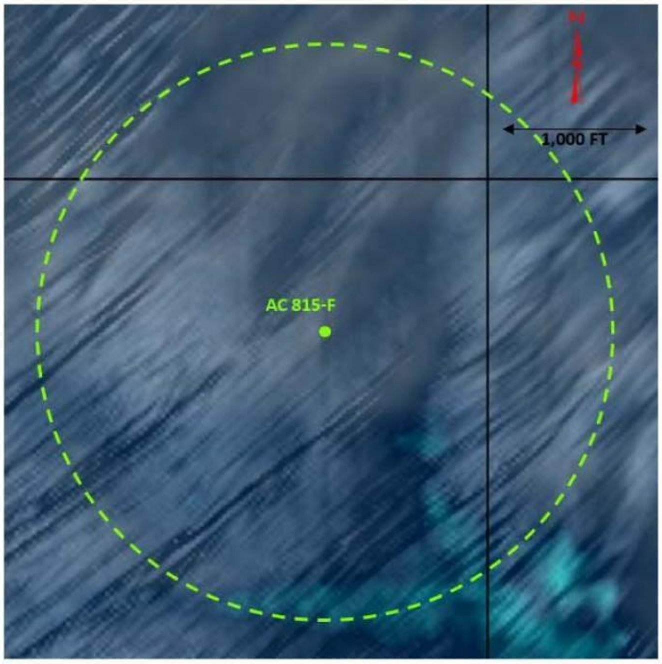
Project No. 18-03-20

B-geo



VatMAX amplitude extraction: Seafloor to Seafloor+0.02
Amplitude threshold for polygons = 24000

High
Seismic Amplitude
Low

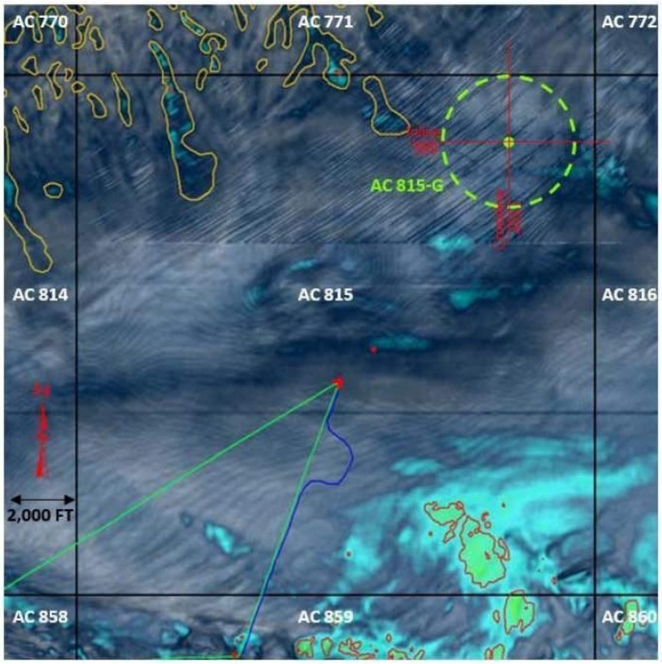


There are no BOEM waterbottom and seafloor amplitude anomalies within 2,000 ft of the proposed well AC 815-F

- ● Existing well location
- Existing oil pipeline, active
- Existing umbilical, active
- Proposed Well Location Circle Represent 2,000 ft Radius
- Seafloor amplitude anomaly
- BOEM waterbottom anomaly

Seafloor Amplitude from 3D Seismic Data

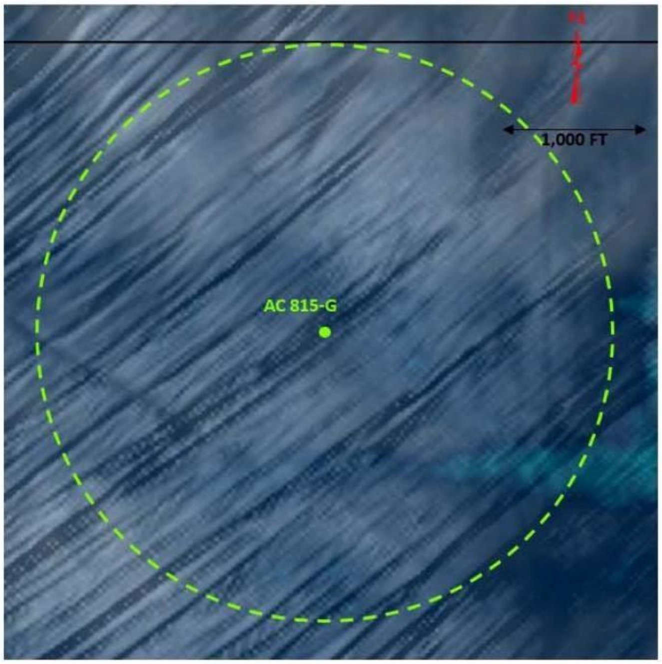
Illustration AC 815-F- 2



**VatMAX amplitude extraction: Seafloor to Seafloor+0.02**
**Amplitude threshold for polygons = 24000**

**High** **Low**

**Seismic Amplitude**



There are no BOEM waterbottom and seafloor amplitude anomalies within 2,000 ft of the proposed well AC 815-G

- ● **Existing well location**
- **Existing oil pipeline, active**
- **Existing umbilical, active**
- **Proposed Well Location Circle Represent 2,000 ft Radius**
- **Seafloor amplitude anomaly**
- **BOEM waterbottom anomaly**

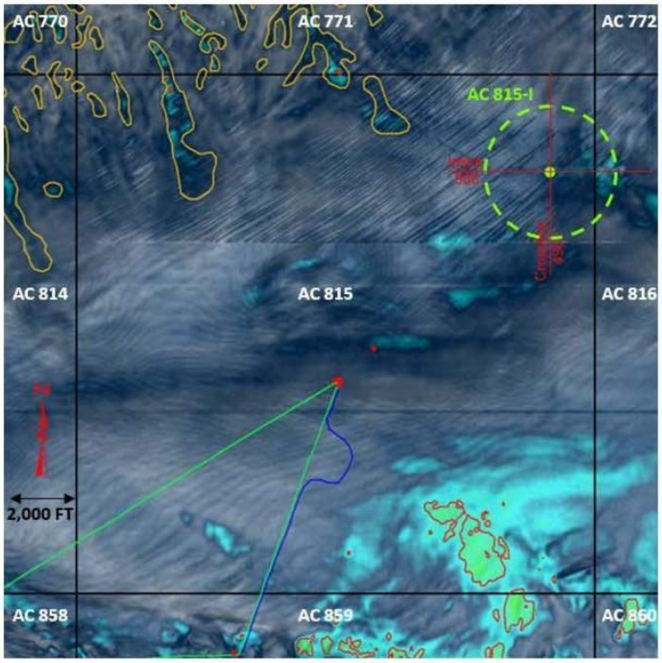
Seafloor Amplitude from 3D Seismic Data

Illustration AC 815-G- 2

**Attachment 6K – ESR – Well H**

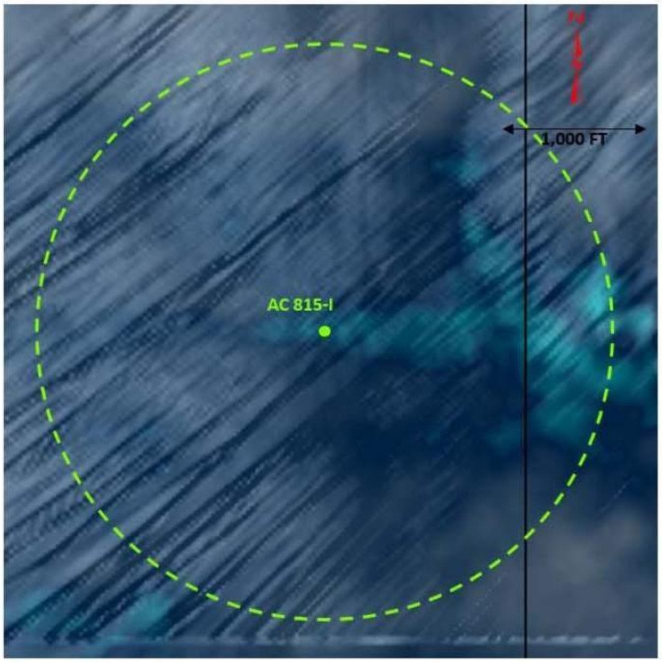
Project No. 18-03-20

B-geO



VatMAX amplitude extraction: Seafloor to Seafloor+0.02
Amplitude threshold for polygons = 24000

High — Seismic Amplitude — Low



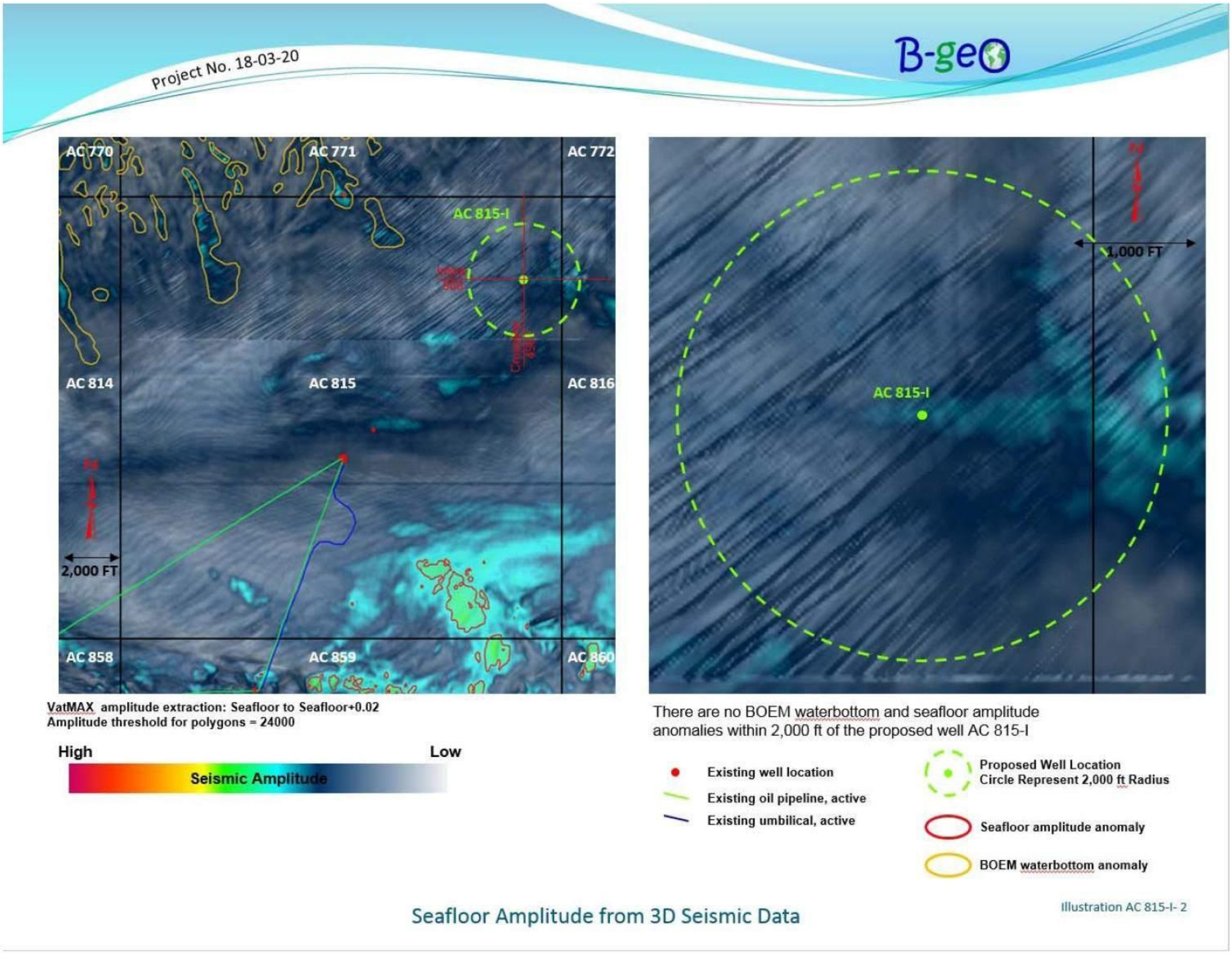
There are no BOEM waterbottom and seafloor amplitude anomalies within 2,000 ft of the proposed well AC 815-I

- ● Existing well location
- Existing oil pipeline, active
- Existing umbilical, active
- Proposed Well Location Circle Represent 2,000 ft Radius
- Seafloor amplitude anomaly
- BOEM waterbottom anomaly

Seafloor Amplitude from 3D Seismic Data

Illustration AC 815-I- 2

# Attachment 6L – ESR – Well I



Project No. 18-03-20

B-geO

VatMAX amplitude extraction: Seafloor to Seafloor+0.02
Amplitude threshold for polygons = 24000

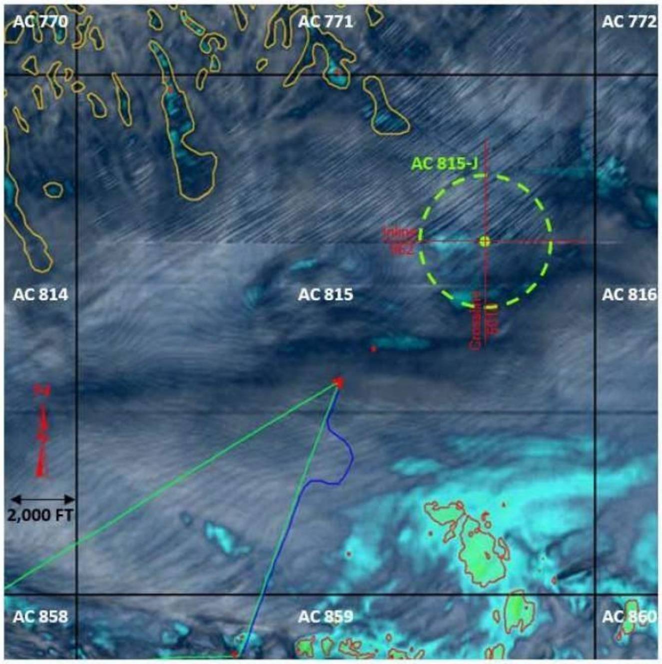
There are no BOEM waterbottom and seafloor amplitude anomalies within 2,000 ft of the proposed well AC 815-I

- ● Existing well location
- Existing oil pipeline, active
- Existing umbilical, active
- Proposed Well Location Circle Represent 2,000 ft Radius
- Seafloor amplitude anomaly
- BOEM waterbottom anomaly

Seafloor Amplitude from 3D Seismic Data

Illustration AC 815-I- 2

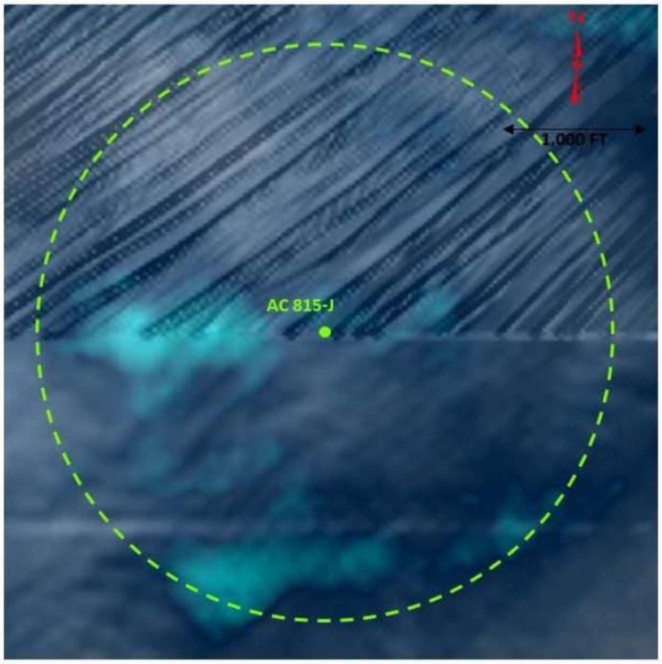
**Attachment 6M – ESR – Well J**



**VatMAX amplitude extraction: Seafloor to Seafloor+0.02**
**Amplitude threshold for polygons = 24000**

**High** **Low**

**Seismic Amplitude**



There are no BOEM waterbottom and seafloor amplitude anomalies within 2,000 ft of the proposed well AC 815-J

- ● **Existing well location**
- **Existing oil pipeline, active**
- **Existing umbilical, active**
- **Proposed Well Location Circle Represent 2,000 ft Radius**
- **Seafloor amplitude anomaly**
- **BOEM waterbottom anomaly**

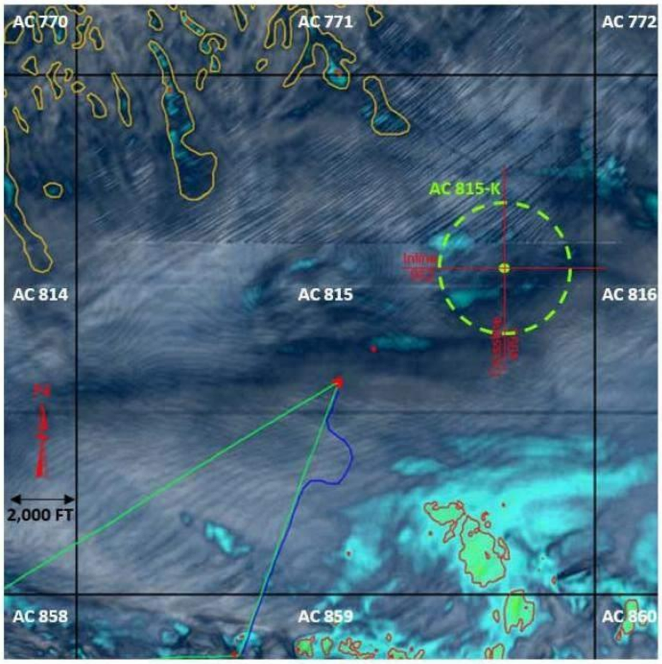
Seafloor Amplitude from 3D Seismic Data

Illustration AC 815-J- 2

**Attachment 6N – ESR – Well K**

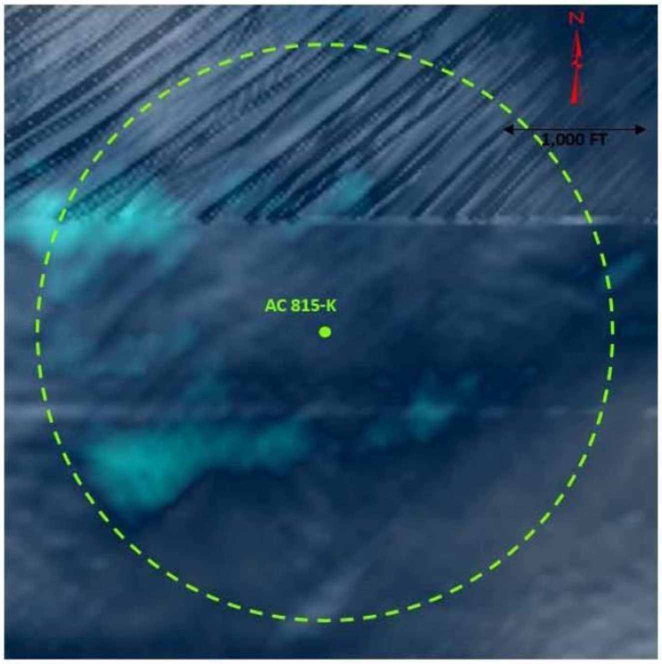
Project No. 18-03-20

B-geO



VatMAX amplitude extraction: Seafloor to Seafloor+0.02
Amplitude threshold for polygons = 24000

High Low
Seismic Amplitude



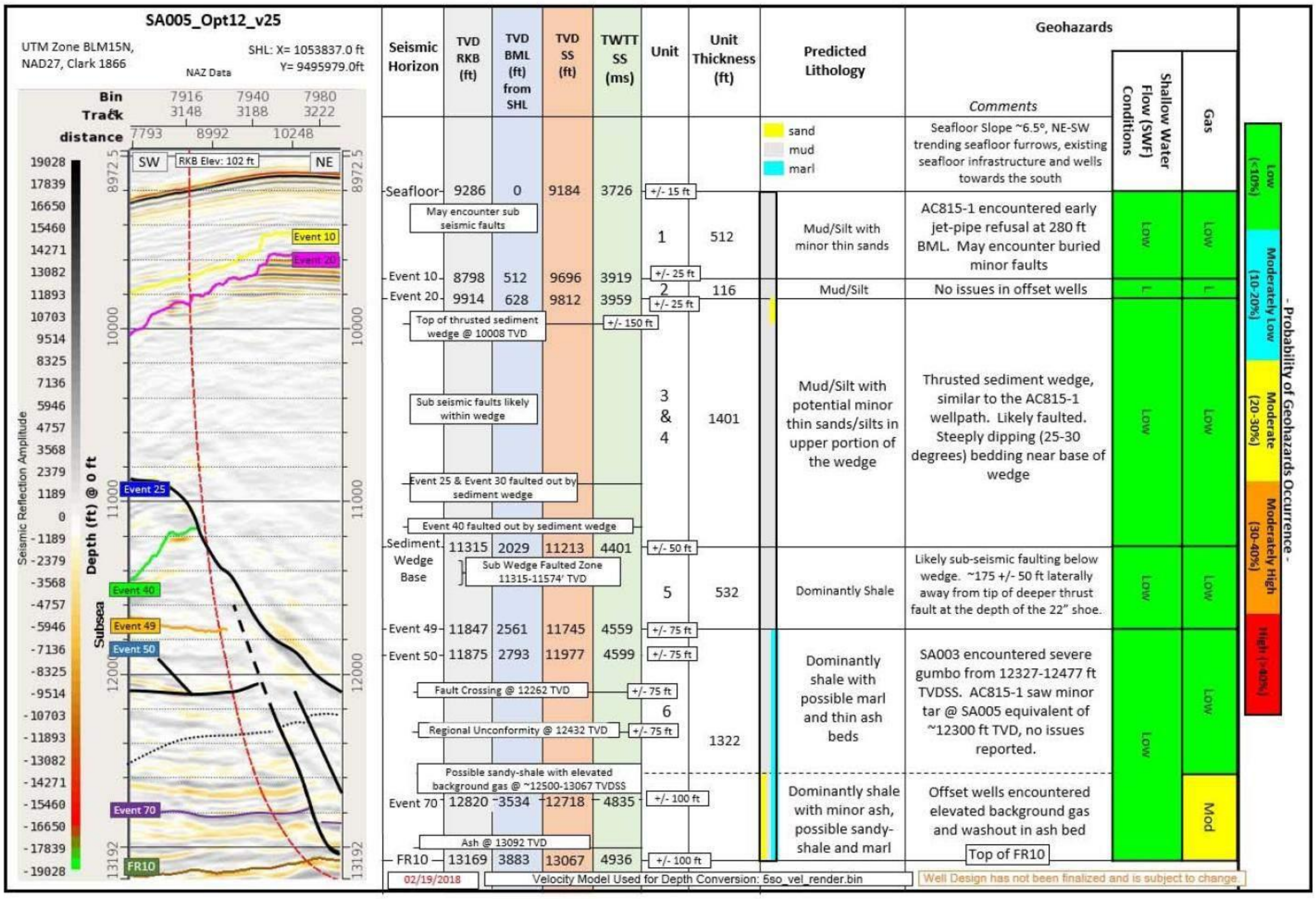
There are no BOEM waterbottom and seafloor amplitude anomalies within 2,000 ft of the proposed well AC 815-K

- ● Existing well location
- ― Existing oil pipeline, active
- ― Existing umbilical, active
- ◌ Proposed Well Location Circle Represent 2,000 ft Radius
- ○ Seafloor amplitude anomaly
- ○ BOEM waterbottom anomaly

Seafloor Amplitude from 3D Seismic Data

Illustration AC 815-K- 2

# Attachment 6O – Tophole Prog – SA5, SA5 ALT A & SA5 Alt B



**SA005_Opt12_v25**

UTM Zone BLM15N,
NAD27, Clark 1866

SHL: X= 1053837.0 ft
Y= 9495979.0ft

| Seismic Horizon | TVD RKB (ft) | TVD BML (ft) from SHL | TVD SS (ft) | TWTT SS (ms) | | Unit | Unit Thickness (ft) | Predicted Lithology | Geohazards<br>*Comments* | Shallow Water Flow (SWF) Conditions | Gas |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 🟨 sand<br>⬜ mud<br>🟦 marl | Seafloor Slope ~6.5°, NE-SW trending seafloor furrows, existing seafloor infrastructure and wells towards the south | | |
| Seafloor | 9286 | 0 | 9184 | 3726 | +/- 15 ft | | | | | | |
| May encounter sub seismic faults | | | | | | 1 | 512 | Mud/Silt with minor thin sands | AC815-1 encountered early jet-pipe refusal at 280 ft BML. May encounter buried minor faults | Low | Low |
| Event 10 | 8798 | 512 | 9696 | 3919 | +/- 25 ft | 2 | 116 | Mud/Silt | No issues in offset wells | L | L |
| Event 20 | 9914 | 628 | 9812 | 3959 | +/- 25 ft | | | | | | |
| Top of thrusted sediment wedge @ 10008 TVD | | | | | +/- 150 ft | 3 & 4 | 1401 | Mud/Silt with potential minor thin sands/silts in upper portion of the wedge | Thrusted sediment wedge, similar to the AC815-1 wellpath. Likely faulted. Steeply dipping (25-30 degrees) bedding near base of wedge | Low | Low |
| Sub seismic faults likely within wedge | | | | | | | | | | | |
| Event 25 & Event 30 faulted out by sediment wedge | | | | | | | | | | | |
| Event 40 faulted out by sediment wedge | | | | | | | | | | | |
| Sediment Wedge Base | 11315 | 2029 | 11213 | 4401 | +/- 50 ft | 5 | 532 | Dominantly Shale | Likely sub-seismic faulting below wedge. ~175 +/- 50 ft laterally away from tip of deeper thrust fault at the depth of the 22" shoe. | Low | Low |
| Sub Wedge Faulted Zone 11315-11574' TVD | | | | | | | | | | | |
| Event 49 | 11847 | 2561 | 11745 | 4559 | +/- 75 ft | 6 | 1322 | Dominantly shale with possible marl and thin ash beds | SA003 encountered severe gumbo from 12327-12477 ft TVDSS. AC815-1 saw minor tar @ SA005 equivalent of ~12300 ft TVD, no issues reported. | Low | Low |
| Event 50 | 11875 | 2793 | 11977 | 4599 | +/- 75 ft | | | | | | |
| Fault Crossing @ 12262 TVD | | | | | +/- 75 ft | | | | | | |
| Regional Unconformity @ 12432 TVD | | | | | +/- 75 ft | | | | | | |
| Possible sandy-shale with elevated background gas @ ~12500-13067 TVDSS | | | | | | | | Dominantly shale with minor ash, possible sandy-shale and marl | Offset wells encountered elevated background gas and washout in ash bed | | Mod |
| Event 70 | 12820 | 3534 | 12718 | 4835 | +/- 100 ft | | | | | | |
| Ash @ 13092 TVD | | | | | | | | | | | |
| FR10 | 13169 | 3883 | 13067 | 4936 | +/- 100 ft | | | | Top of FR10 | | |

- Probability of Geohazards Occurrence -

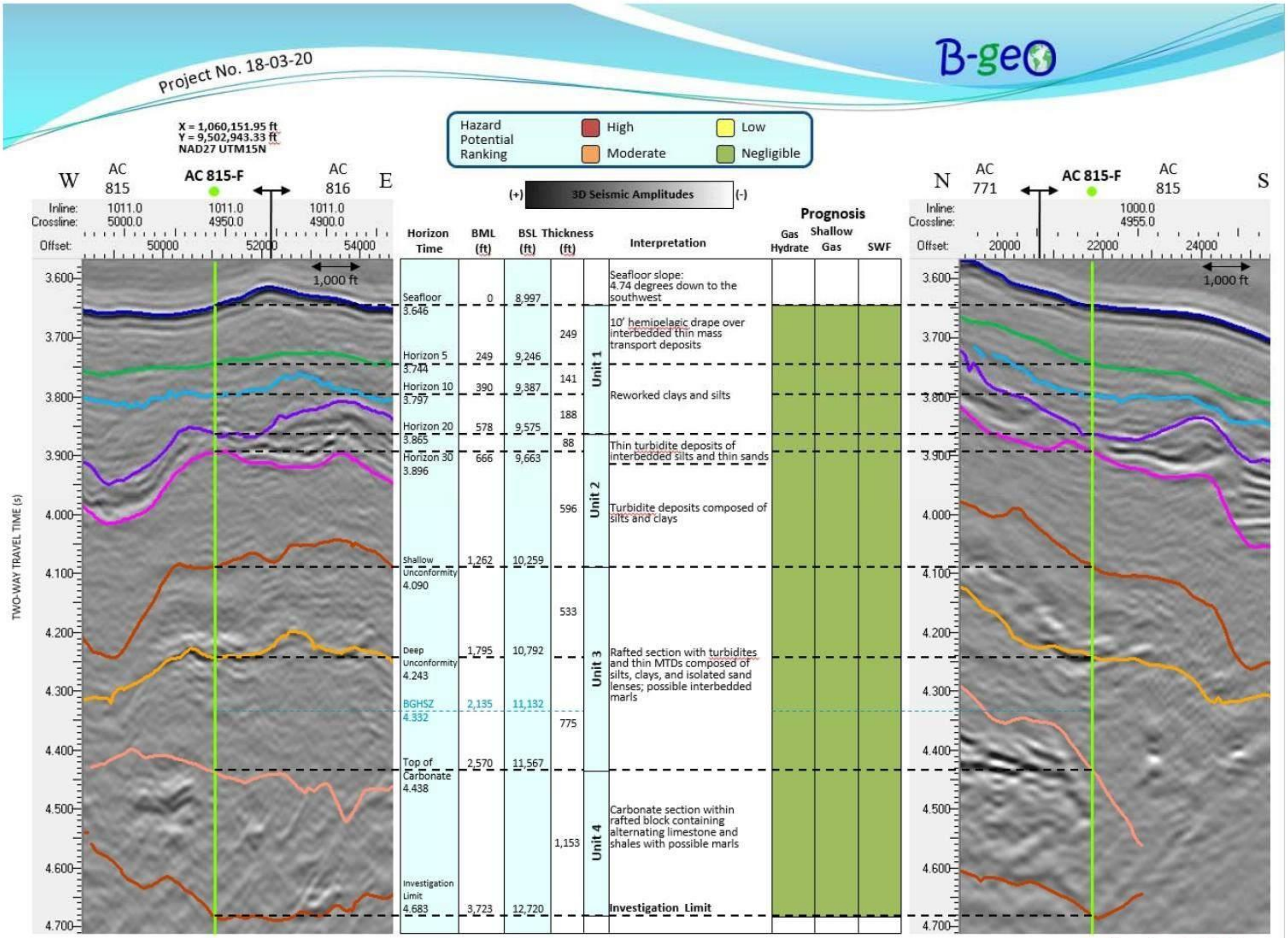
- 🟩 Low (<10%)
- 🟦 Moderately Low (10-20%)
- 🟨 Moderate (20-30%)
- 🟧 Moderately High (30-40%)
- 🟥 High (>40%)

02/19/2018

Velocity Model Used for Depth Conversion: 5so_vel_render.bin

Well Design has not been finalized and is subject to change.

# Attachment 6P – Tophole Prog – Well F

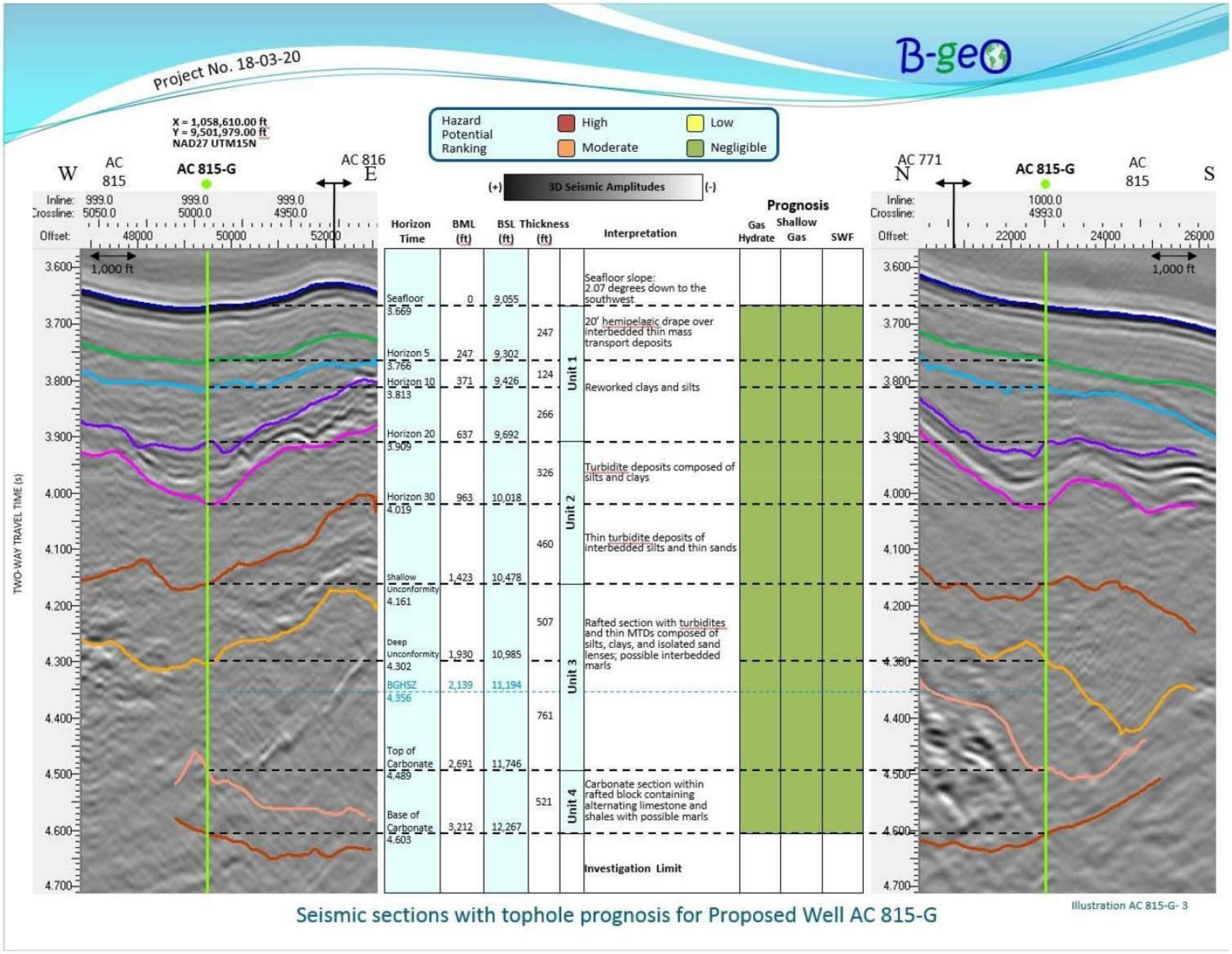


| Horizon Time | BML (ft) | BSL (ft) | Thickness (ft) | | Interpretation | Prognosis Gas Hydrate | Prognosis Shallow Gas | Prognosis SWF |
|---|---|---|---|---|---|---|---|---|
| | | | | | Seafloor slope: 4.74 degrees down to the southwest | | | |
| Seafloor 3.646 | 0 | 8,997 | | | | | | |
| | | | 249 | Unit 1 | 10' hemipelagic drape over interbedded thin mass transport deposits | 🟩 | 🟩 | 🟩 |
| Horizon 5 3.744 | 249 | 9,246 | | | | | | |
| | | | 141 | | Reworked clays and silts | 🟩 | 🟩 | 🟩 |
| Horizon 10 3.797 | 390 | 9,387 | | | | | | |
| | | | 188 | | | 🟩 | 🟩 | 🟩 |
| Horizon 20 3.865 | 578 | 9,575 | | | | | | |
| | | | 88 | Unit 2 | Thin turbidite deposits of interbedded silts and thin sands | 🟩 | 🟩 | 🟩 |
| Horizon 30 3.896 | 666 | 9,663 | | | | | | |
| | | | 596 | | Turbidite deposits composed of silts and clays | 🟩 | 🟩 | 🟩 |
| Shallow Unconformity 4.090 | 1,262 | 10,259 | | | | | | |
| | | | 533 | Unit 3 | | 🟩 | 🟩 | 🟩 |
| Deep Unconformity 4.243 | 1,795 | 10,792 | | | Rafted section with turbidites and thin MTDs composed of silts, clays, and isolated sand lenses; possible interbedded marls | 🟩 | 🟩 | 🟩 |
| BGHSZ 4.332 | 2,135 | 11,132 | | | | | | |
| | | | 775 | | | 🟩 | 🟩 | 🟩 |
| Top of Carbonate 4.438 | 2,570 | 11,567 | | | | | | |
| | | | 1,153 | Unit 4 | Carbonate section within rafted block containing alternating limestone and shales with possible marls | 🟩 | 🟩 | 🟩 |
| Investigation Limit 4.683 | 3,723 | 12,720 | | | **Investigation Limit** | | | |

Seismic sections with tophole prognosis for Proposed Well AC 815-F

Illustration AC 815-F- 3

# Attachment 6Q – Tophole Prog – Well G



Project No. 18-03-20

X = 1,058,610.00 ft
Y = 9,501,979.00 ft
NAD27 UTM15N

Hazard Potential Ranking

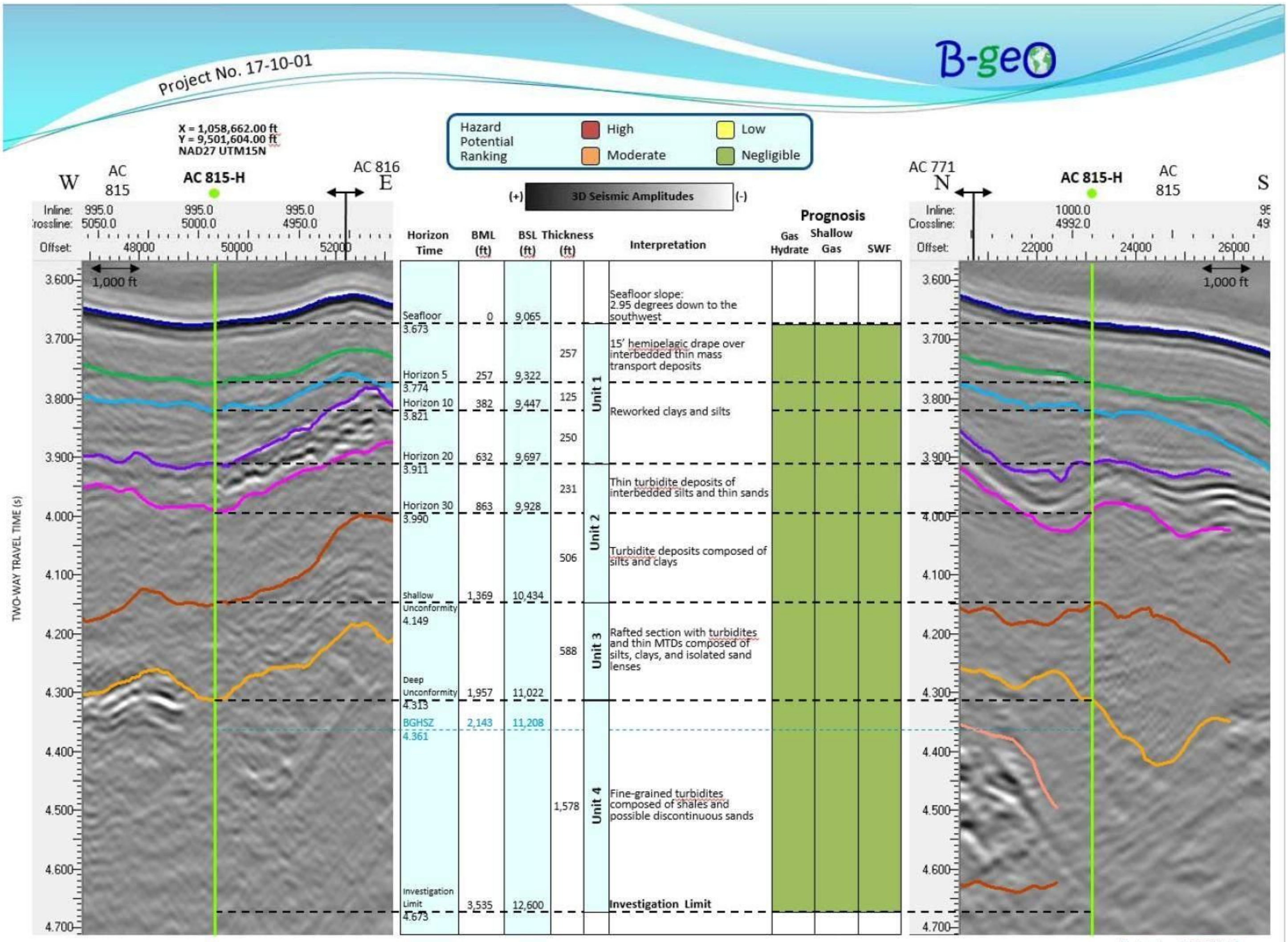
| | | | |
|---|---|---|---|
| 🟥 | High | 🟨 | Low |
| 🟧 | Moderate | 🟩 | Negligible |

| Horizon Time | BML (ft) | BSL (ft) | Thickness (ft) | | Interpretation | Prognosis Gas Hydrate | Prognosis Shallow Gas | Prognosis SWF |
|---|---|---|---|---|---|---|---|---|
| | | | | | Seafloor slope: 2.07 degrees down to the southwest | | | |
| Seafloor 3.669 | 0 | 9,055 | | Unit 1 | | 🟩 | 🟩 | 🟩 |
| | | | 247 | | 20' hemipelagic drape over interbedded thin mass transport deposits | 🟩 | 🟩 | 🟩 |
| Horizon 5 3.766 | 247 | 9,302 | | | | 🟩 | 🟩 | 🟩 |
| | | | 124 | | Reworked clays and silts | 🟩 | 🟩 | 🟩 |
| Horizon 10 3.813 | 371 | 9,426 | | | | 🟩 | 🟩 | 🟩 |
| | | | 266 | | | 🟩 | 🟩 | 🟩 |
| Horizon 20 3.909 | 637 | 9,692 | | Unit 2 | | 🟩 | 🟩 | 🟩 |
| | | | 326 | | Turbidite deposits composed of silts and clays | 🟩 | 🟩 | 🟩 |
| Horizon 30 4.019 | 963 | 10,018 | | | | 🟩 | 🟩 | 🟩 |
| | | | 460 | | Thin turbidite deposits of interbedded silts and thin sands | 🟩 | 🟩 | 🟩 |
| Shallow Unconformity 4.161 | 1,423 | 10,478 | | Unit 3 | | 🟩 | 🟩 | 🟩 |
| | | | 507 | | Rafted section with turbidites and thin MTDs composed of silts, clays, and isolated sand lenses; possible interbedded marls | 🟩 | 🟩 | 🟩 |
| Deep Unconformity 4.302 | 1,930 | 10,985 | | | | 🟩 | 🟩 | 🟩 |
| BGHSZ 4.356 | 2,139 | 11,194 | | | | 🟩 | 🟩 | 🟩 |
| | | | 761 | | | 🟩 | 🟩 | 🟩 |
| Top of Carbonate 4.489 | 2,691 | 11,746 | | Unit 4 | | 🟩 | 🟩 | 🟩 |
| | | | 521 | | Carbonate section within rafted block containing alternating limestone and shales with possible marls | 🟩 | 🟩 | 🟩 |
| Base of Carbonate 4.603 | 3,212 | 12,267 | | | | | | |
| | | | | | **Investigation Limit** | | | |

Seismic sections with tophole prognosis for Proposed Well AC 815-G

Illustration AC 815-G- 3

**Attachment 6R – Tophole Prog – Well H**

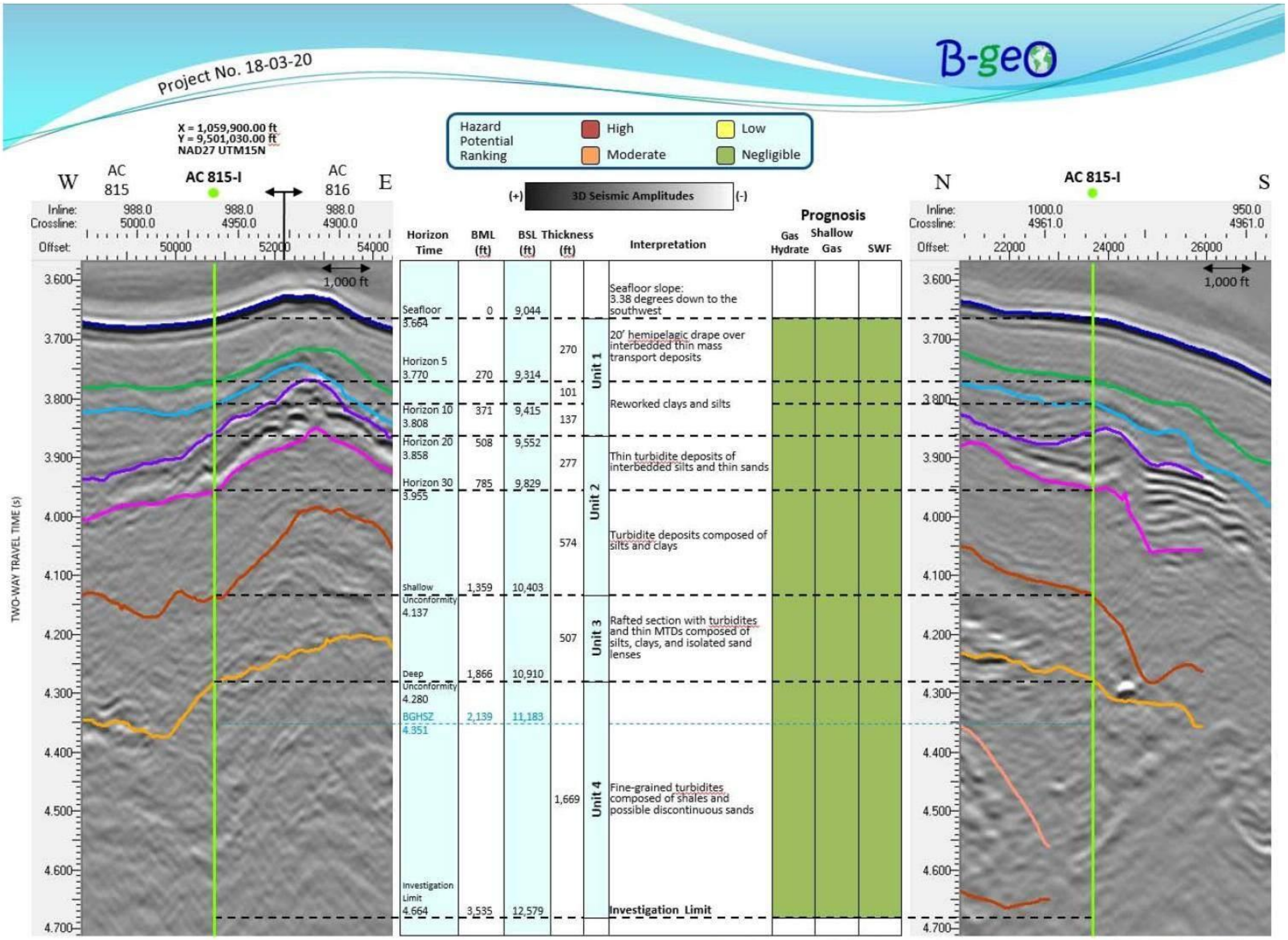


| Horizon Time | BML (ft) | BSL (ft) | Thickness (ft) | | Interpretation | Prognosis Gas Hydrate | Prognosis Shallow Gas | Prognosis SWF |
|---|---|---|---|---|---|---|---|---|
| | | | | | Seafloor slope: 2.95 degrees down to the southwest | | | |
| Seafloor 3.673 | 0 | 9,065 | | | | | | |
| | | | 257 | Unit 1 | 15' hemipelagic drape over interbedded thin mass transport deposits | 🟩 | 🟩 | 🟩 |
| Horizon 5 3.774 | 257 | 9,322 | | | | | | |
| | | | 125 | | Reworked clays and silts | 🟩 | 🟩 | 🟩 |
| Horizon 10 3.821 | 382 | 9,447 | | | | | | |
| | | | 250 | | | 🟩 | 🟩 | 🟩 |
| Horizon 20 3.911 | 632 | 9,697 | | | | | | |
| | | | 231 | Unit 2 | Thin turbidite deposits of interbedded silts and thin sands | 🟩 | 🟩 | 🟩 |
| Horizon 30 3.990 | 863 | 9,928 | | | | | | |
| | | | 506 | | Turbidite deposits composed of silts and clays | 🟩 | 🟩 | 🟩 |
| Shallow Unconformity 4.149 | 1,369 | 10,434 | | | | | | |
| | | | 588 | Unit 3 | Rafted section with turbidites and thin MTDs composed of silts, clays, and isolated sand lenses | 🟩 | 🟩 | 🟩 |
| Deep Unconformity 4.313 | 1,957 | 11,022 | | | | | | |
| BGHSZ 4.361 | 2,143 | 11,208 | | Unit 4 | | 🟩 | 🟩 | 🟩 |
| | | | 1,578 | | Fine-grained turbidites composed of shales and possible discontinuous sands | 🟩 | 🟩 | 🟩 |
| Investigation Limit 4.673 | 3,535 | 12,600 | | | **Investigation Limit** | | | |

Seismic sections with tophole prognosis for Proposed Well AC 815-H

Illustration AC 772-H- 3

**Attachment 6S – Tophole Prog – Well I**

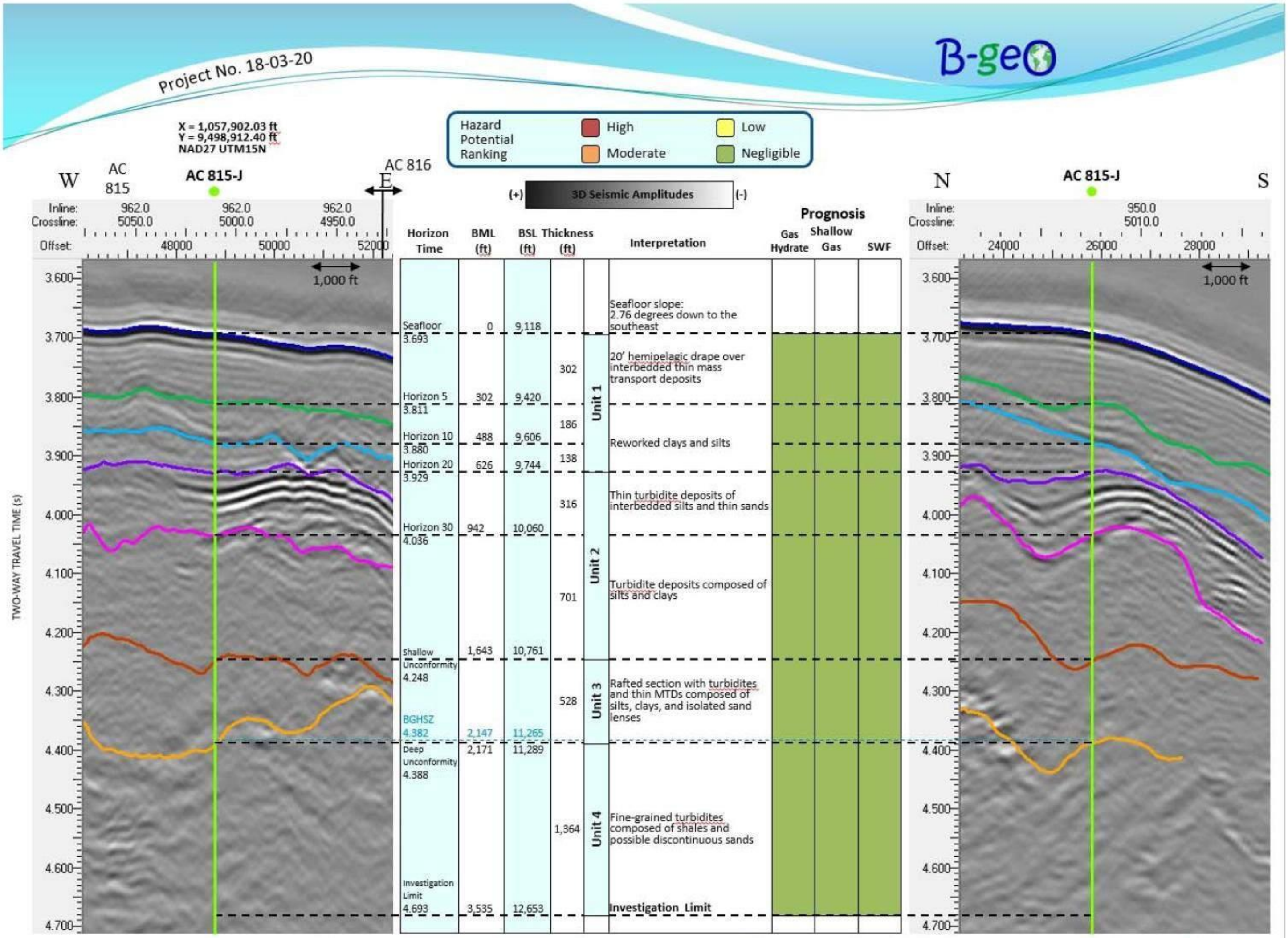


| Horizon Time | BML (ft) | BSL (ft) | Thickness (ft) | | Interpretation | Gas Hydrate | Shallow Gas | SWF |
|---|---|---|---|---|---|---|---|---|
| Seafloor 3.664 | 0 | 9,044 | | | Seafloor slope: 3.38 degrees down to the southwest | | | |
| Horizon 5 3.770 | 270 | 9,314 | 270 | Unit 1 | 20' hemipelagic drape over interbedded thin mass transport deposits | 🟩 | 🟩 | 🟩 |
| Horizon 10 3.808 | 371 | 9,415 | 101 | | Reworked clays and silts | 🟩 | 🟩 | 🟩 |
| Horizon 20 3.858 | 508 | 9,552 | 137 | | | 🟩 | 🟩 | 🟩 |
| Horizon 30 3.955 | 785 | 9,829 | 277 | Unit 2 | Thin turbidite deposits of interbedded silts and thin sands | 🟩 | 🟩 | 🟩 |
| Shallow Unconformity 4.137 | 1,359 | 10,403 | 574 | | Turbidite deposits composed of silts and clays | 🟩 | 🟩 | 🟩 |
| Deep Unconformity 4.280 | 1,866 | 10,910 | 507 | Unit 3 | Rafted section with turbidites and thin MTDs composed of silts, clays, and isolated sand lenses | 🟩 | 🟩 | 🟩 |
| BGHSZ 4.351 | 2,139 | 11,183 | | | | 🟩 | 🟩 | 🟩 |
| Investigation Limit 4.664 | 3,535 | 12,579 | 1,669 | Unit 4 | Fine-grained turbidites composed of shales and possible discontinuous sands<br>**Investigation Limit** | 🟩 | 🟩 | 🟩 |

Seismic sections with tophole prognosis for Proposed Well AC 815-I

Illustration AC 815-I- 3

# Attachment 6T – Tophole Prog – Well J

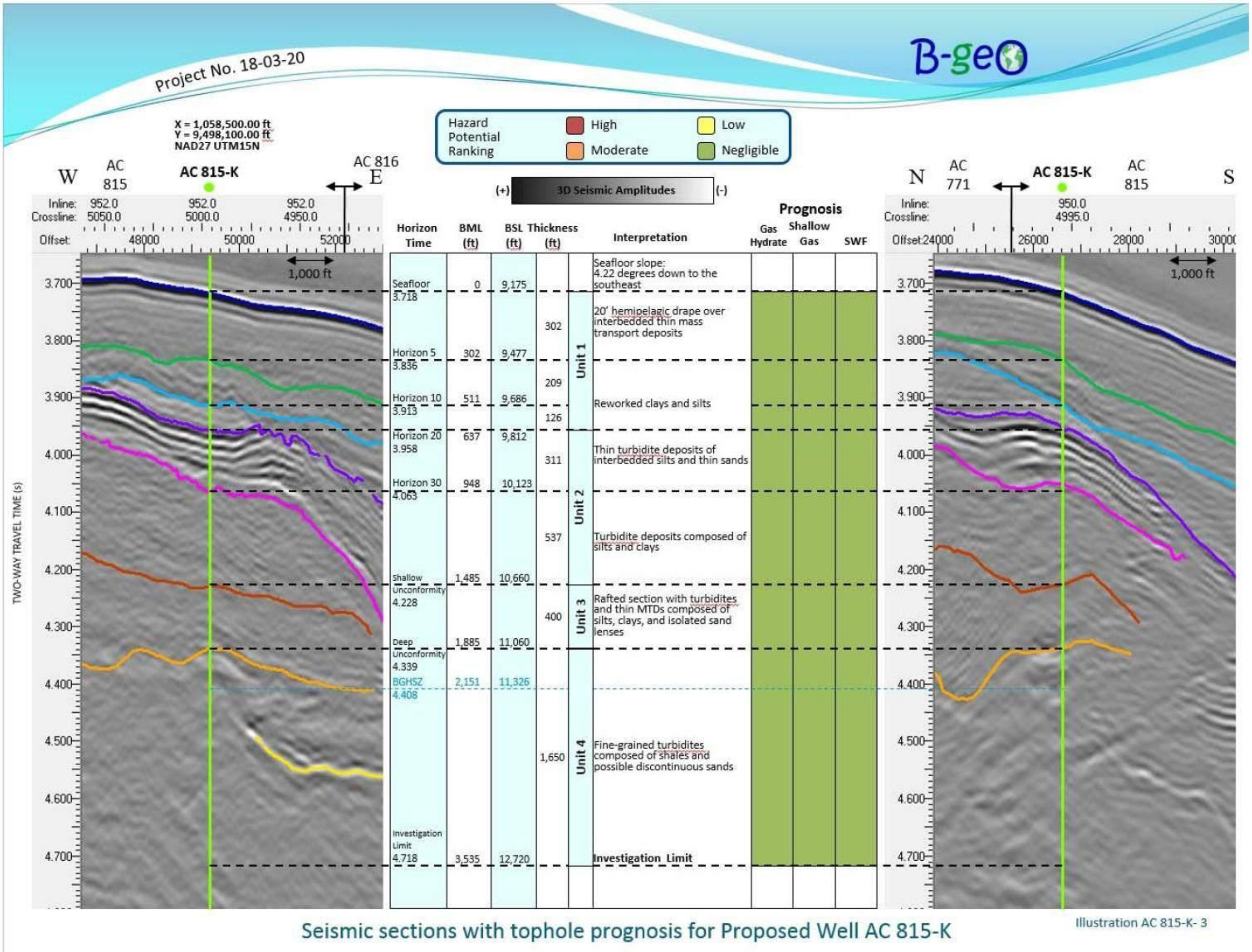


| Horizon Time | BML (ft) | BSL (ft) | Thickness (ft) | | Interpretation | Prognosis<br>Gas Hydrate | Prognosis<br>Shallow Gas | Prognosis<br>SWF |
|---|---|---|---|---|---|---|---|---|
| | | | | | Seafloor slope:<br>2.76 degrees down to the southeast | | | |
| Seafloor<br>3.693 | 0 | 9,118 | | | | | | |
| | | | 302 | Unit 1 | 20' hemipelagic drape over interbedded thin mass transport deposits | 🟩 | 🟩 | 🟩 |
| Horizon 5<br>3.811 | 302 | 9,420 | | | | | | |
| | | | 186 | | Reworked clays and silts | 🟩 | 🟩 | 🟩 |
| Horizon 10<br>3.880 | 488 | 9,606 | | | | | | |
| | | | 138 | | | 🟩 | 🟩 | 🟩 |
| Horizon 20<br>3.929 | 626 | 9,744 | | | | | | |
| | | | 316 | Unit 2 | Thin turbidite deposits of interbedded silts and thin sands | 🟩 | 🟩 | 🟩 |
| Horizon 30<br>4.036 | 942 | 10,060 | | | | | | |
| | | | 701 | | Turbidite deposits composed of silts and clays | 🟩 | 🟩 | 🟩 |
| Shallow Unconformity<br>4.248 | 1,643 | 10,761 | | | | | | |
| | | | 528 | Unit 3 | Rafted section with turbidites and thin MTDs composed of silts, clays, and isolated sand lenses | 🟩 | 🟩 | 🟩 |
| BGHSZ<br>4.382 | 2,147 | 11,265 | | | | | | |
| Deep Unconformity<br>4.388 | 2,171 | 11,289 | | | | | | |
| | | | 1,364 | Unit 4 | Fine-grained turbidites composed of shales and possible discontinuous sands | 🟩 | 🟩 | 🟩 |
| Investigation Limit<br>4.693 | 3,535 | 12,653 | | | **Investigation Limit** | | | |

Seismic sections with tophole prognosis for Proposed Well AC 815-J

Illustration AC 815-J- 3

# Attachment 6U – Tophole Prog – Well K



| Horizon Time | BML (ft) | BSL (ft) | Thickness (ft) | | Interpretation | Gas Hydrate | Shallow Gas | SWF |
|---|---|---|---|---|---|---|---|---|
| Seafloor 3.718 | 0 | 9,175 | | | Seafloor slope: 4.22 degrees down to the southeast | | | |
| | | | 302 | Unit 1 | 20' hemipelagic drape over interbedded thin mass transport deposits | 🟩 | 🟩 | 🟩 |
| Horizon 5 3.836 | 302 | 9,477 | | | | | | |
| | | | 209 | | Reworked clays and silts | 🟩 | 🟩 | 🟩 |
| Horizon 10 3.913 | 511 | 9,686 | | | | | | |
| | | | 126 | | | 🟩 | 🟩 | 🟩 |
| Horizon 20 3.958 | 637 | 9,812 | | | | | | |
| | | | 311 | Unit 2 | Thin turbidite deposits of interbedded silts and thin sands | 🟩 | 🟩 | 🟩 |
| Horizon 30 4.063 | 948 | 10,123 | | | | | | |
| | | | 537 | | Turbidite deposits composed of silts and clays | 🟩 | 🟩 | 🟩 |
| Shallow Unconformity 4.228 | 1,485 | 10,660 | | | | | | |
| | | | 400 | Unit 3 | Rafted section with turbidites and thin MTDs composed of silts, clays, and isolated sand lenses | 🟩 | 🟩 | 🟩 |
| Deep Unconformity 4.339 | 1,885 | 11,060 | | | | | | |
| BGHSZ 4.408 | 2,151 | 11,326 | | | | | | |
| | | | 1,650 | Unit 4 | Fine-grained turbidites composed of shales and possible discontinuous sands | 🟩 | 🟩 | 🟩 |
| Investigation Limit 4.718 | 3,535 | 12,720 | | | **Investigation Limit** | | | |

Seismic sections with tophole prognosis for Proposed Well AC 815-K

Illustration AC 815-K- 3

# SECTION 7: WASTE AND DISCHARGE INFORMATION

## A. Projected Ocean Discharges

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

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

| Projected generated waste | | | Projected ocean discharges | | Projected Downhole Disposal |
|---|---|---|---|---|---|
| **Type of Waste and Composition** | **Composition** | **Projected Amount** | **Discharge rate** | **Discharge Method** | **Answer yes or no** |
| **Will drilling occur ? If yes, you should list muds and cuttings** | | | | | |
| *EXAMPLE: Cuttings wetted with ynthetic based fluid* | *Cuttings generated while using synthetic based drilling fluid.* | *X bbl/well* | *X bbl/day/well* | *discharge pipe* | *No* |
| Water-based drilling fluid | barite, additives, mud | 85000 bbls/well | 17000 bbls/day | 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 | 0 bbls / well | 0 bbls/well | Overboard discharge line below the water line | No |
| Spent drilling fluids - water based | Synthetic-based drilling mud | 0 bbls / well | 0 bbls/well | Overboard discharge line below the water line | No |
| Chemical product waste | Chemical product waste | 0 bbls / well | 0 bbls/day | Treated to meet NPDES limits and discharged overboard | No |
| Brine | brine | N/A | N/A | N/A | No |
| **Will humans be there? If yes, expect conventional waste** | | | | | |
| *EXAMPLE: Sanitary waste water* | | *X liter/person/day* | *NA* | *chlorinate and discharge* | *No* |
| Domestic waste (kitchen water, shower water) | grey water | 40000 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 | 30000 bbls/well | 150 bbls/day/well | Treated in the MSD** prior to discharge to meet NPDES limits | No |
| **Is there a deck? If yes, there will be Deck Drainage** | | | | | |
| Deck Drainage | Wash and rainwater | 4000 bbls/well | 20 bbls/day | Drained overboard through deck scuppers | No |
| **Will you conduct well treatment, completion, or workover?** | | | | | |
| well treatment fluids | Linear Frac Gel Flush Fluids, Crosslinked Frac Fluids carrying ceramic proppant and acidic breaker fluid | 750 bbls/well | 10 bbls/day | Overboard discharge line below the water level if oil and greese free and meets LC50 requirements. | No |
| well completion fluids | Completion brine contaminated with WBDM and displacement spacers | 1125 bbls/well | 15 bbls/day | Overboard discharge line below the water level if oil and greese free and meets LC50 requirements. | No |
| workover fluids | NA | NA | NA | NA | No |
| **Miscellaneous discharges. If yes, only fill in those associated with your activity.** | | | | | |
| Desalinization unit discharge | Rejected water from watermaker unit | 80000 bbls/well | 400 bbls/day/well | RO Desalinization Unit Discharge Line below waterline | No |
| Blowout preventer fluid | Water based | 40 bbls/well | 0 bbls/day | Discharge Line @ Subsea BOP @ seafloor | No |
| Ballast water | Uncontaminated seawater | 655200 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). | 308600 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 | 25000 bbls/well (assume planned 100% excess is discharged) | 200 bbls/day | Discharged at seafloor. | No |
| Fire water | Treated seawater | 13333 bbls/well | 2000 bbls/month | Discharged below waterline | No |
| Cooling water | Treated seawater | 91268600 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 |
| **Will you produce hydrocarbons? If yes fill in for produced water.** | | | | | |
| Produced water | NA | NA | NA | NA | |
| **Will you be covered by an individual or general NPDES permit ?** | | | GENERAL PERMIT | GMG290103 | |
| NOTE: If you will not have a type of waste, enter NA in the row. | | | | | |

## B. Projected Generated Wastes

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

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

| **Projected generated waste** | | **Solid and Liquid Wastes transportation** | **Waste Disposal** | | |
|---|---|---|---|---|---|
| **Type of Waste** | **Composition** | **Transport Method** | **Name/Location of Facility** | **Amount** | **Disposal Method** |
| **Will drilling occur ? If yes, fill in the muds and cuttings.** | | | | | |
| *EXAMPLE: Oil-based drilling fluid or mud* | *NA* | *NA* | *NA* | *NA* | *NA* |
| Oil-based drilling fluid or mud | NA | NA | NA | NA | NA |
| Synthetic-based drilling fluid or mud | used SBF and additives | Drums/tanks on supply boat/barges | Halliburton Drilling Fluids or MiSwaco - Fourchon, LA; Ecoserv (Fourchon, La.), R360 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), R360 Environmental Solutions (Fourchon, LA), or FCC Environmental (Fourchon, LA) | 300 bbls / well | Deep Well Injection or landfarm |
| Cuttings wetted with oil-based fluids | NA | NA | NA | NA | NA |
| Completion Fluids | Used brine, acid | Storage tank on supply boat | Halliburton, Baker Hughers, Tetra, or Superior - Fourchon, LA; Ecoserv (Fourchon, La.), R360 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. (Jeanereette, LA) | <15000 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,* | *barged in a storage bin* | *shorebase* | *z tons total* | *recycle* |
| Trash and debris - recyclables | trash and debris | various storage containers on supply boat | Omega Waste Managment, W. Patterson, LA;<br>Lamp Environmental, Hammond, LA | 200 lbs/month | Recycle |
| Trash and debris - non-recyclables | trash and debris | various storage containers on supply boat | Republic/BFI landfill, Sorrento, LA or the parish landfill, Avondale, LA | 400 lbs/month | Landfill |
| E&P Wastes | Completion and treatment wastes | various storage containers on supply boat | Ecoserv (Fourchon, La.), R360 Environmental Solutions (Fourchon, La.), or FCC Environmental (Fourchon, LA) | <60,000 bbl. | Deep Well Injection, or landfarm |
| Used oil and glycol | used oil, oily rags and pads, empty drums and cooking oil | various storage containers on supply boat | Omega Waste Managment, West Patterson, LA | 20 bbls/month | Recycle |
| Non-Hazardous Waste | paints, solvents, chemicals, completion and treatment fluids | various storage containers on supply boat | Republic/BFI landfill, Sorrento, LA<br>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 Managment, 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 |
| NOTE: If you will not have a type of waste, enter NA in the row. | | | | | |

## C. Modeling Report

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

## SECTION 8: AIR EMISSIONS INFORMATION

### A. Emissions Worksheet and Screening Questions

| Screening Questions for 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)? | X | |
| Do your emission calculations include any emission reduction measures or modified emission factors? | | X |
| Are your proposed exploration activities located east of 87.5° W longitude? | | x |
| Do you expect to encounter $H_2S$ at concentrations greater than 20 parts per million (ppm)? | | x |
| Do you propose to flare or vent natural gas for more than 48 continuous hours From any proposed well? | | x |
| Do you propose to burn produced hydrocarbon liquids? | | x |

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

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

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

**(2) Contact:** Tracy Albert, 504.425.4652, tracy.albert@shell.com

### B. Worksheets

See attached worksheets.

| | |
|---|---|
| COMPANY | Shell Offshore Inc |
| AREA | Alaminos Canyon |
| BLOCK | 815 |
| LEASE | OCS-G-18409 |
| PLATFORM | DP MODU, DP Semi |
| WELL | Whale (F, G, H, I, J, K) & Silvertip SA005, SA005 Alt-A, SA005 Alt-B |
| DISTANCE TO LAND | 144 |
| COMPANY CONTACT | Josh O'Brien |
| TELEPHONE NO. | 504-425-9097 |
| REMARKS | Whale, Silver Tip SA005-AC815-EP AQR-MODU-20180327-BOEM.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 | 42 1.4-1, 14-2, & 1 | 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

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

| COMPANY | AREA | BLOCK | LEASE | PLATFORM | WELL | | CONTACT | PHONE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| Shell Offshore Inc | Alaminos Canyon | 815 | OCS-G-18409 | | Whale (F, G, H, I, J, K) & Silvertip SA005, S | | Josh O'Brien | 504-425-9097 | Whale, Silver Tip SA005-AC815-EP AQR-MODU-20180509-BOEM 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 | 200 | 7.56 | 4.34 | 259.93 | 7.80 | 56.71 | 18.15 | 10.41 | 623.83 | 18.71 | 136.11 |
| | PRIME MOVER>600hp diesel | 10728 | 518 | 12436 | 24 | 200 | 7.56 | 4.34 | 259.93 | 7.80 | 56.71 | 18.15 | 10.41 | 623.83 | 18.71 | 136.11 |
| | PRIME MOVER>600hp diesel | 10728 | 518 | 12436 | 24 | 200 | 7.56 | 4.34 | 259.93 | 7.80 | 56.71 | 18.15 | 10.41 | 623.83 | 18.71 | 136.11 |
| | PRIME MOVER>600hp diesel | 10728 | 518 | 12436 | 24 | 200 | 7.56 | 4.34 | 259.93 | 7.80 | 56.71 | 18.15 | 10.41 | 623.83 | 18.71 | 136.11 |
| | PRIME MOVER>600hp diesel | 10728 | 518 | 12436 | 24 | 200 | 7.56 | 4.34 | 259.93 | 7.80 | 56.71 | 18.15 | 10.41 | 623.83 | 18.71 | 136.11 |
| | PRIME MOVER>600hp diesel | 10728 | 518 | 12436 | 24 | 200 | 7.56 | 4.34 | 259.93 | 7.80 | 56.71 | 18.15 | 10.41 | 623.83 | 18.71 | 136.11 |
| | Energency Generator>600hp diesel | 2547 | 123 | 2952 | 1 | 200 | 1.80 | 1.03 | 61.71 | 1.85 | 13.46 | 0.18 | 0.10 | 6.17 | 0.19 | 1.35 |
| | Emergency Air Compressor< 600hp | 26 | 1 | 30 | 1 | 200 | 0.06 | 0.01 | 0.80 | 0.06 | 0.17 | 0.01 | 0.00 | 0.08 | 0.01 | 0.02 |
| | All other rig-equipment is electric (e.g cranes) or negligible in emissions potential (e.g. life boats, welding equipment, etc.) | | | | | | | | | | | | | | | |
| | Supply Vessel>600hp diesel (gener | 10100 | 488 | 11708 | 24 | 200 | 7.12 | 4.08 | 244.71 | 7.34 | 53.39 | 17.09 | 9.80 | 587.31 | 17.62 | 128.14 |
| | Supply Vessel>600hp diesel (riserle | 10100 | 488 | 11708 | 24 | 10 | 7.12 | 4.08 | 244.71 | 7.34 | 53.39 | 0.85 | 0.49 | 29.37 | 0.88 | 6.41 |
| | Supply Vessel>600hp diesel (riserle | 10100 | 488 | 11708 | 24 | 10 | 7.12 | 4.08 | 244.71 | 7.34 | 53.39 | 0.85 | 0.49 | 29.37 | 0.88 | 6.41 |
| | Crew Vessel>600hp diesel | 8000 | 386 | 9274 | 24 | 60 | 5.64 | 3.23 | 193.83 | 5.81 | 42.29 | 4.06 | 2.33 | 139.56 | 4.19 | 30.45 |
| | Frac Boat Engines >600hp diesel | 12100 | 584 | 14026 | 24 | 20 | 8.53 | 4.89 | 293.17 | 8.80 | 63.96 | 2.05 | 1.17 | 70.36 | 2.11 | 15.35 |
| | Frac Boat-Completion Equipment > | 16500 | 797 | 19127 | 24 | 20 | 11.63 | 6.67 | 399.78 | 11.99 | 87.22 | 2.79 | 1.60 | 95.95 | 2.88 | 20.93 |
| 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 | 10 | | 0.84 | 101.39 | 85.63 | 551.67 | | 0.10 | 12.17 | 10.28 | 66.20 |
| | AHV / MPS Vessel>600 hp diesel | 13500 | 652 | 15649 | 24 | 10 | 9.52 | 5.46 | 327.09 | 9.81 | 71.37 | 1.14 | 0.65 | 39.25 | 1.18 | 8.56 |
| | Main Tug Boat Vessel>600 hp | 10100 | 488 | 11708 | 24 | 10 | 7.12 | 4.08 | 244.71 | 7.34 | 53.39 | 0.85 | 0.49 | 29.37 | 0.88 | 6.41 |
| | Tug Boat Vessel>600 hp | 4500 | 217 | 5216 | 24 | 10 | 3.17 | 1.82 | 109.03 | 3.27 | 23.79 | 0.38 | 0.22 | 13.08 | 0.39 | 2.85 |
| | Tug Boat Vessel>600 hp | 4500 | 217 | 5216 | 24 | 10 | 3.17 | 1.82 | 109.03 | 3.27 | 23.79 | 0.38 | 0.22 | 13.08 | 0.39 | 2.85 |
| | MISC. | BPD | SCF/HR | COUNT | | | | | | | | | | | | |
| | TANK-BARGE | 15000 | | | 24 | 10 | | | | 18.75 | | | | | 2.25 | |
| | TANK-500BBL | 15000 | | | 24 | 10 | | | | 18.75 | | | | | 2.25 | |
| | TANK-100BBL | 15000 | | | 24 | 10 | | | | 18.75 | | | | | 2.25 | |
| | FUGITIVES- | | | 452 | | 6 | | | | 0.23 | | | | | 0.02 | |
| | 2018-2026 ANNUAL TOTAL | | | | | | 117.35 | 68.12 | 4134.27 | 263.13 | 1431.57 | 139.52 | 80.11 | 4808.10 | 160.92 | 1112.59 |
| EXEMPTION CALCULATION | DISTANCE FROM LAND IN MILES | | | | | | | | | | | 4895.10 | 4895.10 | 4895.10 | 4895.10 | 94701.56 |
| | 147.0 | | | | | | | | | | | | | | | |

NOTE - Emissions for MODU activities are estimated at the Potential to Emit (no fuel reduction measures). Similar to wireline, cementing and other eqpt. not listed above, equipment is proposed for these well tests and would also be included in "unlisted" but fuel-monitored eqpt.

| COMPANY | AREA | BLOCK | LEASE | PLATFORM | WELL |
|---|---|---|---|---|---|
| Shell Offshore Inc | Alaminos Canyon | 815 | OCS-G-18409 | DP MODU, DP Semi | Whale (F, G, H, I, J, K) & Silvertip SA005, SA005 Alt-A, SA005 Alt-B |
| **Year** | **Emitted** |  |  | **Substance** |  |
|  | **PM** | **SOx** | **NOx** | **VOC** | **CO** |
|  |  |  | **AQR Emissions if DP MODU(Semi-sub or Drillship) is Utilized** |  |  |
| **2018-2026** | **139.52** | **80.11** | **4808.10** | **160.92** | **1112.59** |
| **Allowable** | **4895.10** | **4895.10** | **4895.10** | **4895.10** | **94701.56** |

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 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 on June 29, 2017 and the biannual review was found to be in compliance by BSEE on November 2, 2017.

Spill Response sites are as follows:

| Primary Response Equipment Locations | Preplanned Staging Location(s) |
|---|---|
| Venice, LA; Ft. Jackson, LA; Harvey, LA; Stennis, MS; Pascagoula, MS, Galveston, TX | Venice, LA; Pacagouls, MS ; Mobile, AL, Galveston, TX |

*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.

| Category | Regional OSRP | EP |
|---|---|---|
| Type of Activity | Drilling | Drilling |
| Facility Location (area/block) | MC 812 | AC 772 |
| Facility Designation | Subsea well B◇ | Subsea well C◇◇ |
| Distance to Nearest Shoreline (miles) | 59 | 148 |
| Volume<br>Storage tanks (total)<br>Flowlines (on facility)<br>Pipelines<br>Uncontrolled blowout (volume per day)<br>Total Volume | <br>N/A<br>N/A<br>N/A<br>468,000* BOPD<br>468,000 Bbls | <br>N/A<br>N/A<br>N/A<br>71,000** BOPD<br>71,000 Bbls |
| Type of Oil(s) - (crude oil, condensate, diesel) | Crude oil | Crude oil |
| API Gravity(s) | 31º | 39.1º |

*Table 9.2 - Worst Case Scenario Determination*

***24 hour rate (432,000 BOPD 30 day average)**
****24 hour rate (53,300 BOPD 30 day average)**

◇This number was accepted by BOEM in plan N-9840.
◇◇This number was accepted by BOEM in plan N-9899.

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

Shell did not model a potential oil or hazardous substance spill for operations proposed in this plan.

## 9B. Oil Spill Response Discussion

### 1. Volume of the Worst-Case Discharge

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

### 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 815 | 19409 | 27 | Cameron, TX | 2 |
| | | | Willacy, TX | 1 |
| | | | Kenedy, TX | 4 |
| | | | Kleberg, TX | 3 |
| | | | Nueces, TX | 2 |
| | | | Aransas, TX | 3 |
| | | | Calhoun, TX | 3 |
| | | | **Matagorda, TX** | **7** |
| | | | Brazoria, TX | 2 |
| | | | Galveston, TX | 3 |
| | | | Jefferson, TX | 1 |
| | | | Cameron, LA | 3 |
| | | | Vermilion, LA | 1 |

*Table 9.C.1 Probability of Land Segment Impact*

## C. Resource Identification

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

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

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

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

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

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

## D. Worst Case Discharge Response

Shell will make every effort to respond to the AC 815 Worst Case Discharge as effectively as possible. Below is a table outlining the applicable evaporation and surface dispersion quantity:

| Alaminos Canyon Block 857 | | Calculations (BBLS) |
|---|---|---|
| **i.** | **TOTAL WCD (based on 30 day average (per day))** | **53,300** |
| **ii.** | Loss of volume of oil to natural surface dispersion and evaporation base (approximate bbls per day)*<br>(17% Natural surface evaporation and dispersion in 24 hrs) | -8,670 |
| | **TOTAL REMAINING** | **~44,630** |

* As this scenario involves a surface blowout onboard the platform, an ADIOS 2 Model was ran to account for surface dispersion and evaporation.

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

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

| | |
|---|---|
| **MSRC OSRV** | 8 foot seas |
| **VOSS System** | 4 foot seas |
| **Expandi Boom** | 6 foot seas, 20 knot winds |
| **Dispersants** | Winds more than 25 knots,<br>Visibility less than 3 nautical miles, or<br>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 17 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 857 will be addressed in Shell's NTL10 submission at the time the APD is submitted.

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

**Mechanical Recovery (skimming):** Response strategies include skimming utilizing available OSROs Oil Spill Response Vessels (OSRVs), Oil Spill Response Barges (OSRBs), ID Boats, and Quick Strike OSRVs. There is a combined de-rated recovery rate capability of approximately 424,000 barrels/day. Temporary storage associated with the identified skimming and temporary storage equipment equals approximately 197,000 barrels.

| | De-rated Recovery Rate (bopd) | Storage (bbls) |
|---|---|---|
| Offshore Recovery and Storage | 78,026 | 181,695 |
| Nearshore Recovery and Storage | 346,415 | 15,679 |
| Total | 424,441 | 197,374 |

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

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

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

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

Table 9.D.6 Aerial Surveillance Activation List

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

Table 9.D.7 Offshore Aerial Dispersant Activation List

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

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

**Subsea Dispersant:** Shell has contracted with MWCC and Wild Well Control for 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 2005-N05. Response techniques will utilize new learnings from Macondo response to include in-situ burning and subsea dispersant application. Mechanical recovery advancements are continuing to be made to incorporate utilization of Koseq arms outfitted on barges, conversion of Platform Support Vessels for Oil Spill Response, and inclusion of nighttime spill detection radar to improve tracking capabilities (X-Band radar, Infrared sensing, etc.). In addition, new response technologies/techniques are continuing to be considered by Shell and the appropriate government organizations for incorporation into our planned response. Any additional response technologies/techniques presented at the time of response will be used at the discretion of the Unified Command and USCG.

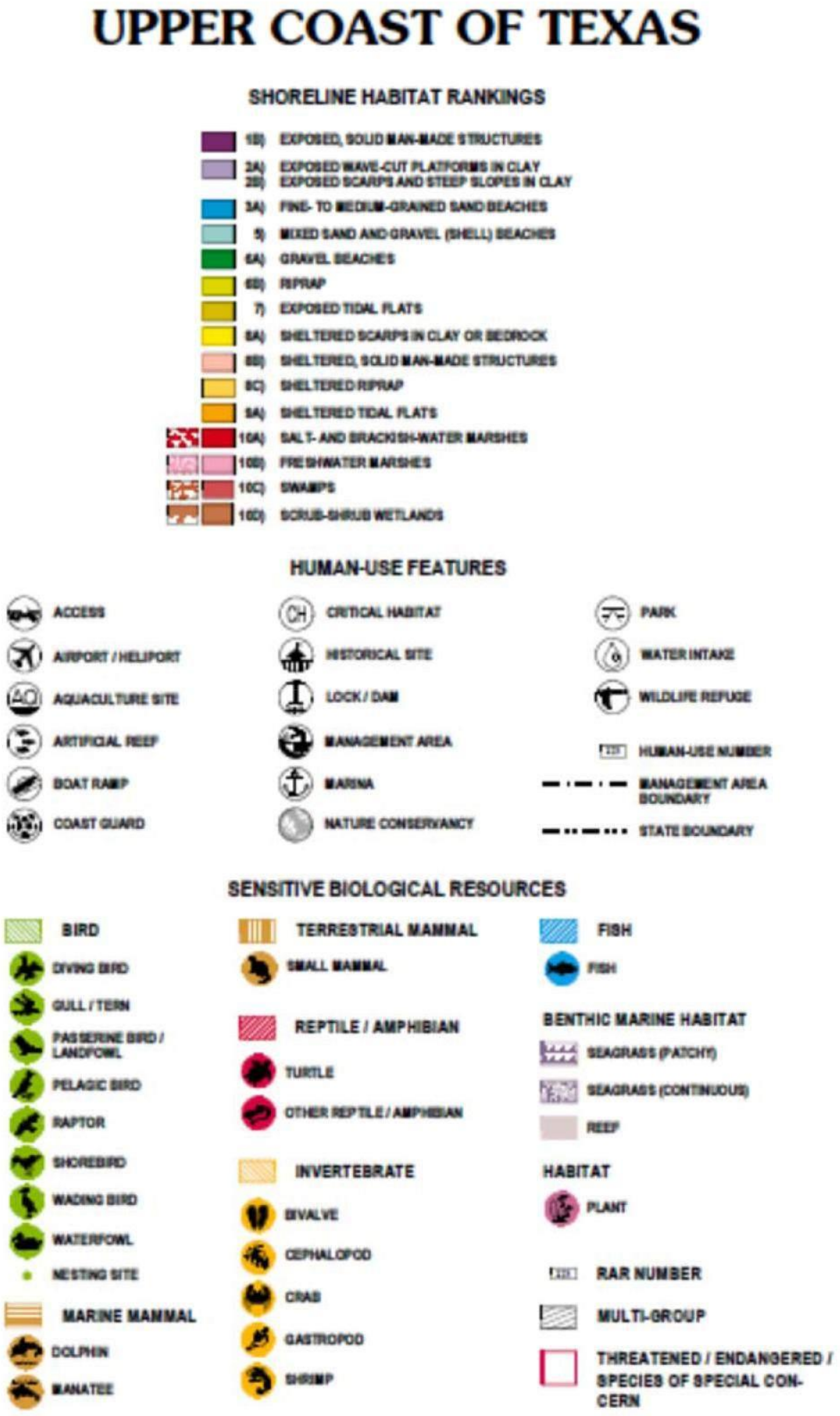


Figure 9.C.1 Environmental Sensitivity Index Map Legend

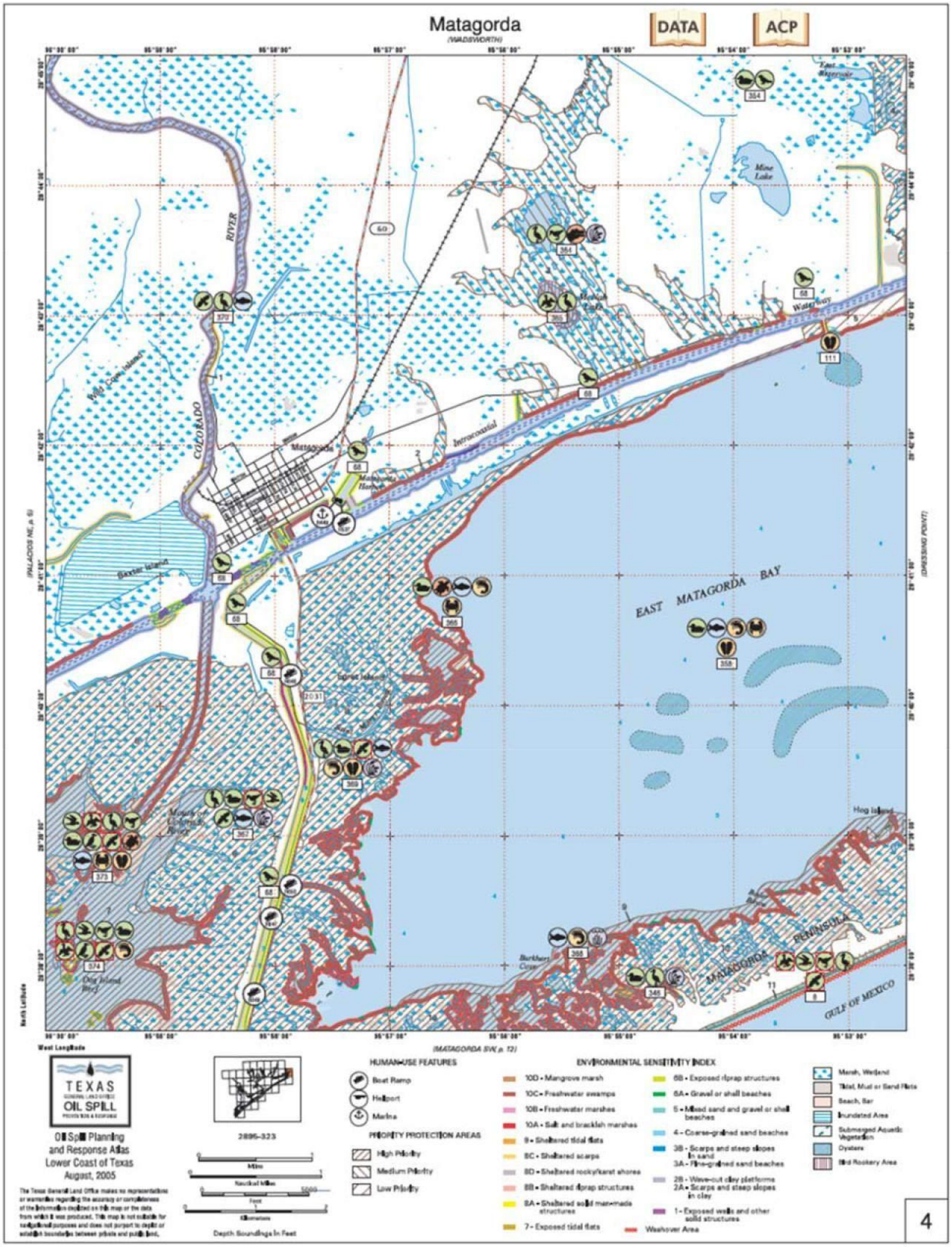


Figure 9.C.2 South Pass ESI Map

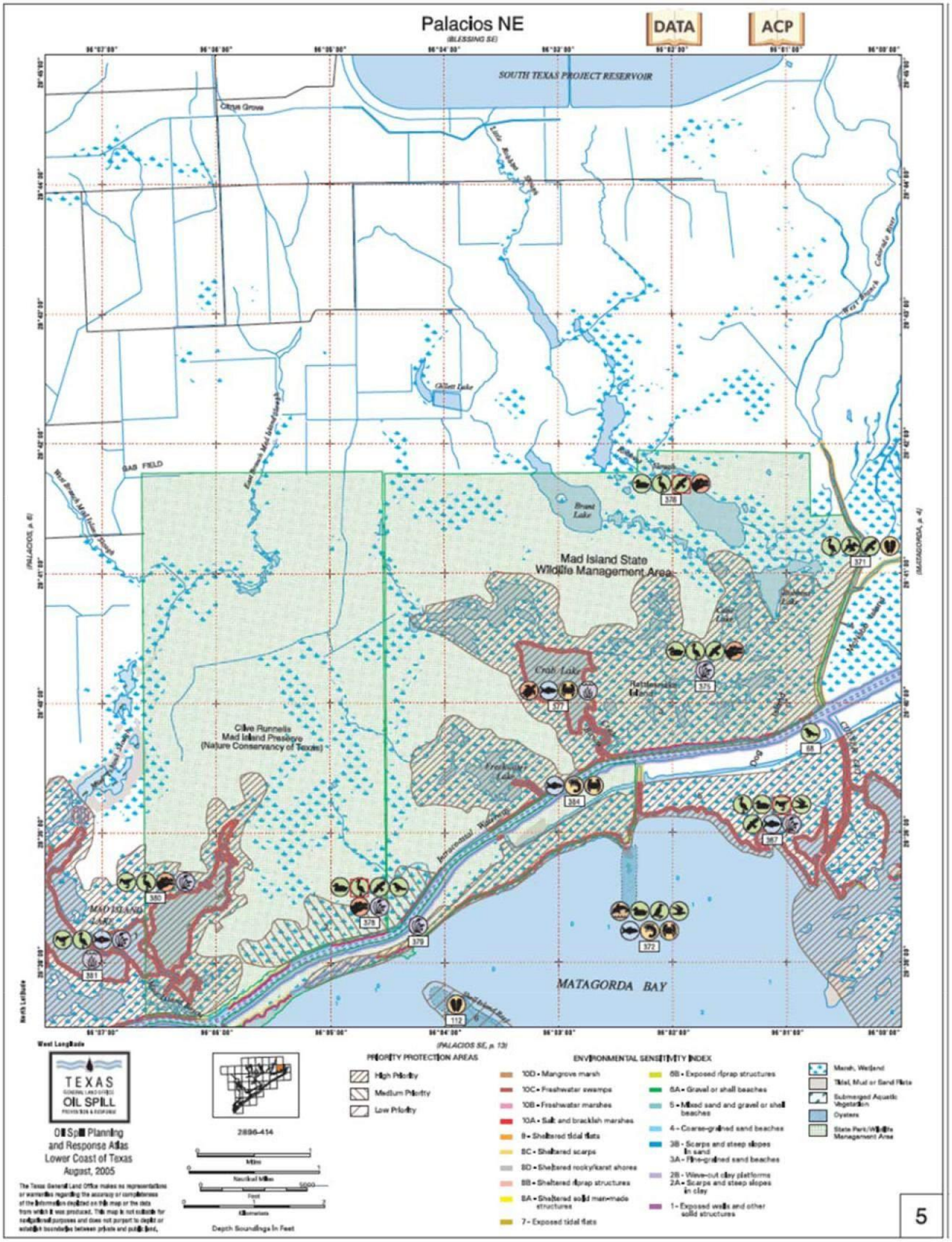


Figure 9.C.3 Garden Island Pass ESI Map

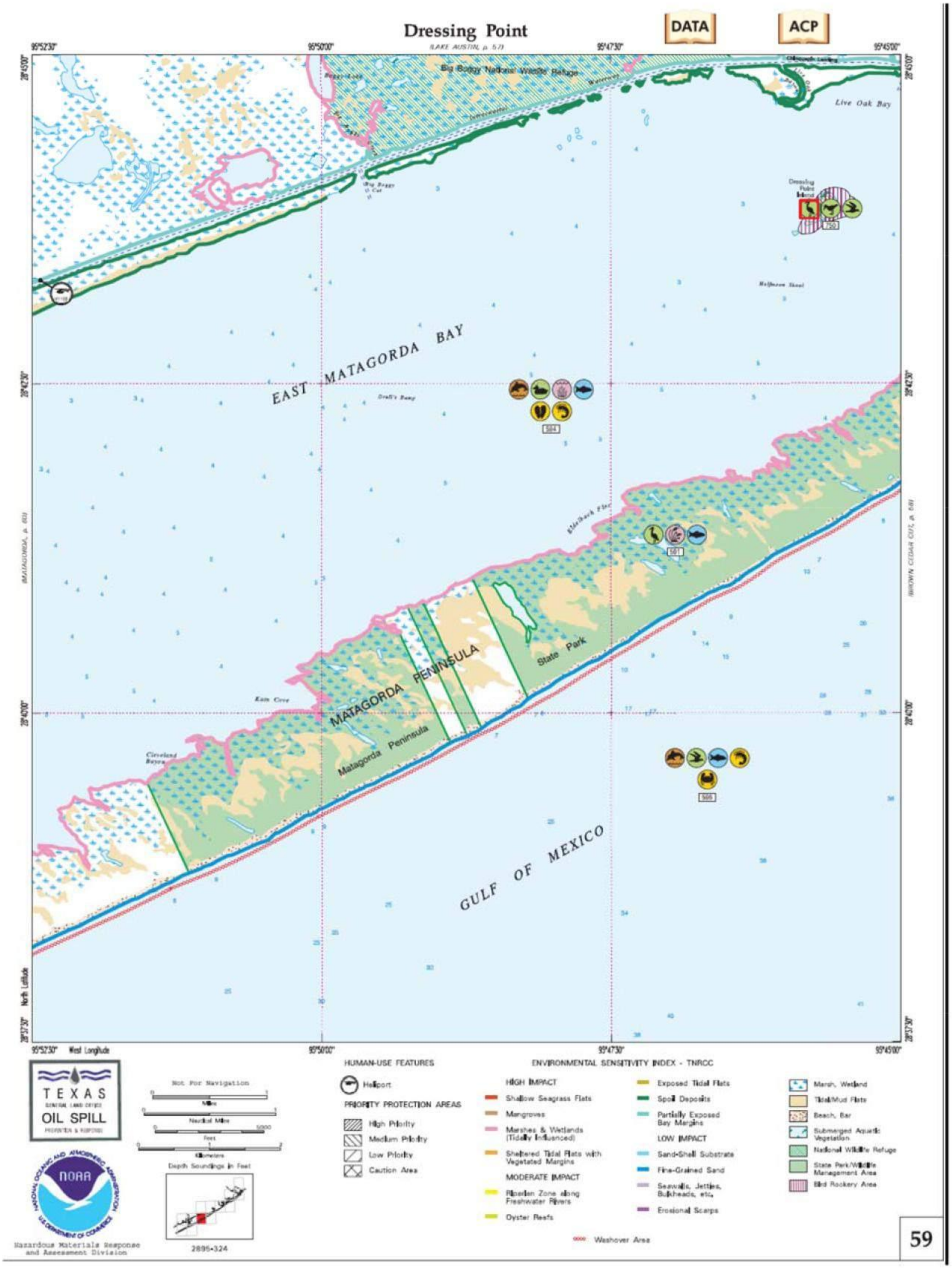


Figure 9.C.4 Pass a Loutre West ESI Map

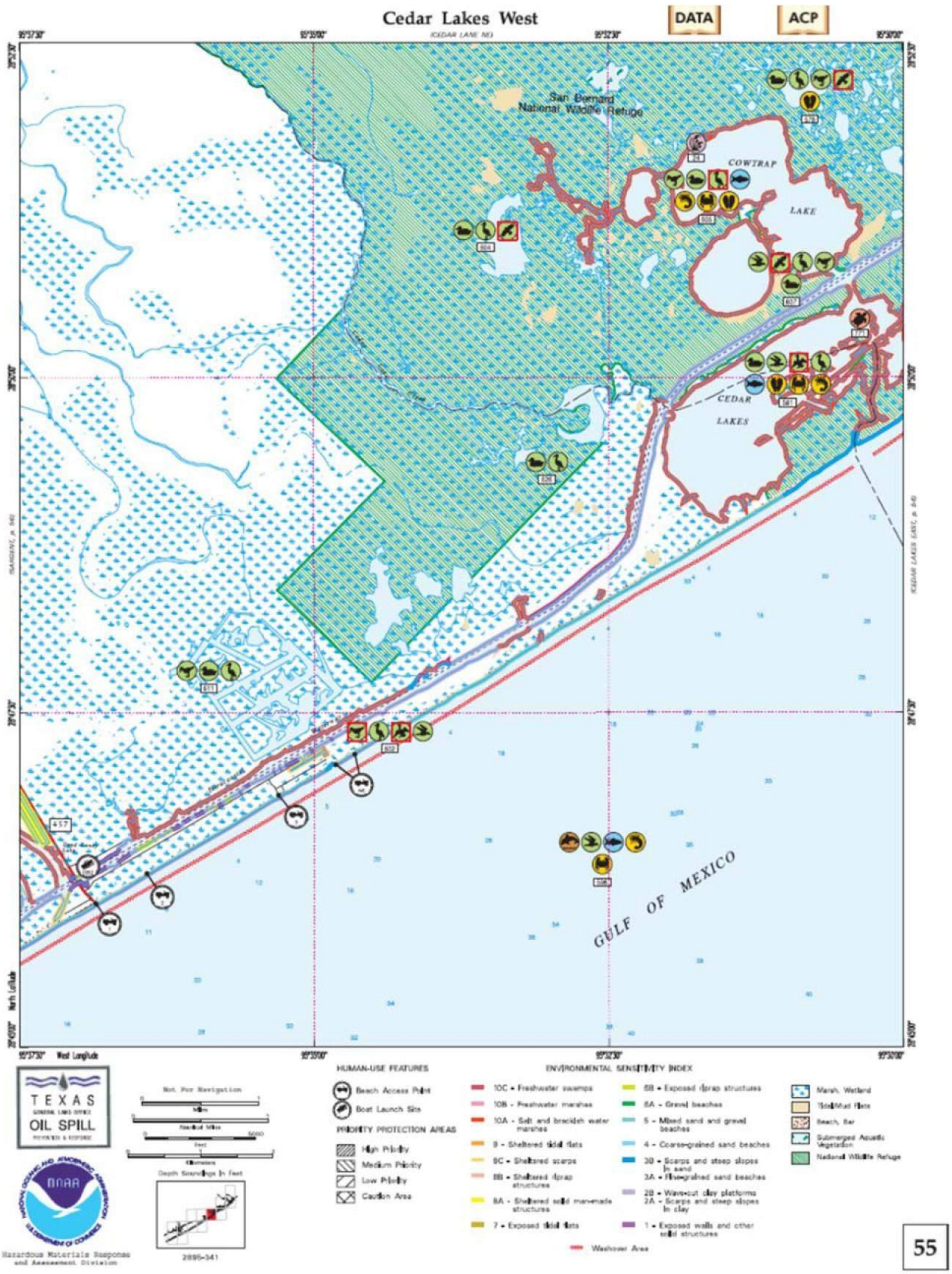
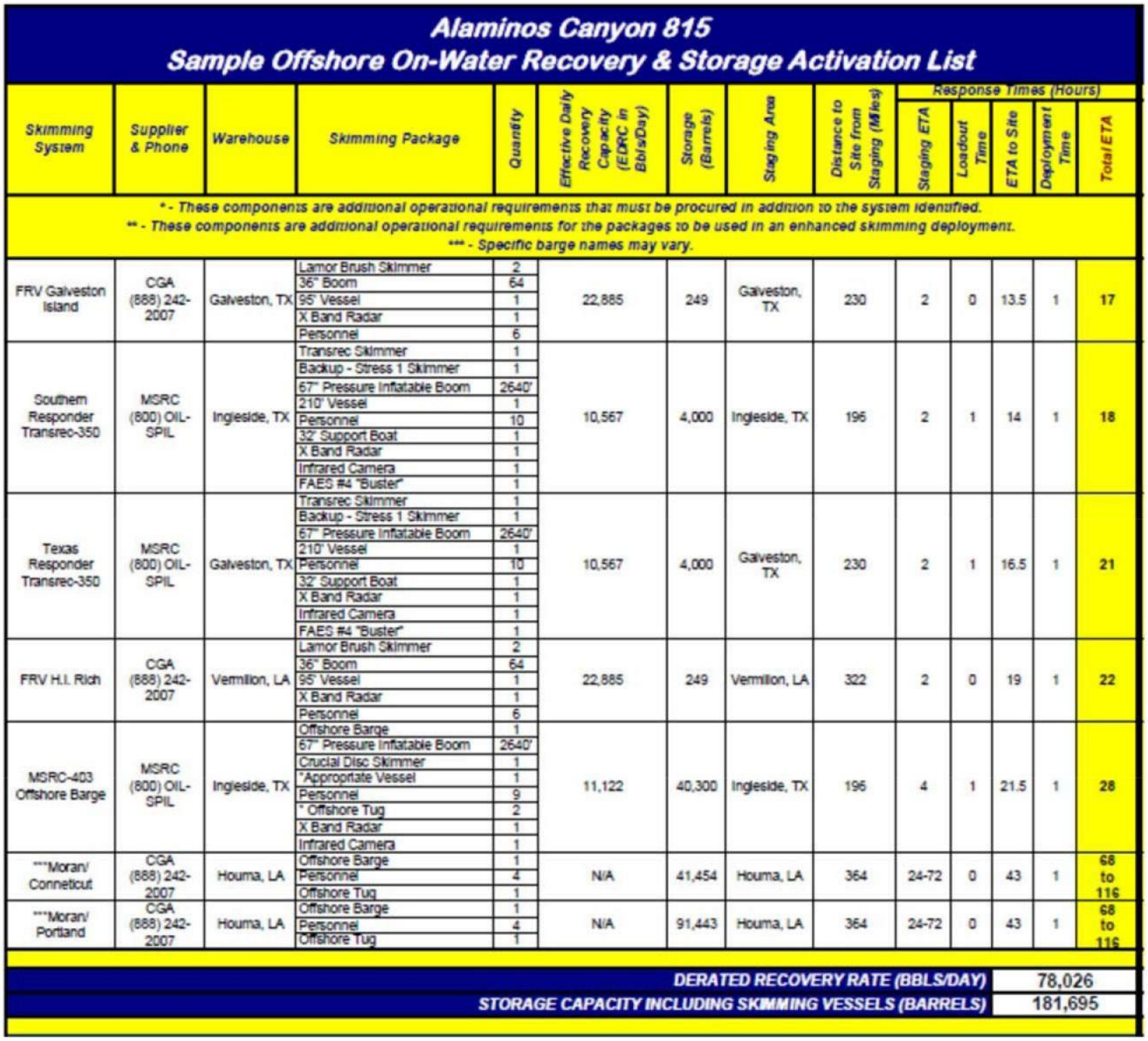


Figure 9.C.5 Main Pass ESI Map



## Alaminos Canyon 815
## Sample Offshore On-Water Recovery & Storage Activation List

| | | | | | | | | | Response Times (Hours) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Skimming System | Supplier & Phone | Warehouse | Skimming Package | Quantity | Effective Daily Recovery Capacity (EDRC in Bbls/Day) | Storage (Barrels) | Staging Area | Distance to Site from Staging (Miles) | Staging ETA | Loadout Time | ETA to Site | Deployment Time | Total ETA |
| FRV Galveston Island | CGA (888) 242-2007 | Galveston, TX | Lamor Brush Skimmer<br>36" Boom<br>95' Vessel<br>X Band Radar<br>Personnel | 2<br>64<br>1<br>1<br>6 | 22,885 | 249 | Galveston, TX | 230 | 2 | 0 | 13.5 | 1 | 17 |
| Southern Responder Transrec-350 | MSRC (800) OIL-SPIL | Ingleside, TX | Transrec Skimmer<br>Backup - Stress 1 Skimmer<br>67" Pressure Inflatable Boom<br>210' Vessel<br>Personnel<br>32' Support Boat<br>X Band Radar<br>Infrared Camera<br>FAES #4 "Buster" | 1<br>1<br>2640'<br>1<br>10<br>1<br>1<br>1<br>1 | 10,567 | 4,000 | Ingleside, TX | 196 | 2 | 1 | 14 | 1 | 18 |
| Texas Responder Transrec-350 | MSRC (800) OIL-SPIL | Galveston, TX | Transrec Skimmer<br>Backup - Stress 1 Skimmer<br>67" Pressure Inflatable Boom<br>210' Vessel<br>Personnel<br>32' Support Boat<br>X Band Radar<br>Infrared Camera<br>FAES #4 "Buster" | 1<br>1<br>2640'<br>1<br>10<br>1<br>1<br>1<br>1 | 10,567 | 4,000 | Galveston, TX | 230 | 2 | 1 | 16.5 | 1 | 21 |
| FRV H.I. Rich | CGA (888) 242-2007 | Vermilion, LA | Lamor Brush Skimmer<br>36" Boom<br>95' Vessel<br>X Band Radar<br>Personnel | 2<br>64<br>1<br>1<br>6 | 22,885 | 249 | Vermilion, LA | 322 | 2 | 0 | 19 | 1 | 22 |
| MSRC-403 Offshore Barge | MSRC (800) OIL-SPIL | Ingleside, TX | Offshore Barge<br>67" Pressure Inflatable Boom<br>Crucial Disc Skimmer<br>*Appropriate Vessel<br>Personnel<br>* Offshore Tug<br>X Band Radar<br>Infrared Camera | 1<br>2640'<br>1<br>1<br>9<br>2<br>1<br>1 | 11,122 | 40,300 | Ingleside, TX | 196 | 4 | 1 | 21.5 | 1 | 28 |
| ***Moran/ Conneticut | CGA (888) 242-2007 | Houma, LA | Offshore Barge<br>Personnel<br>Offshore Tug | 1<br>4<br>1 | N/A | 41,454 | Houma, LA | 364 | 24-72 | 0 | 43 | 1 | 68 to 116 |
| ***Moran/ Portland | CGA (888) 242-2007 | Houma, LA | Offshore Barge<br>Personnel<br>Offshore Tug | 1<br>4<br>1 | N/A | 91,443 | Houma, LA | 364 | 24-72 | 0 | 43 | 1 | 68 to 116 |

* - 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.

| | |
|---|---|
| DERATED RECOVERY RATE (BBLS/DAY) | 78,026 |
| STORAGE CAPACITY INCLUDING SKIMMING VESSELS (BARRELS) | 181,695 |

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

**Alaminos Canyon 815**
**Sample Nearshore On-Water Recovery Activation List**

| | | | | | | | | | Response Times (Hours) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Skimming System | Supplier & Phone | Warehouse | Skimming Package | Quantity | Effective Daily Recovery Capacity (EDRC in Bbls/Day) | Storage (Barrels) | Staging Area | Distance to Nearshore Environment (Miles) | Staging ETA | Loadout Time | ETA to Nearshore Environment | Deployment Time | Total ETA |
| * - These components are additional operational requirements that must be procured in addition to the system identified. | | | | | | | | | | | | | |
| FRV CGA 58 Timballer Bay | CGA (888) 242-2007 | Aransas Pass, TX | Lori Brush Skimmer | 2 | 15,257 | 65 | Aransas Pass, TX | 189 | 2 | 0 | 11 | 1 | 14 |
| | | | 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 | 189 | 4 | 0 | 11 | 1 | 16 |
| | | | 36" Auto Boom | 150' | | | | | | | | | |
| | | | Personnel | 5 | | | | | | | | | |
| | | | 56' SWS Vessel | 1 | | | | | | | | | |
| | | | * 14'-16' Alum. Flatboat | 2 | | | | | | | | | |
| SWS CGA-75 FRV | CGA (888) 242-2007 | Galveston, TX | Lori Brush Skimmer | 2 | 22,885 | 249 | Galveston, TX | 230 | 2 | 0 | 13.5 | 1 | 17 |
| | | | 36" Boom | 150 | | | | | | | | | |
| | | | 60' Vessel | 1 | | | | | | | | | |
| | | | X Band Radar | 1 | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| FRV M/V Bastian Bay | CGA (888) 242-2007 | Lake Charles, LA | Lori Brush Skimmer | 2 | 15,257 | 65 | Lake Charles, LA | 289 | 2 | 0 | 17 | 1 | 20 |
| | | | 36" Boom | 46' | | | | | | | | | |
| | | | 46' Vessel | 1 | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| SW CGA-73 FRV | CGA (888) 242-2007 | Lake Charles, LA | Marco Belt Skimmer | 2 | 21,500 | 249 | Lake Charles, LA | 289 | 2 | 0 | 17 | 1 | 20 |
| | | | 36" Auto Boom | 150' | | | | | | | | | |
| | | | Personnel | 5 | | | | | | | | | |
| | | | 56' SWS Vessel | 1 | | | | | | | | | |
| | | | * 14'-16' Alum. Flatboat | 2 | | | | | | | | | |
| MSRC "Kvichak" | MSRC (800) OIL-SPIL | Ingleside, TX | Marco I Skimmer | 1 | 3,588 | 24 | Aransas Pass, TX | 189 | 4 | 1 | 13.5 | 1 | 20 |
| | | | Personnel | 2 | | | | | | | | | |
| | | | 30' Shallow Water Vessel | 1 | | | | | | | | | |
| SBS w/ GT-185 w/adapter | MSRC (800) OIL-SPIL | Ingleside, TX | Skimmer | 1 | 1,371 | 400 | Aransas Pass, TX | 189 | 4 | 1 | 13.5 | 1 | 20 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Self-propelled barge | 1 | | | | | | | | | |
| SWS CGA-51 MARCO Shallow Water Skimmer | CGA (888) 242-2007 | Lake Charles, LA | Marco Belt Skimmer | 1 | 3,588 | 20 | Aransas Pass, TX | 189 | 8 | 1 | 11 | 1 | 21 |
| | | | * 18" Boom (contractor) | 100' | | | | | | | | | |
| | | | Personnel | 3 | | | | | | | | | |
| | | | 34' Skimming Vessel | 1 | | | | | | | | | |
| | | | Shallow Water Barge | 1 | | 249 | | | | | | | |
| SW CGA-74 FRV | CGA (888) 242-2007 | Vermilion, LA | Marco Belt Skimmer | 2 | 21,500 | 249 | Vermilion, LA | 322 | 2 | 0 | 19 | 1 | 22 |
| | | | 36" Auto Boom | 150' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | 56' SW Vessel | 1 | | | | | | | | | |
| | | | * 14'-16' Alum. Flatboat | 2 | | | | | | | | | |
| MSRC "Kvichak" | MSRC (800) OIL-SPIL | Galveston, TX | Marco I Skimmer | 1 | 3,588 | 24 | Aransas Pass, TX | 189 | 6 | 1 | 13.5 | 1 | 22 |
| | | | Personnel | 2 | | | | | | | | | |
| | | | 30' Shallow Water Vessel | 1 | | | | | | | | | |
| SBS w/ Queensboro | MSRC (800) OIL-SPIL | Galveston, TX | Skimmer | 1 | 905 | 400 | Aransas Pass, TX | 189 | 6 | 1 | 13.5 | 1 | 22 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| SBS w/ GT-185 w/adapter | MSRC (800) OIL-SPIL | Galveston, TX | Skimmer | 1 | 1,371 | 400 | Aransas Pass, TX | 189 | 6 | 1 | 13.5 | 1 | 22 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| FRV M/V RW Armstrong | CGA (888) 242-2007 | Morgan City, LA | Lori Brush Skimmer | 2 | 15,257 | 65 | Morgan City, LA | 336 | 2 | 0 | 20 | 1 | 23 |
| | | | 36" Boom | 46' | | | | | | | | | |
| | | | 46' Vessel | 1 | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| SW CGA-72 FRV | CGA (888) 242-2007 | Morgan City, LA | Marco Belt Skimmer | 2 | 21,500 | 249 | Morgan City, LA | 336 | 2 | 0 | 20 | 1 | 23 |
| | | | 36" Auto Boom | 150' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | 56' SWS Vessel | 1 | | | | | | | | | |
| | | | * 14'-16' Alum. Flatboat | 2 | | | | | | | | | |

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

# Alaminos Canyon 815
# 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. | | | | | | | | | | | | | |
| SBS w/ Queensboro | MSRC (800) OIL-SPIL | Lake Charles, LA | Skimmer | 1 | 905 | 400 | Aransas Pass, TX | 189 | 7.5 | 1 | 13.5 | 1 | 23 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| SBS w/ Queensboro | MSRC (800) OIL-SPIL | Lake Charles, LA | Skimmer | 1 | 905 | 400 | Aransas Pass, TX | 189 | 7.5 | 1 | 13.5 | 1 | 23 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| SBS w/ Queensboro | MSRC (800) OIL-SPIL | Lake Charles, LA | Skimmer | 1 | 905 | 400 | Aransas Pass, TX | 189 | 7.5 | 1 | 13.5 | 1 | 23 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| SBS w/ Queensboro | MSRC (800) OIL-SPIL | Lake Charles, LA | Skimmer | 1 | 905 | 400 | Aransas Pass, TX | 189 | 7.5 | 1 | 13.5 | 1 | 23 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Self-propelled barge | 1 | | | | | | | | | |
| SBS w/ Queensboro | MSRC (800) OIL-SPIL | Lake Charles, LA | Skimmer | 1 | 905 | 400 | Aransas Pass, TX | 189 | 7.5 | 1 | 13.5 | 1 | 23 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Self-propelled barge | 1 | | | | | | | | | |
| SWS CGA-76 FRV | CGA (888) 242-2007 | Leeville, LA | Lori Brush Skimmer | 2 | 22,885 | 249 | Leeville, LA | 358 | 2 | 0 | 21 | 1 | 24 |
| | | | 36" Boom | 150 | | | | | | | | | |
| | | | 60' Vessel | 1 | | | | | | | | | |
| | | | X Band Radar | 1 | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| SWS CGA-53 MARCO Shallow Water Skimmer | CGA (888) 242-2007 | Leeville, LA | Marco Belt Skimmer | 1 | 3,588 | 34 | Aransas Pass, TX | 189 | 11.25 | 1 | 11 | 1 | 25 |
| | | | * 18" Boom (contractor) | 100' | | | | | | | | | |
| | | | Personnel | 3 | | | | | | | | | |
| | | | 38' Skimming Vessel | 1 | | | | | | | | | |
| SBS w/ GT-185 w/adapter | MSRC (800) OIL-SPIL | Baton Rouge, LA | Skimmer | 1 | 1,371 | 400 | Aransas Pass, TX | 189 | 9.25 | 1 | 13.5 | 1 | 25 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| MSRC "Quick Strike" | MSRC (800) OIL-SPIL | Lake Charles, LA | LORI Brush Skimmer | 2 | 5,000 | 50 | Lake Charles, LA | 289 | 2 | 1 | 20.5 | 1 | 25 |
| | | | Personnel | 3 | | | | | | | | | |
| | | | 47' Fast Response Boat | 1 | | | | | | | | | |
| SWS CGA-52 MARCO Shallow Water Skimmer | CGA (888) 242-2007 | Venice, LA | Marco Belt Skimmer | 1 | 3,588 | 34 | Aransas Pass, TX | 189 | 12 | 1 | 11 | 1 | 26 |
| | | | * 18" Boom (contractor) | 100' | | | | | | | | | |
| | | | Personnel | 3 | | | | | | | | | |
| | | | 36' Skimming Vessel | 1 | | | | | | | | | |
| | | | Shallow Water Barge | 1 | | 249 | | | | | | | |
| SWS CGA-77 FRV | CGA (888) 242-2007 | Venice, LA | Lori Brush Skimmer | 2 | 22,885 | 249 | Venice, LA | 409 | 2 | 0 | 24 | 1 | 27 |
| | | | 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 | 409 | 2 | 0 | 24 | 1 | 27 |
| | | | 36" Boom | 46' | | | | | | | | | |
| | | | 46' Vessel | 1 | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| SBS w/ Queensboro | MSRC (800) OIL-SPIL | Belle Chasse, LA | Skimmer | 1 | 905 | 400 | Aransas Pass, TX | 189 | 10.75 | 1 | 13.5 | 1 | 27 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| MSRC "Kvichak" | MSRC (800) OIL-SPIL | Belle Chasse, LA | Marco I Skimmer | 1 | 3,588 | 24 | Aransas Pass, TX | 189 | 10.75 | 1 | 13.5 | 1 | 27 |
| | | | Personnel | 2 | | | | | | | | | |
| | | | 30' Shallow Water Vessel | 1 | | | | | | | | | |
| MSRC "Kvichak" | MSRC (800) OIL-SPIL | Pascagoula, MS | Marco I Skimmer | 1 | 3,588 | 24 | Aransas Pass, TX | 189 | 11.45 | 1 | 13.5 | 1 | 27 |
| | | | Personnel | 2 | | | | | | | | | |
| | | | 30' Shallow Water Vessel | 1 | | | | | | | | | |

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

# Alaminos Canyon 815
# Sample Nearshore On-Water Recovery Activation List

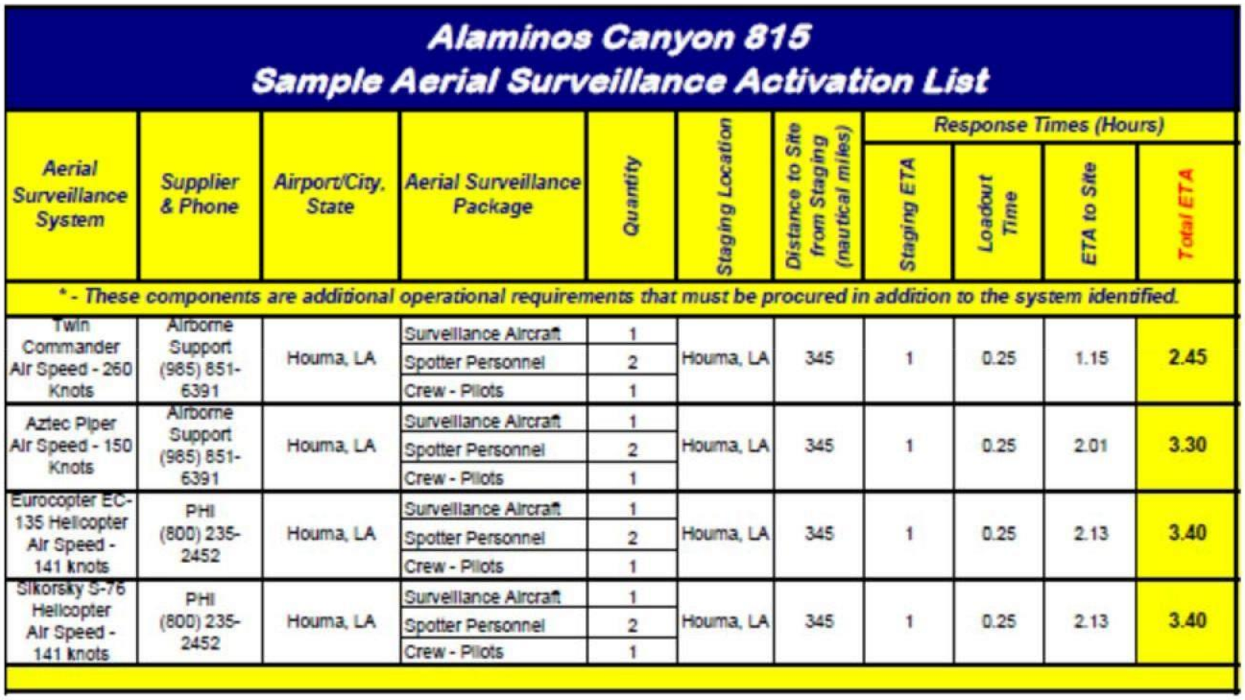
| | | | | | | | | | Response Times (Hours) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Skimming System** | **Supplier & Phone** | **Warehouse** | **Skimming Package** | **Quantity** | **Effective Daily Recovery Capacity (EDRC in Bbls/Day)** | **Storage (Barrels)** | **Staging Area** | **Distance to Nearshore Environment (Miles)** | **Staging ETA** | **Loadout Time** | **ETA to Nearshore Environment** | **Deployment Time** | **Total ETA** |
| ** - These components are additional operational requirements that must be procured in addition to the system identified.* | | | | | | | | | | | | | |
| SBS w/ Queensboro | MSRC (800) OIL-SPIL | Pascagoula, MS | Skimmer | 1 | 905 | 400 | Aransas Pass, TX | 189 | 11.45 | 1 | 13.5 | 1 | **27** |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| SBS w/ AardVAC | MSRC (800) OIL-SPIL | Pascagoula, MS | Skimmer | 1 | 3,840 | 400 | Aransas Pass, TX | 189 | 11.45 | 1 | 13.5 | 1 | **27** |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Self-propelled barge | 1 | | | | | | | | | |
| GT-185 | MSRC (800) OIL-SPIL | Pascagoula, MS | Skimmer | 1 | 1,371 | *500 | Aransas Pass, TX | 189 | 11 | 1 | 13.5 | 1 | **27** |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 5 | | | | | | | | | |
| | | | *Appropriate Vessel | 2 | | | | | | | | | |
| SBS w/ Queensboro | MSRC (800) OIL-SPIL | Memphis, TN | Skimmer | 1 | 905 | 400 | Aransas Pass, TX | 189 | 14 | 1 | 13.5 | 1 | **30** |
| | | | 18" Boom | 60' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| GT-185 | MSRC (800) OIL-SPIL | Jacksonville, FL | Skimmer | 1 | 1,371 | | Aransas Pass, TX | 189 | 18 | 1 | 13.5 | 1 | **33** |
| | | | 18" Boom | 60' | | | | | | | | | |
| | | | Personnel | 5 | | | | | | | | | |
| | | | *Appropriate Vessel | 2 | | | | | | | | | |
| | | | *Temporary Storage | 1 | | 500 | | | | | | | |
| SBS w/ Queensboro | MSRC (800) OIL-SPIL | Roxana, IL | Skimmer | 1 | 905 | 400 | Aransas Pass, TX | 189 | 18 | 1 | 13.5 | 1 | **34** |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| CGA-54 Egmopol Shallow Water Skimmer | CGA (888) 242-2007 | Galveston, TX | Marco Belt Skimmer | 1 | 1,810 | 100 | Aransas Pass, TX | 189 | 6 | 1 | 27 | 1 | **35** |
| | | | * 18" Boom (contractor) | 100' | | | | | | | | | |
| | | | Personnel | 3 | | | | | | | | | |
| | | | 34' Skimming Vessel | 1 | | | | | | | | | |
| | | | Shallow Water Barge | 1 | | 249 | | | | | | | |
| SBS w/ GT-185 w/adapter | MSRC (800) OIL-SPIL | Savannah, GA | Skimmer | 1 | 1,371 | 400 | Aransas Pass, TX | 189 | 19.75 | 1 | 13.5 | 1 | **36** |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| GT-185 w/adapter | MSRC (800) OIL-SPIL | Tampa, FL | Skimmer | 1 | 1,371 | | Aransas Pass, TX | 189 | 20 | 1 | 13.5 | 1 | **36** |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 5 | | | | | | | | | |
| | | | *Appropriate Vessel | 2 | | | | | | | | | |
| | | | *Temporary Storage | 1 | | 500 | | | | | | | |
| WP-1 | MSRC (800) OIL-SPIL | Miami, FL | Skimmer | 1 | 3,017 | | Aransas Pass, TX | 189 | 22 | 1 | 13.5 | 1 | **38** |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 5 | | | | | | | | | |
| | | | *Appropriate Vessel | 2 | | | | | | | | | |
| | | | *Temporary Storage | 1 | | 500 | | | | | | | |
| AARDVAC | MSRC (800) OIL-SPIL | Miami, FL | Skimmer | 1 | 3,840 | | Aransas Pass, TX | 189 | 22 | 1 | 13.5 | 1 | **38** |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 5 | | | | | | | | | |
| | | | * Appropriate Vessel | 2 | | | | | | | | | |
| | | | *Temporary Storage | 1 | | 500 | | | | | | | |
| AARDVAC | MSRC (800) OIL-SPIL | Miami, FL | Skimmer | 1 | 3,840 | | Aransas Pass, TX | 189 | 22 | 1 | 13.5 | 1 | **38** |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 5 | | | | | | | | | |
| | | | * Appropriate Vessel | 2 | | | | | | | | | |
| | | | *Temporary Storage | 1 | | 500 | | | | | | | |
| MSRC "Kvichak" | MSRC (800) OIL-SPIL | Miami, FL | Marco I Skimmer | 1 | 3,588 | 24 | Aransas Pass, TX | 189 | 22.25 | 1 | 13.5 | 1 | **38** |
| | | | Personnel | 2 | | | | | | | | | |
| | | | 30' Shallow Water Vessel | 1 | | | | | | | | | |
| SBS w/ Queensboro | MSRC (800) OIL-SPIL | Whiting, IN | Skimmer | 1 | 905 | 400 | Aransas Pass, TX | 189 | 21.75 | 1 | 13.5 | 1 | **38** |
| | | | 18" Boom | 60' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |

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

# Alaminos Canyon 815
## Sample Nearshore On-Water Recovery Activation List

| | | | | | | | | | Response Times (Hours) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Skimming System** | **Supplier & Phone** | **Warehouse** | **Skimming Package** | **Quantity** | **Effective Daily Recovery Capacity (EDRC in Bbls/Day)** | **Storage (Barrels)** | **Staging Area** | **Distance to Nearshore Environment (Miles)** | **Staging ETA** | **Loadout Time** | **ETA to Nearshore Environment** | **Deployment Time** | **Total ETA** |
| ** - These components are additional operational requirements that must be procured in addition to the system identified.* | | | | | | | | | | | | | |
| SWS CGA-55 Egmopol Shallow Water Skimmer | CGA (888) 242-2007 | Morgan City, LA | Marco Skimmer | 1 | 1,810 | 100 | Aransas Pass, TX | 189 | 10 | 1 | 27 | 1 | 39 |
| | | | * 18" Boom (contractor) | 100' | | | | | | | | | |
| | | | Personnel | 3 | | | | | | | | | |
| | | | 38' Skimming Vessel | 1 | | | | | | | | | |
| | | | Shallow Water Barge | 1 | | 249 | | | | | | | |
| SBS w/ Queensboro | MSRC (800) OIL-SPIL | Toledo, OH | Skimmer | 1 | 905 | 400 | Aransas Pass, TX | 189 | 24 | 1 | 13.5 | 1 | 40 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| MSRC "Kvichak" | MSRC (800) OIL-SPIL | Virginia Beach, VA | Marco I Skimmer | 1 | 3,588 | 24 | Aransas Pass, TX | 189 | 26 | 1 | 13.5 | 1 | 42 |
| | | | Personnel | 2 | | | | | | | | | |
| | | | 30' Shallow Water Vessel | 1 | | | | | | | | | |
| SBS w/ AardVAC | MSRC (800) OIL-SPIL | Virginia Beach, VA | Skimmer | 1 | 3,840 | 400 | Aransas Pass, TX | 189 | 26 | 1 | 13.5 | 1 | 42 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Self-propelled barge | 1 | | | | | | | | | |
| SBS w/ Stress 1 | MSRC (800) OIL-SPIL | Chesapeake City, MD | Skimmer | 1 | 15,840 | 400 | Aransas Pass, TX | 189 | 27 | 1 | 13.5 | 1 | 43 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| SBS w/ Stress 1 | MSRC (800) OIL-SPIL | Edison/Perth Amboy, NJ | Skimmer | 1 | 15,840 | 400 | Aransas Pass, TX | 189 | 29 | 1 | 13.5 | 1 | 45 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Self-propelled barge | 1 | | | | | | | | | |
| MSRC "Kvichak" | MSRC (800) OIL-SPIL | Edison/Perth Amboy, NJ | Marco I Skimmer | 1 | 3,588 | 24 | Aransas Pass, TX | 189 | 29 | 1 | 13.5 | 1 | 45 |
| | | | Personnel | 2 | | | | | | | | | |
| | | | 30' Shallow Water Vessel | 1 | | | | | | | | | |
| SBS w/ GT-185 | MSRC (800) OIL-SPIL | Bayonne, NJ | Skimmer | 1 | 1,371 | | Aransas Pass, TX | 189 | 29 | 1 | 13.5 | 1 | 45 |
| | | | 18" Curtain Internal Foam | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | 400 | | | | | | | |
| | | | *Appropriate Vessel | 1 | | | | | | | | | |
| SBS w/ GT-185 | MSRC (800) OIL-SPIL | Providence, RI | Skimmer | 1 | 1,371 | | Aransas Pass, TX | 189 | 32 | 1 | 13.5 | 1 | 48 |
| | | | 18" Curtain Internal Foam | 60' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | 400 | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| SBS w/ GT-185 | MSRC (800) OIL-SPIL | Everett, MA | Skimmer | 1 | 1,371 | 400 | Aransas Pass, TX | 189 | 32 | 1 | 13.5 | 1 | 48 |
| | | | 18" Boom | 60' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Non-self-propelled barge | 1 | | | | | | | | | |
| | | | Push Boat | 1 | | | | | | | | | |
| MSRC "Kvichak" | MSRC (800) OIL-SPIL | Portland, ME | Marco I Skimmer | 1 | 3,588 | 24 | Aransas Pass, TX | 189 | 34 | 1 | 13.5 | 1 | 50 |
| | | | Personnel | 2 | | | | | | | | | |
| | | | 30' Shallow Water Vessel | 1 | | | | | | | | | |
| SBS w/ WP-1 | MSRC (800) OIL-SPIL | Portland, ME | Skimmer | 1 | 3,017 | 400 | Aransas Pass, TX | 189 | 34 | 1 | 13.5 | 1 | 50 |
| | | | 18" Boom | 50' | | | | | | | | | |
| | | | Personnel | 4 | | | | | | | | | |
| | | | Self-propelled barge | 1 | | | | | | | | | |
| MSRC "Lightning" | MSRC (800) OIL-SPIL | Tampa, FL | LORI Brush Skimmer | 2 | 5,000 | 50 | Tampa, FL | 774 | 2 | 1 | 55.5 | 1 | 60 |
| | | | Personnel | 3 | | | | | | | | | |
| | | | 47' Fast Response Boat | 1 | | | | | | | | | |
| | | | | | | | | | | | **DERATED RECOVERY RATE (BBLS/DAY)** | **346,415** | |
| | | | | | | | | | | | **SKIMMING VESSEL STORAGE CAPACITY (BARRELS)** | **15,679** | |

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



**Alaminos Canyon 815**
**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 | 345 | 1 | 0.25 | 1.15 | **2.45** |
| | | | Spotter Personnel | 2 | | | | | | |
| | | | Crew - Pilots | 1 | | | | | | |
| Aztec Piper Air Speed - 150 Knots | Airborne Support (985) 851-6391 | Houma, LA | Surveillance Aircraft | 1 | Houma, LA | 345 | 1 | 0.25 | 2.01 | **3.30** |
| | | | Spotter Personnel | 2 | | | | | | |
| | | | Crew - Pilots | 1 | | | | | | |
| Eurocopter EC-135 Helicopter Air Speed - 141 knots | PHI (800) 235-2452 | Houma, LA | Surveillance Aircraft | 1 | Houma, LA | 345 | 1 | 0.25 | 2.13 | **3.40** |
| | | | 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 | 345 | 1 | 0.25 | 2.13 | **3.40** |
| | | | Spotter Personnel | 2 | | | | | | |
| | | | Crew - Pilots | 1 | | | | | | |

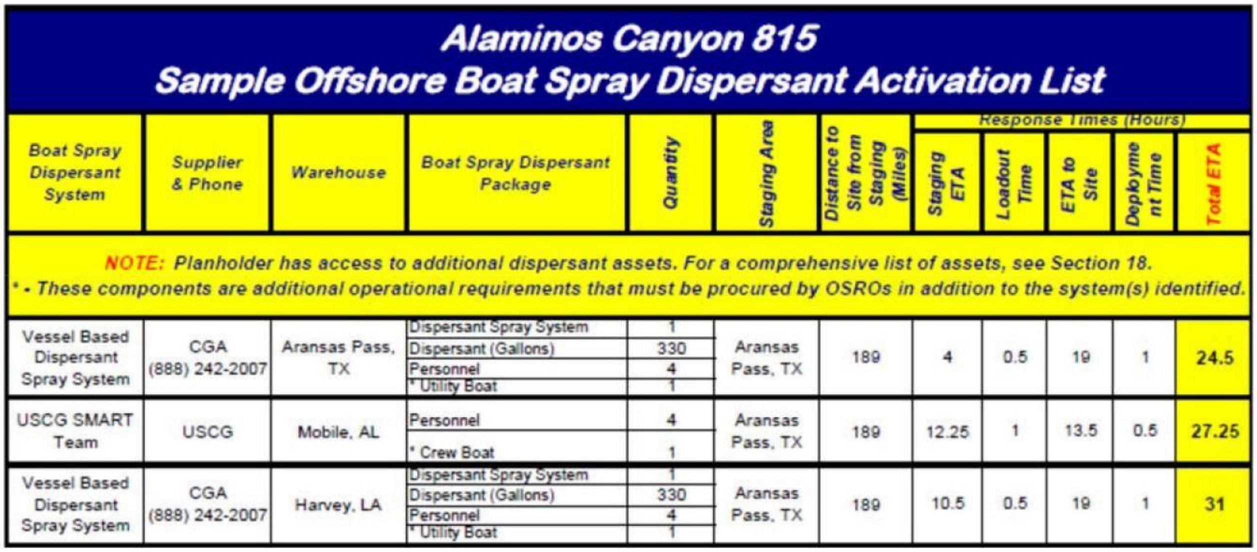
Table 9.D.6 Aerial Surveillance Activation List

# Alaminos Canyon 815
# Sample Offshore Aerial Dispersant Activation List

*NOTE: Planholder has access to additional dispersant assets. For a comprehensive list of assets, see Section 18.*
** - These components are additional operational requirements that must be procured in addition to the system(s) identified.*
*** The second flight times listed are to demonstrate subsequent sortie and application timeframes.*
**** The dispersants listed is for gallon capacity only not amount stored at each location.*

| 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 |
| Twin Commander Air Speed - 300 MPH | CGA/Airborne Support (985) 851-6391 | Houma, LA | Aero Commander | 1 | Houma, LA | 345 | 1 | 0 | 1.15 | 0 | 2.20 |
| | | | Spotter Personnel | 2 | | | | | | | |
| | | | Crew - Pilots | 1 | | | | | | | |
| BT-67 (DC-3 Turboprop) Aircraft Air Speed - 194 MPH | CGA/Airborne Support (985) 851-6391 | Houma, LA | DC-3 Dispersant Aircraft | 1 | Houma, LA **1st Flight** | 345 | 2 | 0.5 | 1.78 | 0.5 | 4.80 |
| | | | Dispersant - Gallons | 2000 | | | | | | | |
| | | | Spotter Aircraft | 1 | | | | | | | |
| | | | Spotter Personnel | 2 | Houma, LA **2nd Flight** | 345 | 1.78 | 0.5 | 1.78 | 0.3 | 4.40 |
| | | | 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** | 435 | 3 | 0.0 | 1.27 | 0.5 | 4.80 |
| | | | Dispersant - Gallons | 4125 | | | | | | | |
| | | | *Spotter Aircraft | 1 | | | | | | | |
| | | | *Spotter Personnel | 2 | Stennis INTL., MS **2nd Flight** | 435 | 0.50 | 0.3 | 1.27 | 0.5 | 2.65 |
| | | | 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** | 435 | 3 | 0.00 | 2.04 | 0.20 | 5.25 |
| | | | Dispersant - Gallons | 250 | | | | | | | |
| | | | * Spotter Aircraft | 1 | | | | | | | |
| | | | *Spotter Personnel | 2 | Stennis INTL., MS **2nd Flight** | 435 | 2.04 | 0.20 | 2.04 | 0.20 | 4.50 |
| | | | Crew - Pilots | 2 | | | | | | | |
| DC-3 Aircraft Air Speed - 150 MPH | CGA/Airborne Support (985) 851-6391 | Houma, LA | DC-3 Dispersant Aircraft | 1 | Houma, LA **1st Flight** | 345 | 2 | 0.5 | 2.30 | 0.5 | 5.35 |
| | | | Dispersant - Gallons | 1200 | | | | | | | |
| | | | Spotter Aircraft | 1 | | | | | | | |
| | | | Spotter Personnel | 2 | Houma, LA **2nd Flight** | 345 | 2.30 | 0.5 | 2.30 | 0.3 | 5.45 |
| | | | 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** | 345 | 2 | 0.5 | 2.30 | 0.5 | 5.35 |
| | | | Dispersant - Gallons | 1200 | | | | | | | |
| | | | Spotter Aircraft | 1 | | | | | | | |
| | | | Spotter Personnel | 2 | Houma, LA **2nd Flight** | 345 | 2.30 | 0.5 | 2.30 | 0.3 | 5.45 |
| | | | 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** | 435 | 7 | 0.3 | 1.27 | 0.5 | 9.15 |
| | | | Dispersant - Gallons | 4125 | | | | | | | |
| | | | *Spotter Aircraft | 1 | | | | | | | |
| | | | *Spotter Personnel | 2 | Stennis INTL., MS **2nd Flight** | 435 | 0.50 | 0.3 | 1.27 | 0.5 | 2.65 |
| | | | Crew - Pilots | 2 | | | | | | | |

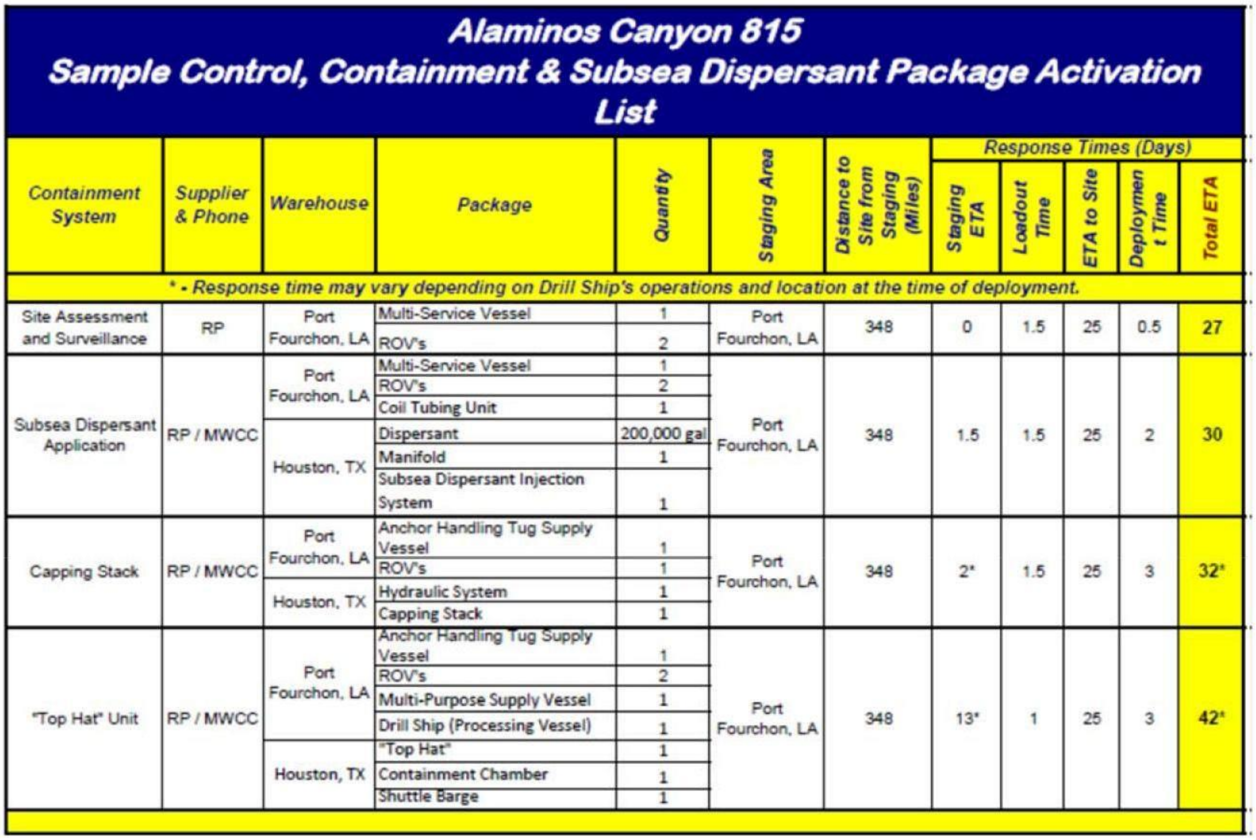
Table 9.D.7 Offshore Aerial Dispersant Activation List



### Alaminos Canyon 815
### 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 |
| NOTE: Planholder has access to additional dispersant assets. For a comprehensive list of assets, see Section 18.<br>* - 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 | Aransas Pass, TX | 189 | 4 | 0.5 | 19 | 1 | 24.5 |
| | | | Dispersant (Gallons) | 330 | | | | | | | |
| | | | Personnel | 4 | | | | | | | |
| | | | * Utility Boat | 1 | | | | | | | |
| USCG SMART Team | USCG | Mobile, AL | Personnel | 4 | Aransas Pass, TX | 189 | 12.25 | 1 | 13.5 | 0.5 | 27.25 |
| | | | * Crew Boat | 1 | | | | | | | |
| Vessel Based Dispersant Spray System | CGA (888) 242-2007 | Harvey, LA | Dispersant Spray System | 1 | Aransas Pass, TX | 189 | 10.5 | 0.5 | 19 | 1 | 31 |
| | | | Dispersant (Gallons) | 330 | | | | | | | |
| | | | Personnel | 4 | | | | | | | |
| | | | * Utility Boat | 1 | | | | | | | |

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



### Alaminos Canyon 815
### 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 | 348 | 0 | 1.5 | 25 | 0.5 | 27 |
| | | | ROV's | 2 | | | | | | | |
| Subsea Dispersant Application | RP / MWCC | Port Fourchon, LA | Multi-Service Vessel | 1 | Port Fourchon, LA | 348 | 1.5 | 1.5 | 25 | 2 | 30 |
| | | | ROV's | 2 | | | | | | | |
| | | | Coil Tubing Unit | 1 | | | | | | | |
| | | Houston, TX | Dispersant | 200,000 gal | | | | | | | |
| | | | Manifold | 1 | | | | | | | |
| | | | Subsea Dispersant Injection System | 1 | | | | | | | |
| Capping Stack | RP / MWCC | Port Fourchon, LA | Anchor Handling Tug Supply Vessel | 1 | Port Fourchon, LA | 348 | 2* | 1.5 | 25 | 3 | 32* |
| | | | ROV's | 1 | | | | | | | |
| | | Houston, TX | Hydraulic System | 1 | | | | | | | |
| | | | Capping Stack | 1 | | | | | | | |
| "Top Hat" Unit | RP / MWCC | Port Fourchon, LA | Anchor Handling Tug Supply Vessel | 1 | Port Fourchon, LA | 348 | 13* | 1 | 25 | 3 | 42* |
| | | | ROV's | 2 | | | | | | | |
| | | | Multi-Purpose Supply Vessel | 1 | | | | | | | |
| | | | Drill Ship (Processing Vessel) | 1 | | | | | | | |
| | | Houston, TX | "Top Hat" | 1 | | | | | | | |
| | | | Containment Chamber | 1 | | | | | | | |
| | | | Shuttle Barge | 1 | | | | | | | |

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

# Alaminos Canyon 815
# Sample In-Situ Burn Equipment Activation List

NOTE: Planholder has access to additional ISB assets. For a comprehensive list of those assets, see Section 19.
* - These components are additional operational requirements that must be procured in addition to the system identified.
** - Teams will deploy in sections of 500' at any given time

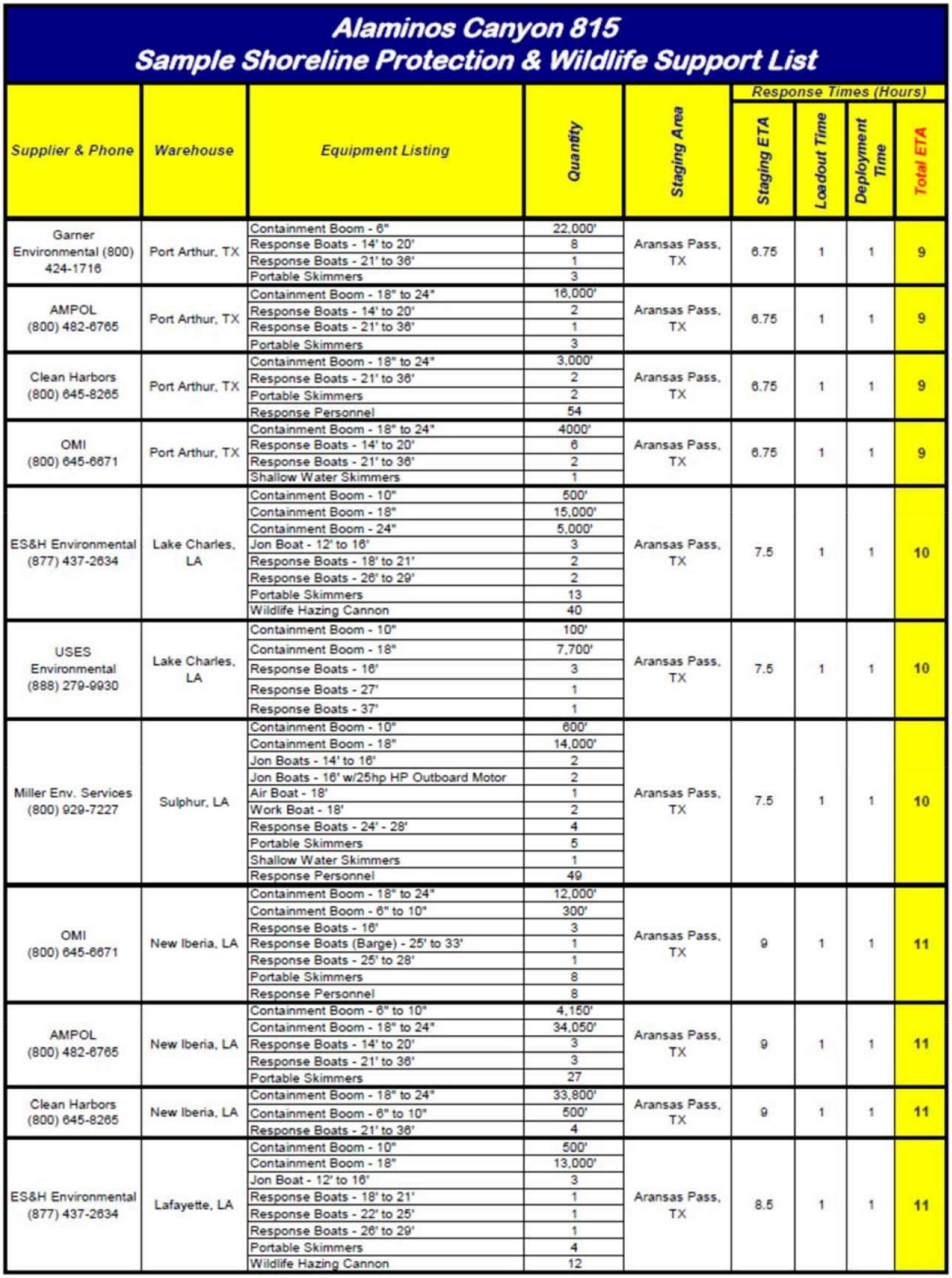
| Skimming System | Supplier & Phone | Warehouse | Skimming Package | Quantity | Staging Area | Distance to Site from Staging (Miles) | Response Times (Hours) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Staging ETA | Loadout Time | ETA to Site | Deployment Time | Total ETA |
| ISB Fire-Fighting Team | TBD | TBD | * Offshore Firefighting Vessels | 2 | Aransas Pass, TX | 189 | 4 | 1 | 13.5 | 1 | 19.5 |
| | | | * Cranes | 2 | | | | | | | |
| | | | * Roll-off Boxes | 2 | | | | | | | |
| | | | Personnel | 8 | | | | | | | |
| | | | * Air Monitoring Equipment | 2 | | | | | | | |
| SMART In-Situ Burn Monitoring Team | USCG | Mobile, AL | * Air Monitoring Equipment | 1 | Aransas Pass, TX | 189 | 4 | 1 | 13.5 | 1 | 19.5 |
| | | | * Offshore Vessel | 1 | | | | | | | |
| | | | Personnel | 4 | | | | | | | |
| Safety Monitoring Team | TBD | TBD | * Air Monitoring Equipment | 1 | Aransas Pass, TX | 189 | 4 | 1 | 13.5 | 1 | 19.5 |
| | | | * Offshore Vessel | 1 | | | | | | | |
| | | | Personnel | 4 | | | | | | | |
| Wildlife Monitoring Team | TBD | TBD | * Air Monitoring Equipment | 1 | Aransas Pass, TX | 189 | 4 | 1 | 13.5 | 1 | 19.5 |
| | | | * Offshore Vessel | 1 | | | | | | | |
| | | | Personnel | 4 | | | | | | | |
| Aerial Spotting Team (per 2 ISB Task Forces) | TBD | TBD | Fixed Wing Aircraft | 1 | Aransas Pass, TX | 189 | 4 | 1 | 13.5 | 1 | 19.5 |
| | | | Trained ISB Spotter | 2 | | | | | | | |
| | | | ISB Documenter | 1 | | | | | | | |
| Fire Team (In-Situ Burn Fire System) | MSRC (800) OIL-SPIL | Houston, TX | **Fire Boom (ft) | 16,000 | Aransas Pass, TX | 189 | 5.25 | 1 | 13.5 | 1 | 20.75 |
| | | | Tow Line (ft) | 600 | | | | | | | |
| | | | * Appropriate Vessel | 2 | | | | | | | |
| | | | Personnel | 2 | | | | | | | |
| | | | Ignition Device | 155 | | | | | | | |
| Fire Team (In-Situ Burn Fire System) | MSRC (800) OIL-SPIL | Galveston, TX | **Fire Boom (ft) | 1,000 | Aransas Pass, TX | 189 | 6 | 1 | 13.5 | 1 | 21.5 |
| | | | Tow Line (ft) | 600 | | | | | | | |
| | | | * Appropriate Vessel | 2 | | | | | | | |
| | | | Personnel | 2 | | | | | | | |
| | | | Ignition Device | 10 | | | | | | | |
| Fire Team (In-Situ Burn Fire System) | MSRC (800) OIL-SPIL | Lake Charles, LA | **Fire Boom (ft) | 2,000 | Aransas Pass, TX | 189 | 7.5 | 1 | 13.5 | 1 | 23 |
| | | | Tow Line (ft) | 600 | | | | | | | |
| | | | * Appropriate Vessel | 2 | | | | | | | |
| | | | Personnel | 2 | | | | | | | |
| | | | Ignition Device | 25 | | | | | | | |
| Supply Team (Supply Vessel System) | MSRC (800) OIL-SPIL | Aransas Pass, TX | *Offshore Vessel 110' - 310' | 1 | Aransas Pass, TX | 189 | 4 | 1 | 37.5 | 1 | 43.5 |
| | | | Personnel | 6 | | | | | | | |
| Fire Team (In-Situ Burn Fire System) | CGA (888) 242-2007 | Harvey, LA | Fire Boom (ft) | 500 | Aransas Pass, TX | 189 | 0 | 24 | 19 | 1 | 44 |
| | | | Guide Boom/Tow Line (ft) | 400 | | | | | | | |
| | | | * Offshore Vessel (0.5 kt capability) | 3 | | | | | | | |
| | | | Personnel | 20 | | | | | | | |
| | | | Ignition Device | 10 | | | | | | | |
| Fire Team (In-Situ Burn Fire System) | CGA (888) 242-2007 | Harvey, LA | Fire Boom (ft) | 500 | Aransas Pass, TX | 189 | 0 | 24 | 19 | 1 | 44 |
| | | | 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) | MSRC (800) OIL-SPIL | Portland, ME | **Fire Boom (ft) | 1,000 | Aransas Pass, TX | 189 | 34 | 1 | 13.5 | 1 | 49.5 |
| | | | Tow Line (ft) | 600 | | | | | | | |
| | | | * Appropriate Vessel | 2 | | | | | | | |
| | | | Personnel | 2 | | | | | | | |
| | | | Ignition Device | 10 | | | | | | | |
| | | | | | | | TOTAL FIRE BOOM AVAILABLE (FEET) | | 21,000 | | |

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

# Alaminos Canyon 815
## Sample Shoreline Protection & Wildlife Support List

| Supplier & Phone | Warehouse | Equipment Listing | Quantity | Staging Area | Response Times (Hours) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Staging ETA | Loadout Time | Deployment Time | Total ETA |
| Miller Env. Services (800) 929-7227 | Corpus Christi, TX | Containment Boom - 10" | 2,000' | Aransas Pass, TX | 4 | 1 | 1 | 6 |
| | | Containment Boom - 18" | 30,000' | | | | | |
| | | Jon Boats - 14' to 16' w/25hp motor | 4 | | | | | |
| | | Jon Boats - 16' to 18' w/Outboard motor | 4 | | | | | |
| | | Air Boat - 14' | 1 | | | | | |
| | | Response Boats - 24' to 26' | 4 | | | | | |
| | | Portable Skimmers | 6 | | | | | |
| | | Shallow Water Skimmers | 2 | | | | | |
| | | Response Personnel | 142 | | | | | |
| Clean Harbors (800) 645-8265 | Houston, TX | Containment Boom - 18" to 24" | 4,500' | Aransas Pass, TX | 5.25 | 1 | 1 | 8 |
| | | Response Boats - 14' to 20' | 2 | | | | | |
| | | Response Boats - 21' to 36' | 3 | | | | | |
| | | Portable Skimmers | 1 | | | | | |
| | | Response Personnel | 14 | | | | | |
| ES&H Environmental (877) 437-2634 | Houston, TX | Containment Boom - 10" | 500' | Aransas Pass, TX | 5.25 | 1 | 1 | 8 |
| | | Containment Boom - 18" | 13,000' | | | | | |
| | | Containment Boom - 24" | 5,000' | | | | | |
| | | Jon Boat - 12' to 16' | 2 | | | | | |
| | | Response Boats - 26' to 29' | 2 | | | | | |
| | | Portable Skimmers | 2 | | | | | |
| | | Wildlife Hazing Cannon | 12 | | | | | |
| Wildlife Ctr. of Texas (713) 861-9453 | Houston, TX | Wildlife Specialist - Personnel | 6 to 20 | Aransas Pass, TX | 5.25 | 1 | 1 | 8 |
| Miller Env. Services (800) 929-7227 | Houston, TX | Containment Boom - 18" | 12,000' | Aransas Pass, TX | 5.25 | 1 | 1 | 8 |
| | | Shallow Water Skimmers | 1 | | | | | |
| | | Response Boats - 28' | 1 | | | | | |
| | | Responder Personnel | 38 | | | | | |
| SWS Environmental (877) 742-4215 | Houston, TX | Containment Boom - 18" | 20,000 | Aransas Pass, TX | 5.25 | 1 | 1 | 8 |
| | | Response Boats - 16' to 25' | 1 | | | | | |
| | | Response Boats - 25' to 42' | 2 | | | | | |
| | | Portable Skimmers | 2 | | | | | |
| | | Response Personnel | 19 | | | | | |
| USES Environmental (888) 279-9930 | Houston, TX | Containment Boom - 6" | 500' | Aransas Pass, TX | 5.25 | 1 | 1 | 8 |
| | | Containment Boom - 20" | 10,000' | | | | | |
| | | Response Boats - 16' | 4 | | | | | |
| | | Response Boats - 26' | 1 | | | | | |
| | | Portable Skimmers | 1 | | | | | |
| OMI (800) 645-6671 | Houston, TX | Containment Boom - 18" to 24" | 4000' | Aransas Pass, TX | 5.25 | 1 | 1 | 8 |
| | | Response Boats - 16' | 3 | | | | | |
| | | Response Boats - 25' to 28' | 1 | | | | | |
| | | Portable Skimmers | 1 | | | | | |
| Garner Environmental (800) 424-1716 | Deer Park, TX | Containment Boom - 6" | 18,900' | Aransas Pass, TX | 5.75 | 1 | 1 | 8 |
| | | Response Boats - 12' | 2 | | | | | |
| | | Response Boats - 16' to 20' | 5 | | | | | |
| | | Respons Boats - 30' | 2 | | | | | |
| | | Portable Skimmers | 25 | | | | | |
| | | Shallow Water Skimmers | 3 | | | | | |
| Garner Environmental (800) 424-1716 | La Marque, TX | Containment Boom - 6" | 9,500' | Aransas Pass, TX | 5.75 | 1 | 1 | 8 |
| | | Response Boats - 16' | 5 | | | | | |
| | | Response Boats - 24' | 1 | | | | | |
| | | Portable Skimmers | 7 | | | | | |
| Phoenix Pollution Control & Environmental Services (281) 838-3400 | Baytown, TX | Containment Boom - 18" | 13,000' | Aransas Pass, TX | 5.75 | 1 | 1 | 8 |
| | | Containment Boom - 10" | 1,150' | | | | | |
| | | Response Boats - 16' | 6 | | | | | |
| | | Response Boats - 20' | 3 | | | | | |
| | | Response Boats - 24' | 1 | | | | | |
| | | Response Boats - 35' | 2 | | | | | |
| | | Portable Skimmers | 24 | | | | | |
| Miller Env. Services (800) 929-7227 | Beaumont, TX | Containment Boom - 18" | 14,000' | Aransas Pass, TX | 6.75 | 1 | 1 | 9 |
| | | Response Boats - 18' | 2 | | | | | |
| | | Response Boats - 24' | 2 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| | | Response Personnel | 47 | | | | | |

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



## Alaminos Canyon 815
## 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 | Port Arthur, TX | Containment Boom - 6" | 22,000' | Aransas Pass, TX | 6.75 | 1 | 1 | 9 |
| | | Response Boats - 14' to 20' | 8 | | | | | |
| | | Response Boats - 21' to 36' | 1 | | | | | |
| | | Portable Skimmers | 3 | | | | | |
| AMPOL (800) 482-6765 | Port Arthur, TX | Containment Boom - 18" to 24" | 16,000' | Aransas Pass, TX | 6.75 | 1 | 1 | 9 |
| | | Response Boats - 14' to 20' | 2 | | | | | |
| | | Response Boats - 21' to 36' | 1 | | | | | |
| | | Portable Skimmers | 3 | | | | | |
| Clean Harbors (800) 645-8265 | Port Arthur, TX | Containment Boom - 18" to 24" | 3,000' | Aransas Pass, TX | 6.75 | 1 | 1 | 9 |
| | | Response Boats - 21' to 36' | 2 | | | | | |
| | | Portable Skimmers | 2 | | | | | |
| | | Response Personnel | 54 | | | | | |
| OMI (800) 645-6671 | Port Arthur, TX | Containment Boom - 18" to 24" | 4000' | Aransas Pass, TX | 6.75 | 1 | 1 | 9 |
| | | Response Boats - 14' to 20' | 6 | | | | | |
| | | Response Boats - 21' to 36' | 2 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| ES&H Environmental (877) 437-2634 | Lake Charles, LA | Containment Boom - 10" | 500' | Aransas Pass, TX | 7.5 | 1 | 1 | 10 |
| | | Containment Boom - 18" | 15,000' | | | | | |
| | | Containment Boom - 24" | 5,000' | | | | | |
| | | Jon Boat - 12' to 16' | 3 | | | | | |
| | | Response Boats - 18' to 21' | 2 | | | | | |
| | | Response Boats - 26' to 29' | 2 | | | | | |
| | | Portable Skimmers | 13 | | | | | |
| | | Wildlife Hazing Cannon | 40 | | | | | |
| USES Environmental (888) 279-9930 | Lake Charles, LA | Containment Boom - 10" | 100' | Aransas Pass, TX | 7.5 | 1 | 1 | 10 |
| | | Containment Boom - 18" | 7,700' | | | | | |
| | | Response Boats - 16' | 3 | | | | | |
| | | Response Boats - 27' | 1 | | | | | |
| | | Response Boats - 37' | 1 | | | | | |
| Miller Env. Services (800) 929-7227 | Sulphur, LA | Containment Boom - 10" | 600' | Aransas Pass, TX | 7.5 | 1 | 1 | 10 |
| | | Containment Boom - 18" | 14,000' | | | | | |
| | | Jon Boats - 14' to 16' | 2 | | | | | |
| | | Jon Boats - 16' w/25hp HP Outboard Motor | 2 | | | | | |
| | | Air Boat - 18' | 1 | | | | | |
| | | Work Boat - 18' | 2 | | | | | |
| | | Response Boats - 24' - 28' | 4 | | | | | |
| | | Portable Skimmers | 5 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| | | Response Personnel | 49 | | | | | |
| OMI (800) 645-6671 | New Iberia, LA | Containment Boom - 18" to 24" | 12,000' | Aransas Pass, TX | 9 | 1 | 1 | 11 |
| | | Containment Boom - 6" to 10" | 300' | | | | | |
| | | Response Boats - 16' | 3 | | | | | |
| | | Response Boats (Barge) - 25' to 33' | 1 | | | | | |
| | | Response Boats - 25' to 28' | 1 | | | | | |
| | | Portable Skimmers | 8 | | | | | |
| | | Response Personnel | 8 | | | | | |
| AMPOL (800) 482-6765 | New Iberia, LA | Containment Boom - 6" to 10" | 4,150' | Aransas Pass, TX | 9 | 1 | 1 | 11 |
| | | Containment Boom - 18" to 24" | 34,050' | | | | | |
| | | Response Boats - 14' to 20' | 3 | | | | | |
| | | Response Boats - 21' to 36' | 3 | | | | | |
| | | Portable Skimmers | 27 | | | | | |
| Clean Harbors (800) 645-8265 | New Iberia, LA | Containment Boom - 18" to 24" | 33,800' | Aransas Pass, TX | 9 | 1 | 1 | 11 |
| | | Containment Boom - 6" to 10" | 500' | | | | | |
| | | Response Boats - 21' to 36' | 4 | | | | | |
| ES&H Environmental (877) 437-2634 | Lafayette, LA | Containment Boom - 10" | 500' | Aransas Pass, TX | 8.5 | 1 | 1 | 11 |
| | | Containment Boom - 18" | 13,000' | | | | | |
| | | Jon Boat - 12' to 16' | 3 | | | | | |
| | | Response Boats - 18' to 21' | 1 | | | | | |
| | | Response Boats - 22' to 25' | 1 | | | | | |
| | | Response Boats - 26' to 29' | 1 | | | | | |
| | | Portable Skimmers | 4 | | | | | |
| | | Wildlife Hazing Cannon | 12 | | | | | |

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

# Alaminos Canyon 815
# Sample Shoreline Protection & Wildlife Support List

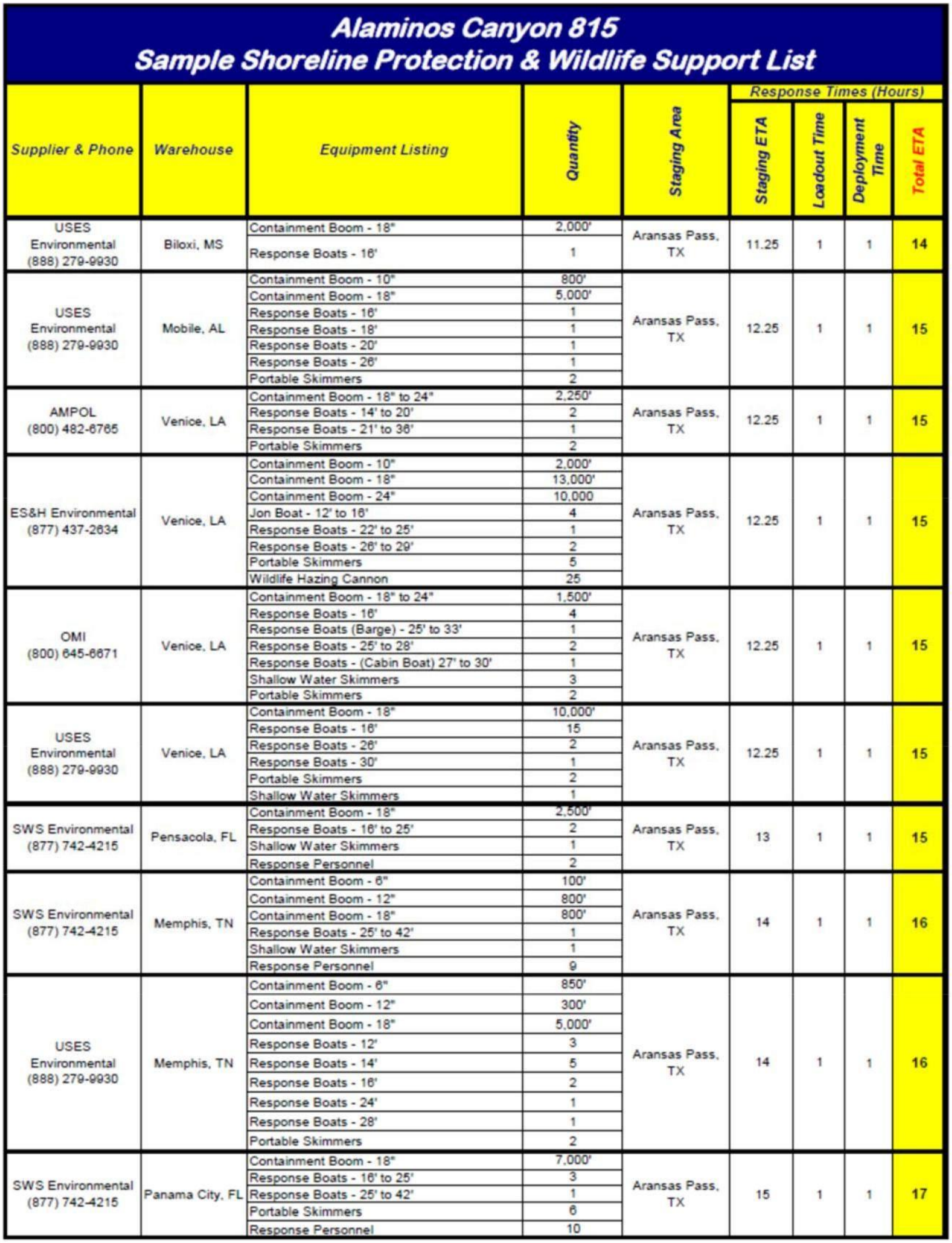
| Supplier & Phone | Warehouse | Equipment Listing | Quantity | Staging Area | Response Times (Hours) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Staging ETA | Loadout Time | Deployment Time | Total ETA |
| OMI<br>(800) 645-6671 | Port Allen, LA | Containment Boom - 18" to 24" | 2500' | Aransas Pass, TX | 9 | 1 | 1 | 11 |
| | | Containment Boom - 6" to 10" | 500' | | | | | |
| | | Response Boats - 16' | 2 | | | | | |
| | | Response Boats - 25 to 33' | 1 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| | | Response Personnel | 6 | | | | | |
| Clean Harbors<br>(800) 645-8265 | Baton Rouge, LA | Containment Boom - 18" to 24" | 14,000' | Aransas Pass, TX | 9.25 | 1 | 1 | 12 |
| | | Response Boats - 14' to 20' | 1 | | | | | |
| | | Portable Skimmers | 3 | | | | | |
| | | Response Personnel | 13 | | | | | |
| SWS Environmental<br>(877) 742-4215 | Baton Rouge, LA | Containment Boom - 18" | 1,000' | Aransas Pass, TX | 9.25 | 1 | 1 | 12 |
| | | Response Boats - 25' to 42' | 2 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| | | Response Personnel | 6 | | | | | |
| Wildlife Ctr. of Texas<br>(713) 861-9453 | Baton Rouge, LA | Wildlife Specialist - Personnel | 6 to 20 | Aransas Pass, TX | 9.25 | 1 | 1 | 12 |
| OMI<br>(800) 645-6671 | Morgan City, LA | Containment Boom - 18" to 24" | 2,500 | Aransas Pass, TX | 9.75 | 1 | 1 | 12 |
| | | Containment Boom - 6" to 10" | 400' | | | | | |
| | | Response Boats - 16' | 2 | | | | | |
| | | Response Boats - 25' to 28' | 1 | | | | | |
| | | Portable Skimmers | 3 | | | | | |
| | | Response Personnel | 3 | | | | | |
| ES&H Environmental<br>(877) 437-2634 | Morgan City, LA | Containment Boom - 10" | 2,000' | Aransas Pass, TX | 9.75 | 1 | 1 | 12 |
| | | Containment Boom - 18" | 500' | | | | | |
| | | Jon Boat - 12' to 16' | 3 | | | | | |
| | | Response Boats - 18' to 21' | 2 | | | | | |
| | | Response Boats - 22' to 25' | 1 | | | | | |
| | | Portable Skimmers | 2 | | | | | |
| | | Wildlife Hazing Cannon | 12 | | | | | |
| USES Environmental<br>(888) 279-9930 | Amelia, LA | Containment Boom - 18" | 500' | Aransas Pass, TX | 9.75 | 1 | 1 | 12 |
| USES Environmental<br>(888) 534-2744 | Geismar, LA | Containment Boom - 18" | 1,000' | Aransas Pass, TX | 9.5 | 1 | 1 | 12 |
| | | Response Boats - 16' | 2 | | | | | |
| | | Portable Skimmers | 1 | | | | | |
| AMPOL<br>(800) 482-6765 | Harvey, LA | Containment Boom - 18" to 24" | 8,000' | Aransas Pass, TX | 10.5 | 1 | 1 | 13 |
| | | Containment Boom - 6" to 10" | 3,000' | | | | | |
| CGA<br>(888) 242-2007 | Harvey, LA | Wildlife Rehab Trailer | 1 | Aransas Pass, TX | 10.5 | 1 | 1 | 13 |
| | | Wildlife Husbandry Trailer | 1 | | | | | |
| | | Support Trailer | 3 | | | | | |
| | | Bird Scare Cannons | 120 | | | | | |
| | | Contract Truck (Third Party) | 3 | | | | | |
| | | Personnel (Responder/Mechanic) | 4 | | | | | |
| ES&H Environmental<br>(877) 437-2634 | Houma, LA | Containment Boom - 10" | 2,000' | Aransas Pass, TX | 10.25 | 1 | 1 | 13 |
| | | Containment Boom - 18" | 20,000' | | | | | |
| | | Containment Boom - 24" | 5,000' | | | | | |
| | | Jon Boat - 12' to 16' | 30 | | | | | |
| | | Response Boats - 22' to 25' | 2 | | | | | |
| | | Response Boats - 26' to 29' | 4 | | | | | |
| | | Portable Skimmers | 23 | | | | | |
| | | Shallow Water Skimmers | 2 | | | | | |
| | | Wildlife Hazing Cannon | 57 | | | | | |
| OMI<br>(985) 798-1005 | Houma, LA | Containment Boom - 18" to 24" | 2,000' | Aransas Pass, TX | 10.25 | 1 | 1 | 13 |
| | | Containment Boom - 6" to 10" | 500' | | | | | |
| | | Response Boats - 16' | 2 | | | | | |
| | | Response Boats - 25' to 28' | 1 | | | | | |
| | | Response Boats - (Cabin Boat) 27' to 30' | 1 | | | | | |
| | | Shallow Water Skimmers | 3 | | | | | |

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

# Alaminos Canyon 815
# 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 |
| Lawson Environmental Service (985) 876-0420 | Houma, LA | Containment Boom - 18" | 30,000' | Aransas Pass, TX | 10.25 | 1 | 1 | 13 |
| | | Containment Boom - 12" | 2,000' | | | | | |
| | | Containment Boom - 10" | 9,500' | | | | | |
| | | Response Boats - 14' | 10 | | | | | |
| | | Response Boats - 16' | 6 | | | | | |
| | | Response Boats - 20' | 5 | | | | | |
| | | Response Boats - 24' | 8 | | | | | |
| | | Response Boats - 26' | 4 | | | | | |
| | | Response Boats - 28' | 7 | | | | | |
| | | Response Boats - 32' | 4 | | | | | |
| | | Portable Skimmers | 6 | | | | | |
| USES Environmental (888) 279-9930 | Lafitte, LA | Containment Boom - 18" | 1,000' | Aransas Pass, TX | 11 | 1 | 1 | 13 |
| | | Response Boats - 18' | 2 | | | | | |
| USES Environmental (888) 279-9930 | Marrero, LA | Containment Boom - 18" | 600' | Aransas Pass, TX | 10.5 | 1 | 1 | 13 |
| USES Environmental (888) 279-9930 | Meraux, LA | Containment Boom - 18" | 6,000' | Aransas Pass, TX | 10.5 | 1 | 1 | 13 |
| | | Containment Boom - 10" | 1,000' | | | | | |
| | | Response Boats - 16' | 23 | | | | | |
| | | Response Boats - 18' | 1 | | | | | |
| | | Response Boats - 24' | 1 | | | | | |
| | | Response Boats - 26' | 2 | | | | | |
| | | Response Boats - 28' | 1 | | | | | |
| | | Portable Skimmers | 2 | | | | | |
| ES&H Environmental (877) 437-2634 | Belle Chasse, LA | Containment Boom - 10" | 1,500' | Aransas Pass, TX | 10.75 | 1 | 1 | 13 |
| | | Containment Boom - 18" | 15,500' | | | | | |
| | | Containment Boom - 24" | 5,000' | | | | | |
| | | Jon Boat - 12' to 16' | 4 | | | | | |
| | | Response Boats - 18' to 21' | 1 | | | | | |
| | | Response Boats - 22' to 25' | 1 | | | | | |
| | | Response Boats - 26' to 29' | 3 | | | | | |
| | | Portable Skimmers | 10 | | | | | |
| | | Wildlife Hazing Cannon | 50 | | | | | |
| OMI (800) 645-6671 | Belle Chasse, LA | Containment Boom - 18" to 24" | 4,500' | Aransas Pass, TX | 10.75 | 1 | 1 | 13 |
| | | Containment Boom - 6" to 10" | 500' | | | | | |
| | | Response Boats - 20' | 1 | | | | | |
| | | Response Boats - 25' to 28' | 2 | | | | | |
| | | Portable Skimmers | 12 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| | | Bird Scare Cannons | 12 | | | | | |
| | | Response Personnel | 24 | | | | | |
| ES&H Environmental (877) 437-2634 | Golden Meadow, LA | Containment Boom - 10" | 1,000' | Aransas Pass, TX | 11 | 1 | 1 | 13 |
| | | Containment Boom - 18" | 13,000 | | | | | |
| | | Jon Boat - 12' to 16' | 2 | | | | | |
| | | Response Boats - 18' to 21' | 1 | | | | | |
| | | Response Boats - 22' to 25' | 1 | | | | | |
| | | Response Boats - 26' to 29' | 1 | | | | | |
| | | Portable Skimmers | 5 | | | | | |
| | | Wildlife Hazing Cannon | 12 | | | | | |
| OMI (800) 645-6671 | Galliano, LA | Containment Boom - 18" to 24" | 2,000' | Aransas Pass, TX | 10.75 | 1 | 1 | 13 |
| | | Containment Boom - 6" to 10" | 500' | | | | | |
| | | Response Boats - 16' | 1 | | | | | |
| | | Response Boats (Barge) - 25' to 33' | 1 | | | | | |
| | | Response Boats - 25' to 28' | 1 | | | | | |
| | | Portable Skimmers | 3 | | | | | |
| USES Environmental (888) 279-9930 | Hahnville, LA | Containment Boom - 18" | 500' | Aransas Pass, TX | 10.25 | 1 | 1 | 13 |
| ES&H Environmental (877) 437-2634 | Port Fourchon, LA | Containment Boom - 18" | 1000' | Aransas Pass, TX | 11.5 | 1 | 1 | 14 |
| | | Response Boats - 22' to 25' | 1 | | | | | |
| | | Portable Skimmers | 1 | | | | | |

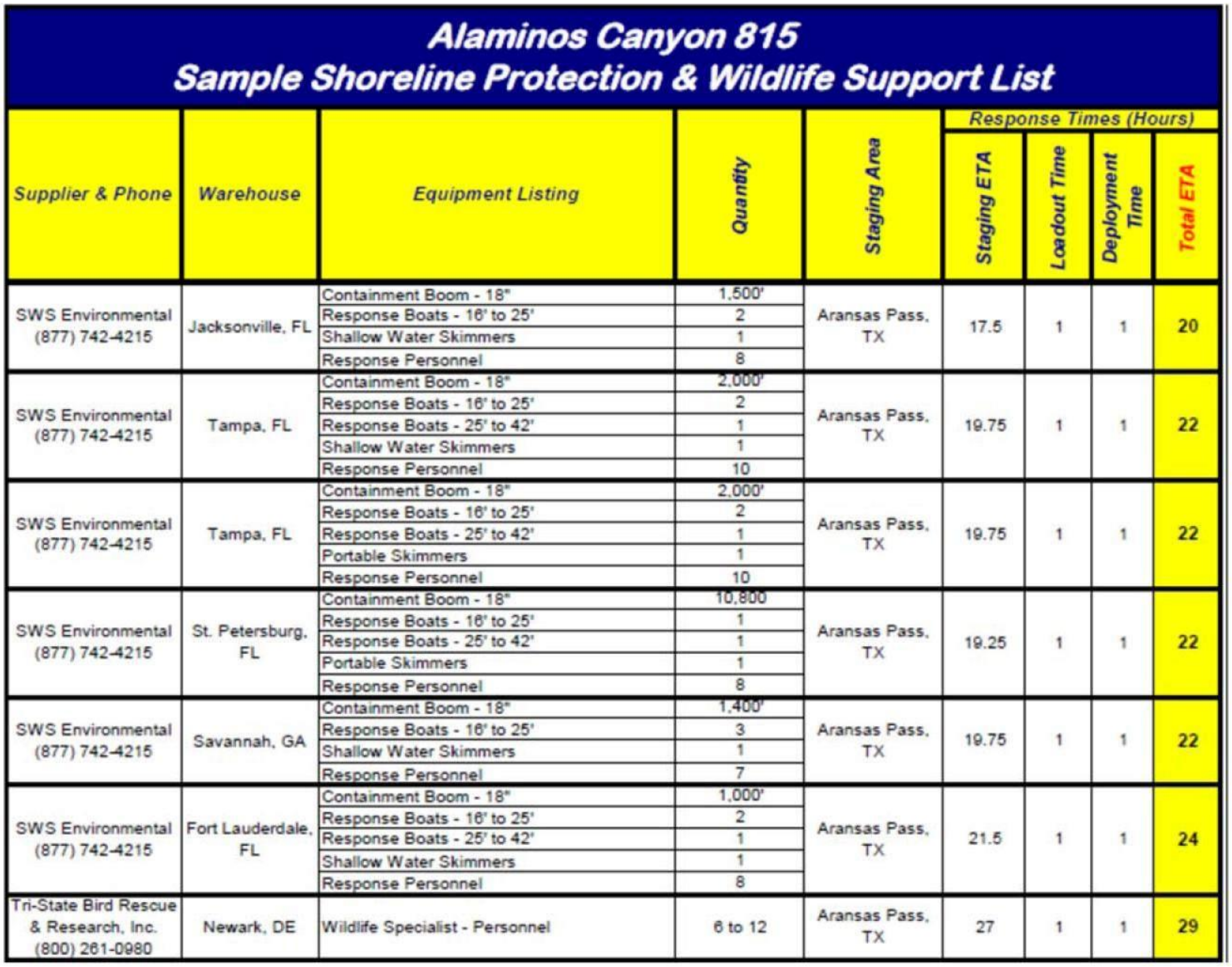
Table 9.D.11 Shoreline Protection and Wildlife Support List (continued)



## Alaminos Canyon 815
## 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 | Biloxi, MS | Containment Boom - 18" | 2,000' | Aransas Pass, TX | 11.25 | 1 | 1 | 14 |
| | | Response Boats - 16' | 1 | | | | | |
| USES Environmental (888) 279-9930 | Mobile, AL | Containment Boom - 10" | 800' | Aransas Pass, TX | 12.25 | 1 | 1 | 15 |
| | | Containment Boom - 18" | 5,000' | | | | | |
| | | Response Boats - 16' | 1 | | | | | |
| | | Response Boats - 18' | 1 | | | | | |
| | | Response Boats - 20' | 1 | | | | | |
| | | Response Boats - 26' | 1 | | | | | |
| | | Portable Skimmers | 2 | | | | | |
| AMPOL (800) 482-6765 | Venice, LA | Containment Boom - 18" to 24" | 2,250' | Aransas Pass, TX | 12.25 | 1 | 1 | 15 |
| | | Response Boats - 14' to 20' | 2 | | | | | |
| | | Response Boats - 21' to 36' | 1 | | | | | |
| | | Portable Skimmers | 2 | | | | | |
| ES&H Environmental (877) 437-2634 | Venice, LA | Containment Boom - 10" | 2,000' | Aransas Pass, TX | 12.25 | 1 | 1 | 15 |
| | | Containment Boom - 18" | 13,000' | | | | | |
| | | Containment Boom - 24" | 10,000 | | | | | |
| | | Jon Boat - 12' to 16' | 4 | | | | | |
| | | Response Boats - 22' to 25' | 1 | | | | | |
| | | Response Boats - 26' to 29' | 2 | | | | | |
| | | Portable Skimmers | 5 | | | | | |
| | | Wildlife Hazing Cannon | 25 | | | | | |
| OMI (800) 645-6671 | Venice, LA | Containment Boom - 18" to 24" | 1,500' | Aransas Pass, TX | 12.25 | 1 | 1 | 15 |
| | | Response Boats - 16' | 4 | | | | | |
| | | Response Boats (Barge) - 25' to 33' | 1 | | | | | |
| | | Response Boats - 25' to 28' | 2 | | | | | |
| | | Response Boats - (Cabin Boat) 27' to 30' | 1 | | | | | |
| | | Shallow Water Skimmers | 3 | | | | | |
| | | Portable Skimmers | 2 | | | | | |
| USES Environmental (888) 279-9930 | Venice, LA | Containment Boom - 18" | 10,000' | Aransas Pass, TX | 12.25 | 1 | 1 | 15 |
| | | Response Boats - 16' | 15 | | | | | |
| | | Response Boats - 26' | 2 | | | | | |
| | | Response Boats - 30' | 1 | | | | | |
| | | Portable Skimmers | 2 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| SWS Environmental (877) 742-4215 | Pensacola, FL | Containment Boom - 18" | 2,500' | Aransas Pass, TX | 13 | 1 | 1 | 15 |
| | | Response Boats - 16' to 25' | 2 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| | | Response Personnel | 2 | | | | | |
| SWS Environmental (877) 742-4215 | Memphis, TN | Containment Boom - 6" | 100' | Aransas Pass, TX | 14 | 1 | 1 | 16 |
| | | Containment Boom - 12" | 800' | | | | | |
| | | Containment Boom - 18" | 800' | | | | | |
| | | Response Boats - 25' to 42' | 1 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| | | Response Personnel | 9 | | | | | |
| USES Environmental (888) 279-9930 | Memphis, TN | Containment Boom - 6" | 850' | Aransas Pass, TX | 14 | 1 | 1 | 16 |
| | | Containment Boom - 12" | 300' | | | | | |
| | | Containment Boom - 18" | 5,000' | | | | | |
| | | Response Boats - 12' | 3 | | | | | |
| | | Response Boats - 14' | 5 | | | | | |
| | | Response Boats - 16' | 2 | | | | | |
| | | Response Boats - 24' | 1 | | | | | |
| | | Response Boats - 28' | 1 | | | | | |
| | | Portable Skimmers | 2 | | | | | |
| SWS Environmental (877) 742-4215 | Panama City, FL | Containment Boom - 18" | 7,000' | Aransas Pass, TX | 15 | 1 | 1 | 17 |
| | | Response Boats - 16' to 25' | 3 | | | | | |
| | | Response Boats - 25' to 42' | 1 | | | | | |
| | | Portable Skimmers | 6 | | | | | |
| | | Response Personnel | 10 | | | | | |

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



**Alaminos Canyon 815**
**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 |
| SWS Environmental (877) 742-4215 | Jacksonville, FL | Containment Boom - 18" | 1,500' | Aransas Pass, TX | 17.5 | 1 | 1 | 20 |
| | | Response Boats - 16' to 25' | 2 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| | | Response Personnel | 8 | | | | | |
| SWS Environmental (877) 742-4215 | Tampa, FL | Containment Boom - 18" | 2,000' | Aransas Pass, TX | 19.75 | 1 | 1 | 22 |
| | | Response Boats - 16' to 25' | 2 | | | | | |
| | | Response Boats - 25' to 42' | 1 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| | | Response Personnel | 10 | | | | | |
| SWS Environmental (877) 742-4215 | Tampa, FL | Containment Boom - 18" | 2,000' | Aransas Pass, TX | 19.75 | 1 | 1 | 22 |
| | | Response Boats - 16' to 25' | 2 | | | | | |
| | | Response Boats - 25' to 42' | 1 | | | | | |
| | | Portable Skimmers | 1 | | | | | |
| | | Response Personnel | 10 | | | | | |
| SWS Environmental (877) 742-4215 | St. Petersburg, FL | Containment Boom - 18" | 10,800 | Aransas Pass, TX | 19.25 | 1 | 1 | 22 |
| | | Response Boats - 16' to 25' | 1 | | | | | |
| | | Response Boats - 25' to 42' | 1 | | | | | |
| | | Portable Skimmers | 1 | | | | | |
| | | Response Personnel | 8 | | | | | |
| SWS Environmental (877) 742-4215 | Savannah, GA | Containment Boom - 18" | 1,400' | Aransas Pass, TX | 19.75 | 1 | 1 | 22 |
| | | Response Boats - 16' to 25' | 3 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| | | Response Personnel | 7 | | | | | |
| SWS Environmental (877) 742-4215 | Fort Lauderdale, FL | Containment Boom - 18" | 1,000' | Aransas Pass, TX | 21.5 | 1 | 1 | 24 |
| | | Response Boats - 16' to 25' | 2 | | | | | |
| | | Response Boats - 25' to 42' | 1 | | | | | |
| | | Shallow Water Skimmers | 1 | | | | | |
| | | Response Personnel | 8 | | | | | |
| Tri-State Bird Rescue & Research, Inc. (800) 261-0980 | Newark, DE | Wildlife Specialist - Personnel | 6 to 12 | Aransas Pass, TX | 27 | 1 | 1 | 29 |

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

## SECTION 10: ENVIRONMENTAL MONITORING INFORMATION

### A. Monitoring Systems

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

### B. Incidental Takes

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 Block 815, OCS-G 19409

This lease was acquired by Chevron U.S.A. Inc. in Lease Sale #168 on 8/27/1997. Shell Offshore Inc. became operator June 1, 2005. The lease is part of Unit No. 754307006 and the lease is held by continuous production. The following stipulations apply to this lease:

*Lease Stipulation 2 – Military Warning Area*
This lease is part of the W-602 Warning and Water Test Area. Shell will enter into an agreement with the Commander of the Tinker AFB in Oklahoma prior to performing activities proposed in this plan.

*Protected Species*

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

Section 6h, Threatened or endangered species, critical habitat, and marine mammal information
Section 10b, Environmental Monitoring Information, Incidental takes
Section 12b, 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 | "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 | 10,100 | 3 | Twice per week |
| Helicopter | 760 | 1 | Once per day |
| Well test support vessel | 16,500 | 2 | 20 days/yr |
| Tug Support vessel | 10,100 | 1 | 10 days/yr |
| Tug Support vessel | 4,500 | 2 | 10 days/yr |
| | | | |

## 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 |
|---|---|---|---|
| 28- foot length | 100,000 gals. | 1 week | Galveston due south to block 815 |

## C. Drilling Fluids Transportation

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

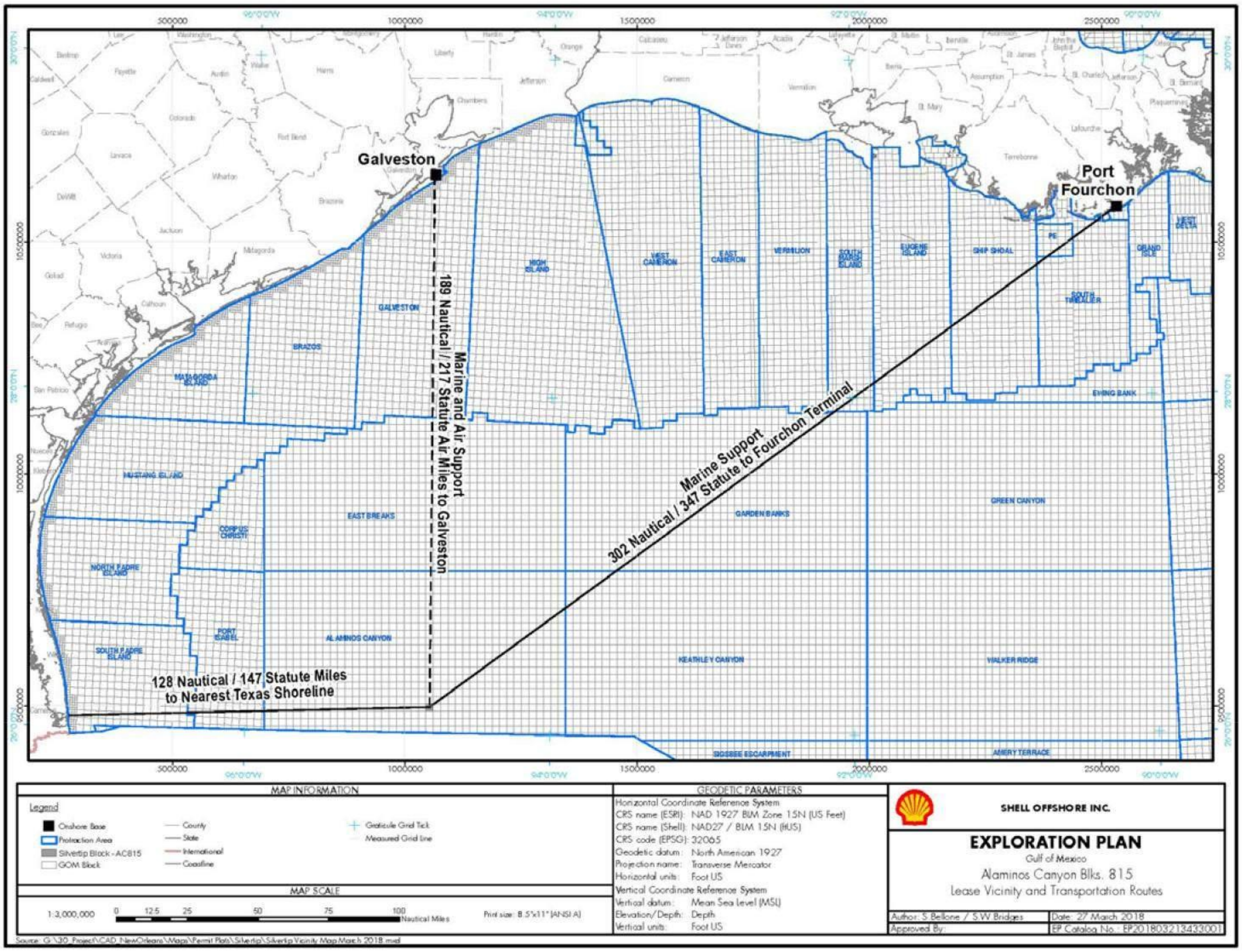
## D. Solid and Liquid Wastes Transportation

See Section 7, Table 7B.

## E. Vicinity Map

See Attachment 14A for Vicinity Map.

# Attachment 14A – Vicinity Map



GEODETIC PARAMETERS

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

SHELL OFFSHORE INC.

EXPLORATION PLAN
Gulf of Mexico
Alaminos Canyon Blks. 815
Lease Vicinity and Transportation Routes

Author: S.Bellone / S.W Bridges
Date: 27 March 2018
Approved By:
EP Catalog No.: EP201803213433001

Source: G:\30_Project\CAD_NewOrleans\Maps\Permit Plats\Silvertip\Silvertip Vicinity Map March 2018.mxd

# SECTION 15: ONSHORE SUPPORT FACILITIES INFORMATION

## A. General

The existing onshore support base for air transportation will be PHI Heliport in Galveston, TX, located at 2215 Terminal Drive. Marine support for the drilling operation will be from Halliburton located at 1800 Seawolf Parkway in Galveston, TX or Martin Midstream at Pelican Island in Galveston, TX. The Fourchon boat facility may be utilized and is operated by Shell. It is located on Bayou Lafourche, south of Leeville, LA approximately 3 miles from the Gulf of Mexico.

| Name | Location | Existing/New/Modified |
|---|---|---|
| Fourchon | Port Fourchon, LA | Existing |
| Galveston PHI | Galveston, TX | Existing |
| Halliburton | Galveston, TX | Existing |

## 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

Louisiana and Texas CZM concurrence for AC 815, OCS-G 19409, was obtained in Initial Exploration Plan N-9899 and is not required for Supplemental Exploration Plans.

# SECTION 18: ENVIRONMENTAL IMPACT ANALYSIS (EIA)

## Environmental Impact Analysis

## for

## Supplemental Exploration Plan

## Alaminos Canyon Block 815 (OCS G-19409)

Offshore Texas

April 2018

**Prepared for:**

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

**Prepared by:**

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

# Acronyms and Abbreviations

| | |
|---|---|
| ABS | American Bureau of Shipping |
| AC | Alaminos Canyon |
| ac | acre |
| ADIOS | Automated Data Inquiry for Oil Spills |
| AQR | Air Quality Emissions Report |
| bbl | barrel |
| BOEM | Bureau of Ocean Energy Management |
| BOEMRE | Bureau of Ocean Energy Management, Regulation and Enforcement |
| BOP | Blowout preventer |
| BOPD | barrels of oil per day |
| BSEE | Bureau of Safety and Environmental Enforcement |
| CFR | Code of Federal Regulations |
| $CH_4$ | methane |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| dB | decibel |
| DNV | Det Norske Veritas |
| DP | dynamically positioned |
| DPS | distinct population segment |
| EFH | Essential Fish Habitat |
| EIA | Environnemental Impact Analysis |
| EIS | Environmental Impact Statement |
| EP | Exploration Plan |
| ESA | Endangered Species Act |
| FAD | fish-attracting device |
| FR | Federal Register |
| GMFMC | Gulf of Mexico Fishery Management Council |
| $H_2S$ | hydrogen sulfide |
| ha | hectare |
| HAPC | Habitat Area of Particular Concern |
| Hz | hertz |
| IPF | impact-producing factor |
| kHz | kilohertz |
| LARS | launch and recovery system |
| MARPOL | International Convention for the Prevention of Pollution from Ships |
| MMC | Marine Mammal Commission |
| MMPA | Marine Mammal Protection Act |
| MMS | Minerals Management Service |
| MODU | mobile offshore drilling unit |
| MWCC | Marine Well Containment Company |
| NAAQS | National Ambient Air Quality Standards |
| NEPA | National Environmental Policy Act |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| $NO_x$ | nitrogen oxides |
| NPDES | National Pollutant Discharge Elimination System |
| NRC | National Research Council |
| NTL | Notice to Lessees and Operators |
| NWR | National Wildlife Refuge |
| OCS | Outer Continental Shelf |
| OCSLA | Outer Continental Shelf Lands Act |
| OSRA | Oil Spill Risk Analysis |
| OSRP | Oil Spill Response Plan |
| PAH | polycyclic aromatic hydrocarbon |
| PM | particulate matter |
| re 1 µPa | relative to one micropascal |
| re 1 µPa m | relative to one micropascal meter |
| re 1 $\mu Pa^{2} \cdot s$ | relative to one micropascal squared second |
| SBF | synthetic-based fluid |
| SBM | synthetic-based mud |
| Shell | Shell Offshore Inc. |
| $SO_x$ | sulfur oxides |
| USCG | U.S. Coast Guard |
| USDOI | U.S. Department of the Interior |
| USEPA | U.S. Environmental Protection Agency |
| USFWS | U.S. Fish and Wildlife Service |
| VOC | volatile organic compound |
| WCD | worst case discharge |
| WMA | Wildlife Management Area |

# Introduction

## Project Summary

Shell Offshore Inc. (Shell) is submitting a supplemental Exploration Plan (EP) for Alaminos Canyon (AC) Block 815 for nine wells (F, G, H, I, J, K, SA005, SA005 Alt-A, and SA005 Alt-B) in AC 815. Shell previously submitted Development Operations Coordination Document S-7157 and R-5085. 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, 147 miles (237 km) from the nearest shoreline (Texas), 346 miles (557 km) from the onshore support base at Port Fourchon, Louisiana, and 217 miles (349 km) from the helicopter base in Galveston, Texas. Estimated water depths at the proposed wellsites range from 8,997 to 9,184 ft (2,742 to 2,799 m). All distances are in statute miles.

Nine wells are scheduled to be drilled and completed from 2018 to 2026 with one well drilled each year. 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 200 days for drilling and completion. 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 for the Outer Continental Shelf (OCS) Oil and Gas Leasing Program (BOEM, 2016a) and in multisale Environmental Impact Statements (EISs) for the Western and Central Gulf of Mexico Planning Areas (BOEM, 2012a, b, 2013a, 2014, 2015, 2016b, 2017c).

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, 2013a, 2014, 2015, 2016b, 2017c). 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 (2016a). Under the OCSLA, the U.S. Department of the Interior (USDOI) is responsible for the administration of mineral exploration and development of the OCS. Within the USDOI, BOEM and the Bureau of Safety and Environmental Enforcement (BSEE) are responsible for managing and regulating the development of OCS oil and gas resources in accordance with the provisions of the OCSLA. The BSEE offshore regulations are in 30 CFR Chapter II, Subchapter B. BOEM offshore regulations are in 30 CFR Chapter V, Subchapter B.

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

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

Table 1. Notices to Lessees and Operators (NTLs) that are applicable to this Environmental Impact Analysis (EIA), 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. Supersedes NTL 2012-JOINT-G01. |
| BSEE-2015-G03 | Marine Trash and Debris Awareness and Elimination | Instructs operators to exercise caution in the handling and disposal of small items and packaging materials; requires the posting of placards at prominent locations on offshore vessels and structures; and mandates a yearly marine trash and debris awareness training and certification process. Supersedes and replaces NTL 2012-G01. |

Table 1. (Continued).

| NTL | Title | Summary |
|---|---|---|
| BOEM-2015-N02 | Elimination of Expiration Dates on Certain Notice to Lessees and Operators Pending Review and Reissuance | Eliminates the expiration dates on past or upcoming expiration dates from NTLs currently posted. |
| 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. Supersedes NTL 2010-N06. |
| 2014-G04 | Military Warning and Water Test Areas | Provides contact links to individual command headquarters for the military warning and water test areas in the Gulf of Mexico. |
| BSEE-2012-N06 | Guidance to Owners and Operators of Offshore Facilities Seaward of the Coast Line Concerning Regional Oil Spill Response Plans | Provides clarification, guidance, and information for preparation of regional Oil Spill Response Plans. Recommends description of response strategy for WCD scenarios to ensure capability to respond to oil discharges is both efficient and effective. |
| 2011-JOINT-G01 | Revisions to the List of OCS Blocks Requiring Archaeological Resource Surveys and Reports | Provides new information on which OCS blocks require archaeological surveys and reports and line spacing required in each block. This NTL augments NTL 2005-G07. |
| 2010-N10 | Statement of Compliance with Applicable Regulations and Evaluation of Information Demonstrating Adequate Spill Response and Well Containment Resources | Informs operators using subsea blowout preventers (BOPs) or surface BOPs on floating facilities that applications for well permits must include a statement signed by an authorized company official stating that the operator will conduct all activities in compliance with all applicable regulations, including the increased safety measures regulations (75 *Federal Register* [FR] 63346). Informs operators that BOEM will be evaluating whether each operator has submitted adequate information demonstrating that it has access to and can deploy containment resources to promptly respond to a blowout or other loss of well control. |
| 2009-G40 | Deepwater Benthic Communities | Provides guidance for avoiding and protecting high-density deepwater benthic communities (including chemosynthetic and deepwater coral communities) from damage caused by OCS oil and gas activities in water depths greater than 984 ft (300 m). Prescribes separation distances of 2,000 ft (610 m) from each mud and cuttings discharge location and 250 ft (76 m) from all other seafloor disturbances. |

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) (**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 information required by NTL 2008-G04 (as extended by NTL 2015-N02), which provides guidance regarding information required by 30 CFR Part 550 for EIAs. The main impact-related discussions are in **Section A** (Impact-Producing Factors [IPF]) 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**, adapted from Form BOEM-0142, and has been developed *a priori* to focus the impact analysis on those environmental resources that may be impacted as a result of one or more IPFs. The tabular matrix indicates which of the routine activities and accidental events could affect specific resources. An "X" indicates that an IPF could reasonably be expected to affect a certain resource, and a dash (--) indicates no impact or negligible impact. Where there may be an effect, an analysis is provided in **Section C**. Potential IPFs for the proposed activities are listed below and briefly discussed in the following sections.

- 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.

## 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 200 days per year from 2018 to 2026. 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 (dB) relative to one micropascal (re 1 µPa) m from the source, with a primary frequency below 600 hertz (Hz) (Blackwell and Greene Jr., 2003, McKenna et al., 2012, 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 relative to one micropascal meter (re 1 µPa 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 µPa 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 µPa 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).

Table 2. Matrix of impact-producing factors (IPFs) and affected environmental resources.

| Environmental Resources | Impact-producing Factors | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | MODU Presence (incl. noise & lights) | Physical Disturbance to Seafloor | Air Pollutant Emissions | Effluent Discharges | Water Intake | Onshore Waste Disposal | Marine Debris | Support Vessel/Helicopter Traffic | Accidents | |
| | | | | | | | | | Small Fuel Spill | Large Oil Spill |
| **Physical/Chemical Environment** | | | | | | | | | | |
| Air quality | -- | -- | **X**(5) | -- | -- | -- | -- | -- | **X**(6) | **X**(6) |
| Water quality | -- | -- | -- | **X** | -- | -- | -- | -- | **X**(6) | **X**(6) |
| **Seafloor Habitats and Biota** | | | | | | | | | | |
| Soft bottom benthic communities | -- | **X** | -- | **X** | -- | -- | -- | -- | -- | **X**(6) |
| High-density deepwater benthic communities | -- | --(4) | -- | --(4) | -- | -- | -- | -- | -- | **X**(6) |
| Designated topographic features | -- | --(1) | -- | --(1) | -- | -- | -- | -- | -- | -- |
| Pinnacle trend area live bottoms | -- | --(2) | -- | --(2) | -- | -- | -- | -- | -- | -- |
| Eastern Gulf live bottoms | -- | --(3) | -- | --(3) | -- | -- | -- | -- | -- | -- |
| **Threatened, Endangered, and Protected Species and Critical Habitat** | | | | | | | | | | |
| Sperm whale (endangered) | **X**(8) | -- | -- | -- | -- | -- | -- | **X**(8) | **X**(6,8) | **X**(6,8) |
| 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)** |
| **Coastal and Marine Birds** | | | | | | | | | | |
| Marine and pelagic birds | **X** | -- | -- | -- | -- | -- | -- | **X** | **X**(6) | **X**(6) |
| Shorebirds and coastal nesting birds | -- | -- | -- | -- | -- | -- | -- | **X** | -- | **X**(6) |
| **Fisheries Resources** | | | | | | | | | | |
| Pelagic communities and ichthyoplankton | **X** | -- | -- | **X** | **X** | -- | -- | -- | **X**(6) | **X**(6) |
| Essential Fish Habitat | **X** | -- | -- | **X** | **X** | -- | -- | -- | **X**(6) | **X**(6) |
| **Archaeological Resources** | | | | | | | | | | |
| Shipwreck sites | -- | --(7) | -- | -- | -- | -- | -- | -- | -- | **X**(7) |
| Prehistoric archaeological sites | -- | --(7) | -- | -- | -- | -- | -- | -- | -- | **X**(6) |
| **Coastal Habitats and Protected Areas** | | | | | | | | | | |
| Barrier beaches and dunes | -- | -- | -- | -- | -- | -- | -- | **X** | -- | **X**(6) |
| Wetlands and seagrass beds | -- | -- | -- | -- | -- | -- | -- | **X** | -- | **X**(6) |
| Coastal wildlife refuges and wilderness areas | -- | -- | -- | -- | -- | -- | -- | -- | -- | **X**(6) |
| **Socioeconomic and Other Resources** | | | | | | | | | | |
| Recreational and commercial fishing | **X** | -- | -- | -- | -- | -- | -- | -- | **X**(6) | **X**(6) |
| Public health and safety | -- | -- | -- | -- | -- | -- | -- | -- | **--** | **X**(6) |
| Employment and infrastructure | -- | -- | -- | -- | -- | -- | -- | -- | -- | **X**(6) |
| Recreation and tourism | -- | -- | -- | -- | -- | -- | -- | -- | -- | **X**(6) |
| Land use | -- | -- | -- | -- | -- | -- | -- | -- | -- | **X**(6) |
| Other marine uses | -- | -- | -- | -- | -- | -- | -- | -- | -- | **X**(6) |

X = potential impact on the resource; dash (--) = no impact or negligible impact on the resource. 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 BOEM as being in water depths 300 m or greater.*
   - No impacts on high-density deepwater benthic communities are anticipated. The wellsite assessments found that no features indicative of high-density chemosynthetic communities or coral communities were identified within 2,000 ft (610 m) of the proposed well locations F, G, H, I, J, K, SA005, SA005 Alt-A, and SA005 Alt-B (Geoscience Earth & Marine Services, 2003, 2007, Berger Geosciences, 2015, C&C Technologies, 2015).

(5) *Exploration or production activities where hydrogen sulfide ($H_2S$) concentrations greater than 500 ppm might be encountered.*
   - **EP Section 4** contains Shell's request for classification of AC 815 as $H_2S$ absent.

(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 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. As discussed in **Section C.6**, 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, 2003, 2007, Berger Geosciences, 2015, C&C Technologies, 2015). The lease area is 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, prehistoric archaeological sites are not likely to be present.

(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 MODU 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.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 only 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 ($SO_x$), nitrogen oxides ($NO_x$), 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) (**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 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 impact from impingement and entrainment of aquatic organisms. The NPDES General Permit No. GMG290103 specifies requirements for new facilities for which construction commenced after July 17, 2006, with a cooling water intake structure having a design intake capacity of greater than 2 million gallons of water per day, of which at least 25% is used for cooling purposes.

The 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, as well as Exploration and Production wastes, will be transported to shore for recycling or deep well injection at Haliburton Drilling Fluids or MiSwaco, 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 Haliburton, 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, posting informational placards, manifesting trash sent to shore, and using special precautions such as covering outside trash bins to prevent accidental loss of solid waste. 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 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 for 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, 2017c).

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., 2012). 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). Propeller cavitation is usually the dominant underwater noise source. 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 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 µPa at 1 m (Richardson et al., 1995, Hildebrand, 2009, McKenna et al., 2012).

Helicopters used for offshore oil and gas operation support are a potential source 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 dB re 1 µPa 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, 2016b, 2017c) discuss other types of accidents: loss of well control, pipeline failures, vessel collisions, chemical and drilling fluid spills, and hydrogen sulfide ($H_2S$) release. These are briefly discussed in this section. No other site-specific issues have been identified for the EIA. The analysis in the lease sale EISs for these topics is incorporated by reference.

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, 2017c). 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 resuspend and disperse bottom sediments (BOEM, 2012a, b, 2013a, 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, 2013a, 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, 2003, 2007, Berger Geosciences, 2015, C&C Technologies, 2015).

Vessel Collisions BSEE data show that there were 119 OCS-related collisions between 2009 and 2016 (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 (2017a), 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 Spill. 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, 2017a). 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, 2017c).

Drilling Fluid Spills. There is the potential for drilling fluids, specifically synthetic-based fluid (SBFs) to be spilled due to an accidental riser disconnect (BOEM, 2017c). 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.

$H_2S$ Release. Based on CFR 550.215, Shell requested the classification of $H_2S$ for AC 815 to be absent. Based on the $H_2S$ absent classification, no further discussion on impacts of $H_2S$ is needed. See **EP Section 4** for more details.

### A.9.1 Small Fuel Spill

Spill Size. According to the analysis by BOEM (2017c), 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, 2017c). 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 147 miles (237 km) from the nearest shoreline (Texas). Slicks from spills are expected to persist for relatively short periods of time ranging from minutes (<1 bbl) to hours (<10 bbl) to a few days (10 to 1,000 bbl) and rapidly spread out, evaporate, and disperse into the water column (BOEM, 2012a). Because of the distance 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 dropped to 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 129,000 bbl of oil during the first day, and the calculated 30-day average WCD rate is 78,700 barrels of oil per day (BOPD) with total potential spill volume of 5.4 million barrels. The 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 the Final Drilling Safety Rule, 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 W027 (the launch area that includes the lease area) are presented in **Table 3**. The model does not predict shoreline contact within the first ten days following a spill. Within 30 days, shorelines in 11 Texas counties and two Louisiana parishes are predicted to be contacted (1% to 7% probability of contact). Matagorda County, Texas, has the highest probability of shoreline contact (7% probabilities within 30 days, respectively).

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.

Table 3. Conditional probabilities of a spill in the lease area contacting shoreline segments based on a 30-day Oil Spill Risk Analysis (OSRA) (From: Ji et al., 2004). Values are conditional probabilities that a hypothetical spill in the lease area (represented by OSRA Launch Area W027) could contact shoreline segments within 3, 10, or 30 days.

| Shoreline Segment | County or Parish, State | Conditional Probability of Contact[1] (%) | | |
|---|---|---|---|---|
| | | 3 Days | 10 Days | 30 Days |
| C1 | Cameron, TX | -- | -- | 2 |
| C2 | Willacy, TX | -- | -- | 1 |
| C3 | Kenedy, TX | -- | -- | 4 |
| C4 | Kleberg, TX | -- | -- | 3 |
| C5 | Nueces, TX | -- | -- | 2 |
| C6 | Aransas, TX | -- | -- | 3 |
| C7 | Calhoun, TX | -- | -- | 3 |
| C8 | Matagorda, TX | -- | -- | 7 |
| C9 | Brazoria, TX | -- | -- | 2 |
| C10 | Galveston, TX | -- | -- | 3 |
| C12 | Jefferson, TX | -- | -- | 1 |
| C13 | Cameron, LA | -- | -- | 3 |
| C14 | Vermilion, LA | -- | -- | 1 |

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

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, 2017c). The more toxic, light aromatic and aliphatic hydrocarbons are lost rapidly by evaporation and dissolution from the oil 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 development of near-term containment capability 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 (LARS), which enables water sampling and monitoring to water depths of 3,000 m. The two 8 ft × 20 ft containers have been certified for offshore use by Det Norske Veritas (DNV) and the American Bureau of Shipping (ABS). The LARS is a combined winch, A-frame, and 3,000-m long cable customized for instruments in the containers. The containers are designed to enable rapid mobilization of equipment to an incident site. The required equipment includes redundant systems to avoid downtime and supplies for sample handling and storage. Once deployed on a suitable vessel, the mobile containers then act as workspaces for scientists and operations personnel.

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

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

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

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

# B. Affected Environment

The lease area is in the Western Planning Area in the central Gulf of Mexico, 147 miles (237 km)from the nearest shoreline (Texas), 346 miles (557 km) from the onshore support base for vessels at Port Fourchon, Louisiana, and 217 miles (349 km) from the helicopter base at Galveston, Texas. The water depths at the proposed wellsites range from 8,997 to 9,184 ft (2,742 to 2,799 m).

Proposed wellsites F through K are located near the base of the Sigsbee Escarpment in a broad area of relatively gradual slope between two low ridges (Berger Geosciences, 2015). The seafloor slopes approximately 6.5 degrees to the southeast at proposed wellsite SA005, SA005 Alt-A, and SA005 Alt-B (Geoscience Earth & Marine Services, 2003, 2007, C&C Technologies, 2015).

No seafloor anomalies were identified within 2,000 ft (610 m) of the proposed wellsites that could indicate potential for chemosynthetic or high-density deepwater benthic communities (Geoscience Earth & Marine Services, 2003, 2007, Berger Geosciences, 2015, C&C Technologies, 2015). The wellsites assessments did not detect any archaeological significant sonar contacts within 2,000 ft (610 m) of the proposed wellsites (Geoscience Earth & Marine Services, 2003, 2007, Berger Geosciences, 2015, C&C Technologies, 2015).

A detailed description of the regional affected environment is provided by BOEM (2012a, 2013a, 2014, 2015, 2016b, 2017c), 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 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 (2012a, 2013a, 2014, 2015, 2016b, 2017c).

# C. Impact Analysis

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

Impacts have been analyzed extensively in lease sale EISs for the Central and Western Gulf of Mexico Planning Areas (BOEM, 2012a, 2013b, 2014, 2015, 2016b, 2017c). Site-specific issues are addressed in this section as appropriate. The following sections are organized by the Environmental Resources identified in **Table 2**, and address 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 March 2018, Mississippi and Alabama coastal counties are in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants. St. Bernard Parish in Louisiana is a nonattainment area for sulfur dioxide based on the 2010 standard (USEPA, 2018). One coastal metropolitan area in Texas (Houston-Galveston-Brazoria) is a nonattainment area for 8-hour ozone. One coastal metropolitan area in Florida (Tampa area) is a nonattainment area for lead, based on the 2008 Standard, and for sulfur dioxide, based on the 2010 standard (USEPA, 2018).

Winds in the region are driven by the clockwise circulation around the Bermuda High (BOEM, 2017c). 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, $SO_x$, $NO_x$, VOCs, and CO.

Due to the distance from shore, routine operations in the project area are not expected to impact air quality along the coast. As noted in the lease sale EISs (BOEM, 2012a, 2013a, 2014, 2015, 2016b, 2017c), 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 815 is located west of 87.5° W longitude; thus, air quality is under BOEM jurisdiction as explained in NTL 2009-N11. The BOEM-implementing regulations are provided in 30 CFR 550 Subpart C. The AQR (**EP Section 8**) prepared in accordance with BOEM requirements shows that the projected emissions from emission 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 418 miles (672 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 ($CO_2$) and methane ($CH_4$) emissions from the project would constitute a very small incremental contribution to greenhouse gas emissions from all OCS activities. According to Programmatic and OCS lease sale EISs (BOEM, 2017c), estimated $CO_2$ emissions from OCS oil and gas sources are 0.4% of the U.S. total. Greenhouse gas emissions from the proposed project represent a negligible contribution to the total greenhouse gas emissions from reasonably foreseeable activities in the Gulf of Mexico area and would not significantly alter any of the climate change impacts evaluated in the Programmatic EIS (BOEM, 2016a).

### Impacts of a Small Fuel Spill

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

A small fuel spill would likely affect air quality near the spill site by introducing VOCs into the atmosphere through evaporation. The ADIOS 2 model (**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 (**Section A.9.1**).

### Impacts of a Large Oil Spill

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

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 $NO_x$, $SO_x$, CO, and PM as well as greenhouse gases. However, *in situ* burning would occur as a response measure only if authorized by the USEPA.

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 predictions (**Table 3**), Matagorda County in Texas is the coastal area most likely to be affected (7% probability 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. 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 (2017c), 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). These IPFs with potential impacts listed in **Table 2** are discussed below.

#### 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.

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

Cuttings wetted with SBMs will be discharged overboard in accordance with the NPDES permit. After discharge, SBM retained on cuttings would be expected to adhere to the cuttings particles and, consequently, would not produce much turbidity as the cuttings sink through the water column (Neff et al., 2000). Recent EISs have concluded that the discharge of treated SBM cuttings will not cause persistent impacts on water quality in the lease area (BOEM, 2017c). 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, 2016b, 2017c). The probability of a small spill would 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 impacts. **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 be kept in suspension and moved by the currents.

Diesel oil 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 oil spill would evaporate or disperse within 24 hours (**Section A.9.1**). The sea surface area covered with a very thin layer of diesel fuel would range from 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, 2016b, 2017c). 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 $CH_4$ were released, causing localized oxygen depletion as methanotrophic bacteria rapidly metabolized the hydrocarbons (Joye et al., 2011, Kessler et al., 2011). However, a broader study of the deepwater Gulf of Mexico found that although some stations showed slight depression of dissolved oxygen concentrations relative to climatological background values, the findings were not indicative of hypoxia ($<2.0$ mg $L^{-1}$) (Operational Science Advisory Team, 2010). Stations revisited around the Macondo wellhead in October 2010, approximately 6 months after the beginning of the event showed no measurable oxygen depressions (Operational Science Advisory Team, 2010).

Due to the 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 predictions (**Table 3**), the nearshore waters and embayments of Matagorda County in Texas is the coastal area most likely to be affected, with a 7% 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 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 8,997 to 9,184 ft (2,742 to 2,799 m). See **EP Section 6a** for further information.

According to BOEM (2012a, 2013a, 2014, 2015, 2016b, 2017c), 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 (2003, 2007), Berger Geosciences (2015), C&C Technologies (2015) conducted shallow hazard and archeological assessment surveys of AC 815. No features indicative of high-density chemosynthetic communities or coral communities were identified within 2,000 ft (610 m) of the proposed wellsites (Geoscience Earth & Marine Services, 2003, 2007, Berger Geosciences, 2015, C&C Technologies, 2015).

## 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 wellsites. **Table 4** summarizes data from two nearby stations within the same faunal zone as the proposed wells. Sediments at these two stations were similar, predominantly clay (60% at Station AC1 and 61% at Station RW6) and silt (35% at Station AC1 and 34% at Station RW6) (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 $m^{-2}$) | Macroinfauna (individuals $m^{-2}$) | Megafauna (individuals $ha^{-1}$) |
| AC1 | 30 mi (48 km) NE | 2,550 | 129,974 | 637 | 1,620 |
| RW6 | 27 mi (43 km) ESE | 3,000 | 144,453 | 715 | -- |

ESE = east-northeast; NE = northeast. Meiofaunal and megafaunal abundance from Rowe and Kennicutt (2009); macroinfaunal abundance from Wei (2006). n/a = not available.

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 between approximately 130,000 to 144,000 individuals $m^{-2}$ (Rowe and Kennicutt, 2009). Nematodes, nauplii, and harpacticoid copepods were the three dominant groups in the meiofauna, accounting for approximately 90% of total abundance.

The benthic macroinfauna is characterized by small mean individual sizes and low densities, both of which reflect the intrinsically low primary production in surface waters of the Gulf of Mexico continental slope (Wei, 2006). Densities decrease exponentially with water depth (Carvalho et al., 2013). Based on an equation presented by Wei (2006), the macroinfaunal density in the water depth of the wellsites is expected to range approximately between 855 to 892 individuals $m^{-2}$; however, actual densities at the proposed wellsites are unknown and often highly variable.

Polychaetes are typically the most abundant macroinfaunal group on the northern Gulf of Mexico continental slope, followed by amphipods, tanaids, bivalves, and isopods. Carvalho et al. (2013) found polychaete abundance to be higher in the central region of the northern Gulf of Mexico when compared to the eastern and western regions. Wei (2006) recognized four depth-dependent faunal zones (Zones 1 through 4), two of which (Zones 2 and 3) are divided horizontally. The lease area is in Zone 3W, which consists of stations on the most complex bathymetric features in the northern Gulf of Mexico, including the AC and the Sigsbee Escarpment. These stations range in depth from 6,150 to 9,870 ft (1,875 to 3,008 m). The five most abundant species in Zone 3W were the polychaetes *Levinsenia uncinata, Paraonella monilaris,* and *Tachytrypane* sp., the bivalve *Heterodonta* sp., and the isopod *Macrostylis* sp. (Wei, 2006, Wei et al., 2010).

Megafaunal density from a nearby station was approximately 1,620 individuals $ha^{-1}$ (**Table 4**). Common megafauna included motile groups such as decapods, ophiuroids, holothurians, and demersal fishes as well as sessile groups such as sponges and anemones (Rowe and Kennicutt, 2009).

Bacteria are the foundation of deep-sea chemosynthetic communities (Ross et al., 2012) and are an important component in terms of biomass and cycling of organic carbon (Cruz-Kaegi, 1998). 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 ($g\ C\ m^{-2}$) in the top 6 inches (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, 1988, 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 water-based drilling mud (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 is 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 $kg^{-1}$, benthic infaunal communities may be adversely affected due to both the toxicity of the base fluid and organic enrichment (with resulting anoxia) (Neff et al., 2000). Infaunal numbers may increase and diversity may decrease as opportunistic species that tolerate low oxygen and high $H_2S$ predominate (Continental Shelf Associates, 2006). As the base synthetic fluid is biodegraded by microbes, the area will gradually recover to pre-drilling conditions. Disturbed sediments will be recolonized through larval settlement and migration from adjacent areas.

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

### Impacts of a Large Oil Spill

Potential impacts of a large oil spill on the benthic community are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017c). 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) estimates that a severe subsurface blowout could resuspend 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 resuspended for more than 30 days and dispersed over a much wider area. A previous study characterized surface sediments at the sampling station nearest to the proposed wellsites. Sediments at these two stations were similar, predominantly clay (60% at Station AC1 and 61% at Station RW6) and silt (35% at Station AC1 and 34% at Station RW6) (Rowe and Kennicutt, 2009).

Previous analyses by BOEM (2016b, 2017c) 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$^2$ (24 km$^2$). Moderate impacts were observed up to 11 miles (17 km) to the southwest and 5 miles (8.5 km) to the northeast of the wellhead, covering an area of 57 miles$^2$ (148 km$^2$). NOAA (2016b) documented a footprint of over 772 miles$^2$ (2,000 km$^2$) of impacts to benthic habitats surrounding the Macondo spill site. The analysis also identified a larger area of approximately 3,552 miles$^2$ (9,200 km$^2$) of potential exposure and uncertain impacts to benthic communities (NOAA, 2016b). Stout and Payne (2017) also noted that SBM released as a result of the blowout covered an area of 2.5 miles$^2$ (6.5 km$^2$).

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, Neff et al., 2005, Continental Shelf Associates, 2006). The nearest known high-density deepwater benthic community is approximately 20 miles (33 km) east-northeast of the project area (BOEM, nd).

Based on the geohazards evaluations of AC 815 as summarized in the site clearance letters, there are no interpreted features or areas capable of supporting high-density benthic communities within 2,000 ft (610 m) of the proposed wellsites (Geoscience Earth & Marine Services, 2003, 2007, Berger Geosciences, 2015, C&C Technologies, 2015). See **EP Section 6a** for further information.

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

BOEM (2012a, 2015, 2016b, 2017c) concluded that oil spills would be unlikely to affect benthic communities beyond the immediate vicinity of the wellhead (i.e., due to physical impacts of a blowout) because the oil would rise quickly to the sea surface directly over the spill location. However, subsea oil plumes resulting from a seafloor blowout could affect sensitive deepwater communities (BOEM, 2016b). During the 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 a water depths of 3,280 to 3,937 ft (1,000 to 1,200 m) (Kujawinski et al., 2011). However, estimated dispersant concentrations in the subsea plume were below levels known to be toxic to marine life. While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could have the potential to contact high-density deepwater benthic communities beyond the 984 ft (300 m) radius estimated by BOEM (2016a), depending on its extent, trajectory, and persistence (Spier et al., 2013). Potential impacts on sensitive resources would be an integral part of the decision and approval process for the use of dispersants.

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

Although chemosynthetic communities live among hydrocarbon seeps, natural seepage occurs at a relatively constant low rate compared with the potential rates of oil release from a blowout. In addition, seep organisms require unrestricted access to oxygenated water at the same time as exposure to hydrocarbon energy sources (MacDonald, 2002). Oil droplets or oiled sediment particles could come into contact with chemosynthetic organisms. As discussed by BOEM (2017c), impacts could include loss of habitat and biodiversity; destruction of hard substrate; change in sediment characteristics; and reduction or loss of one or more commercial and recreational fishery habitats.

Sublethal effects are possible for deepwater coral communities that receive a lower level of oil impact. Effects to deepwater coral communities could be temporary (e.g., lack of feeding and loss of tissue mass) or long lasting and affect the resilience of coral colonies to natural disturbances (e.g., elevated water temperature and diseases) (BOEM, 2012a, 2015, 2016b, 2017c). 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. (2014a) 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., 2014b).

Although no known deepwater coral communities are likely to be impacted by a subsurface plume, previously unidentified communities may be encountered if a large subsurface oil spill occurs. However, because of the scarcity of deepwater hard 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 114 miles (184 km) north-northeast 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 437 miles (704 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 480 miles (773 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 or along the northern and western 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.

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, which is 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 (BOEM, 2015, 2016b). 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 or preventing the implementation of any reasonable and prudent alternative measures. This interim coordination program remains in place while formal consultation and the development of a Biological Opinion are ongoing (BOEM, 2015, 2016b).

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**.

Table 5. Listed endangered, threatened, and candidate species in the lease area and along the U.S. Gulf Coast. Dash (--) = not found in the area.

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

Table 5. (Continued).

| Species | Scientific Name | Status | Potential Presence | | Critical Habitat Designated in Gulf of Mexico |
|---|---|---|---|---|---|
| | | | Lease Area | Coastal | |
| Beach mice (subspecies: Alabama, Choctawhatchee, Perdido Key, St. Andrew) | *Peromyscus polionotus* | E | -- | X | Alabama and Florida (Panhandle) beaches |

E = endangered; P = proposed; T = threatened; X = indicates location of where species are found.

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).The National Marine Fisheries Service and U.S. Fish and Wildlife Service designated critical habitat for this DPS, including beaches and nearshore reproductive habitat in Mississippi, Alabama, and the Florida Panhandle as well as *Sargassum* habitat throughout most of the central and western Gulf of Mexico (79 FR 39756 and 79 FR 39856).

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., 2016, Hayes et al., 2017) nor in the most recent BOEM multisale EIS (BOEM, 2017c); 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., 2016). A "strategic stock" is defined by the MMPA as a marine mammal stock that meets the following criteria:

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

According to the recovery plan, the main threats to sperm whale populations include collisions with vessels, direct harvest, loss of prey base because of climate change, disturbance from anthropogenic noise, and possibly competition for resources (NMFS, 2010b). No critical habitat for the sperm whale has been designated in the Gulf of Mexico.

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).

Current threats to sperm whale populations worldwide are discussed in a final recovery plan for the sperm whale published by NMFS (2010b). 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).

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 NTLs BSEE 2015-G013 and BOEM-2016-G01 will minimize the potential for marine debris-related impacts on sperm whales. Those IPFs with potential impacts listed in **Table 2** are discussed below.

### 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. It is unlikely that any auditory injury would result from MODU activites. Behavioral responses to noise by marine mammals varies widely and overall, are short-term and include, temporary displacement or cessation of feeding, resting, or social interactions (NMFS, 2009a, Gomez et al., 2016). Additionally, behavioral changes resulting in auditory masking sounds may induce and animal to produce more calls, longer calls, or shift the frequency of the calls. For example, masking caused by vessel noise was found to reduce the number of whale calls in the Gulf of Mexico (Azzara et al., 2013).

As discussed in **Section A.1**, noise generated by an actively drilling MODU can produce broadband (10 Hz to 10 kHz) sound pressure levels of approximately 190 dB re 1 µPa m (Hildebrand, 2005). Therefore, vessel-related noise is likely to be heard by sperm whales. Sounds pressure levels produced during drilling operations may have greater amplitudes than rig noise alone and therefore, may have a greater likelihood of eliciting a behavioral response.

NMFS (2016) lists sperm whales in the same hearing group (i.e., mid-frequency cetaceans) as dolphins, toothed whales, and bottlenose whales (estimated hearing range from 150 Hz to 160 kHz. Sperm whale sounds generally consist of clicks that have a bandwidth of 100 Hz to 30 kHz (Erbe et al., 2017). Acoustic energy produced peaks at around 15 kHz and is generally concentrated 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). Source levels of clicks are generally 186 ± 0.9 dB re 1 µ$Pa_{rms}$ m with extremes up to 236 dB re 1 µ$Pa_{rms}$ 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).

The most recent acoustic criteria (NMFS, 2016a) are based on received sound level accumulations that equate to the onset of marine mammal auditory threshold shifts. 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 dB relative to one micropascal squared second (re 1 $\mu Pa^2 \cdot s$) over a 24 hour period. Similarly, temporary threshold shifts are estimated to occur when the mammal has received a cummulative noise exposure level of 178 dB re 1 $\mu Pa^2 \cdot s$ over a 24 hour period. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters are not expected to produce received levels greater than 160 dB re 1 µPa beyond 25 m from the source. Due to the short propagation distance of high sound pressure levels, the transient nature of sperm whales, and the stationary nature of the proposed activites, it is not expected that any sperm whales will receive exposure levels necessary for the onset of auditory threshold shifts.

The 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 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, BOEM, 2012a, 2013a, 2014, 2015, 2016b, 2017c).

### 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, 2010b). 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 (NMFS, 2007). With implementation of the mitigation measures in NTL BOEM-2016-G01, NMFS concluded that the likelihood of collisions between vessels and sperm whales would be reduced to insignificant levels. NMFS concluded that the observed avoidance of passing vessels by sperm whales is an advantageous response to avoid a potential threat and is not expected to result in any significant effect on migration, breathing, nursing, breeding, feeding, or sheltering to individuals, or have any consequences at the level of the population. With implementation of the vessel strike avoidance measures requirement to maintain a distance of 295 ft (90 m) from sperm whales, 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 800 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 specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals (BOEM, 2016a, 2017c). Although whales may respond to helicopters (Smultea et al., 2008), NMFS (2007) and BOEM (2016a) 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 BOEM (2012a, 2015, 2016b, 2017c) and the Biological Opinion for the Five-Year Oil and Gas Leasing Program in the Central and Western Planning Areas of the Gulf of Mexico (NMFS, 2007). Oil impacts on marine mammals 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 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 (Marine Mammal Commission [MMC], 2011). However, due to the limited areal extent and short duration of water quality impacts from a small fuel spill, as well as the mobility of sperm whales, no significant impacts are expected.

### Impacts of a Large Oil Spill

Potential spill impacts on marine mammals including sperm whales are discussed by BOEM (2012a, 2015, 2016b, 2017c), and NMFS (2007). Oil impacts on marine mammals 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.

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 areas near 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-G01to 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. Although, based on increased sightings in warmer months, the north and northwest regions of the Gulf of Mexico are also important regions for manatees (Hieb et al., 2017). 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 147 miles (237 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 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 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

The OSRA results summarized in **Table 3** predict that shorelines in 11 Texas counties and two Louisiana Parishes could be contacted by a large oil spill within 30 days. Matagorda County in Texas is the coastal area most likely to be affected with a 7% probability of shoreline contact within 30 days. There is no critical habitat designated in these areas, and the number of manatees potentially present is a small fraction of the population in peninsular Florida.

In the event that manatees were exposed to oil, effects could include direct impacts from oil exposure, as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants) (MMC, 2011). Direct physical and physiological effects can include 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 (or contaminated vegetation, in the case of manatees); and stress from the activities and noise of response vessels and aircraft (BOEM, 2017c). 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 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 manatees are expected.

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

In addition to the two endangered species of marine mammals that were cited in **Section C.3**, 21 additional species of marine mammals may be found in the Gulf of Mexico, including 1 species of mysticete whale, the dwarf and pygmy sperm whales, 4 species of beaked whales, and 14 species of delphinid whales and dolphins (**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). All marine mammals are protected species under the MMPA. The most common non-endangered cetaceans in the deepwater environment are odontocetes such as the pantropical spotted dolphin, spinner dolphin, and rough-toothed dolphin. A brief summary is presented in this section, and additional information on these groups is presented by BOEM (2017c).

Bryde's whale. 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 (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 along the 328 ft (100 m) isobath (Davis and Fargion, 1996, Davis et al., 2000a). Most sightings have been made in the DeSoto Canyon region and off western Florida, although there have been some in the west-central portion of the northeastern Gulf 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., 2016). 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 or are 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., 2016).

Delphinids. Fourteen species of delphinids are known from the Gulf of Mexico, including 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 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., 2016).

The bottlenose dolphin (*Tursiops truncatus*) is a common inhabitant of the northern Gulf of Mexico, particularly within continental shelf waters. There are two ecotypes of bottlenose dolphins, a coastal form and an offshore form, which are genetically isolated from each other (Waring et al., 2016). The offshore form of the bottlenose dolphin 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 that has affected these stock areas. This Unusual Mortality Event began in April 2010 and ended in July 2014 (NOAA, 2016c). Carmichael et al. (2012) hypothesized that the unusual number of bottlenose dolphin strandings in the northern Gulf of Mexico 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.

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 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 (toothed whales and dolphins) 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, 2016a). Eighteen of the 20 odonotocete species are considered to be in the mid-frequency functional hearing group, 2 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, 2016a). Thruster and installation noise will affect each group differently depending on the frequency bandwiths produced by operations.

For mid frequency cetaceans exposed to a non-impulsive source (like installation operations), permanent threshold shifts are estimated to occur when the mammal has received a cumulative exposure level of 198 dB re 1 µPa$^2$·s over a 24 hour period. Simlarly, temporary threshold shifts are estimated to occur when the mammal has received a cummulative noise exposure level of 178 dB re 1 µPa$^2$·s over a 24 hour period. For low frequency cetaceans, specifically the Brydes whale, permant and temporary threshold shift onset is estimated to occur at 199 dB re 1 µPa$^2$·s and 179 re 1 µPa$^2$·s, repectively. Based on transmission loss calculations, 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 µPa beyond 25 m from the source. Due to the short propagation distance of high sound pressure levels, the transient nature of marine mammals and the stationary nature of the proposed activites, it is not expected that any marine mammals will receive exposure levels necessary for the onset of auditory threshold shifts.

Behavioral criteria are currently being updated; therefore, the NOAA (2005) criteria are used in the interim to determine behavioral disturbance thresholds for marine mammals and are applied equally across all functional hearing groups. Received sound pressure levels of 120 dB re 1 µPa from a non-impulsive source are considered high enough to illicit a behavioral reaction in some marine mammal species (NOAA, 2005). The 120 dB isopleth may extend tens to hundreds of kilometers from the source depending on the propagation environment. There are other OCS facilities and activities near the lease area, and the region as a whole has a large number of similar sources. Marine mammal species in the northern Gulf of Mexico have been exposed to noise from anthropogenic sources for a long period of time and over large geographic areas and likely do not represent a naïve population with regard to sound (National Research Council, 2003a). It is expected that marine mammals within or near the lease area would be able to detect the presence of the DP installation vessel or MODU and avoid exposure to higher energy sounds, particularly within an open ocean 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 exposes 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 (2016b, 2017c). 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 (2017c). To reduce the potential for vessel strikes, BOEM has issued NTL BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. Vessel 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 specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals (BOEM, 2017c). 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 (2012a, 2013a, 2014, 2015, 2016b, 2017c), 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 (2016b, 2017c), and Geraci and St. Aubin (1990). 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 (or contaminated vegetation, in the case of manatees); 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 (2016), approximately 100 marine mammals were collected within the spill area during the 6 months following the Macondo spill, most of which were bottlenose dolphins. NMFS (2014a) documented 13 dolphins and whales live-stranded, and over 150 dolphins and whales dead during the oil spill response. Other affected species included dwarf/pygmy sperm whales, melon-headed whales, and spinner dolphins. Because of known low detection rates of carcasses, it is possible that the number of marine mammal deaths is underestimated (Williams et al., 2011). Schwacke et al. (2014) reported that 1 year after the spill, many dolphins in Barataria Bay, Louisiana, showed evidence of disease conditions associated with petroleum exposure and toxicity. Venn-Watson et al. (2015) found evidence that exposure to petroleum compounds during and after the Macondo spill may lead to increased primary bacterial pneumonia and thin adrenal cortices in bottlenose dolphins.

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, 2017c). 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 include 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, 2017c).

The critically endangered Kemp's ridley turtle nests almost exclusively on a 16 mile (26 km) stretch of coastline near Rancho Nuevo in the Mexican state of Tamaulipas. A much smaller, but growing, population nests in Padre Island National Seashore, mostly as a result of reintroduction efforts (NMFS et al., 2011). Sporadic nesting takes place elsewhere along the southern Texas and northern Mexican coasts. 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.

Loggerhead turtles in the Gulf of Mexico are part of the Northwest Atlantic Ocean DPS (NMFS, 2014b). Effective August 11, 2014, NMFS and the USFWS designated critical habitat for this DPS, as shown in **Figure 1**. The USFWS designation (79 FR 39755) 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 39855) includes nearshore reproductive habitat within 0.99 miles (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 takes on a planktonic, often pelagic existence after being removed from reefs during rough weather. Rafts of Sargassum serve as important foraging and developmental habitat for numerous fishes, and young sea turtles, including loggerhead turtles. Additionally, NMFS 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.

The nearest designated nearshore reproductive critical habitat for loggerhead sea turtles is approximately 458 miles (737 km) northeast of the lease area (**Figure 1**).

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 turtles may be present in deepwater areas, including the lease area, where they may be associated with *Sargassum* and other flotsam.

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

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

- Loggerhead turtles—Loggerhead turtles nest in significant numbers along the Florida Panhandle (Florida Fish and Wildlife Conservation Commission, 2017a) and, to a lesser extent, from Texas through Alabama (NMFS and USFWS, 2008);
- Green and leatherback turtles—Green and leatherback turtles infrequently nest on Texas beaches (Florida Fish and Wildlife Conservation Commission, 2017b, c);
- Kemp's ridley turtles: The main nesting site is Rancho Nuevo beach in Tamaulipas, Mexico (NMFS et al., 2011). A total of 353 Kemp's Ridley turtles have nested on Texas beaches in 2017 (Turtle Island Restoration Network, 2017) an increase from 185 counted in 2016 and 159 counted in 2015. 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.
- Hawksbill turtles: Typically, do not nest anywhere near the project area (USFWS, 2016a).

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 will minimize the potential for marine debris-related impacts on sea turtles.

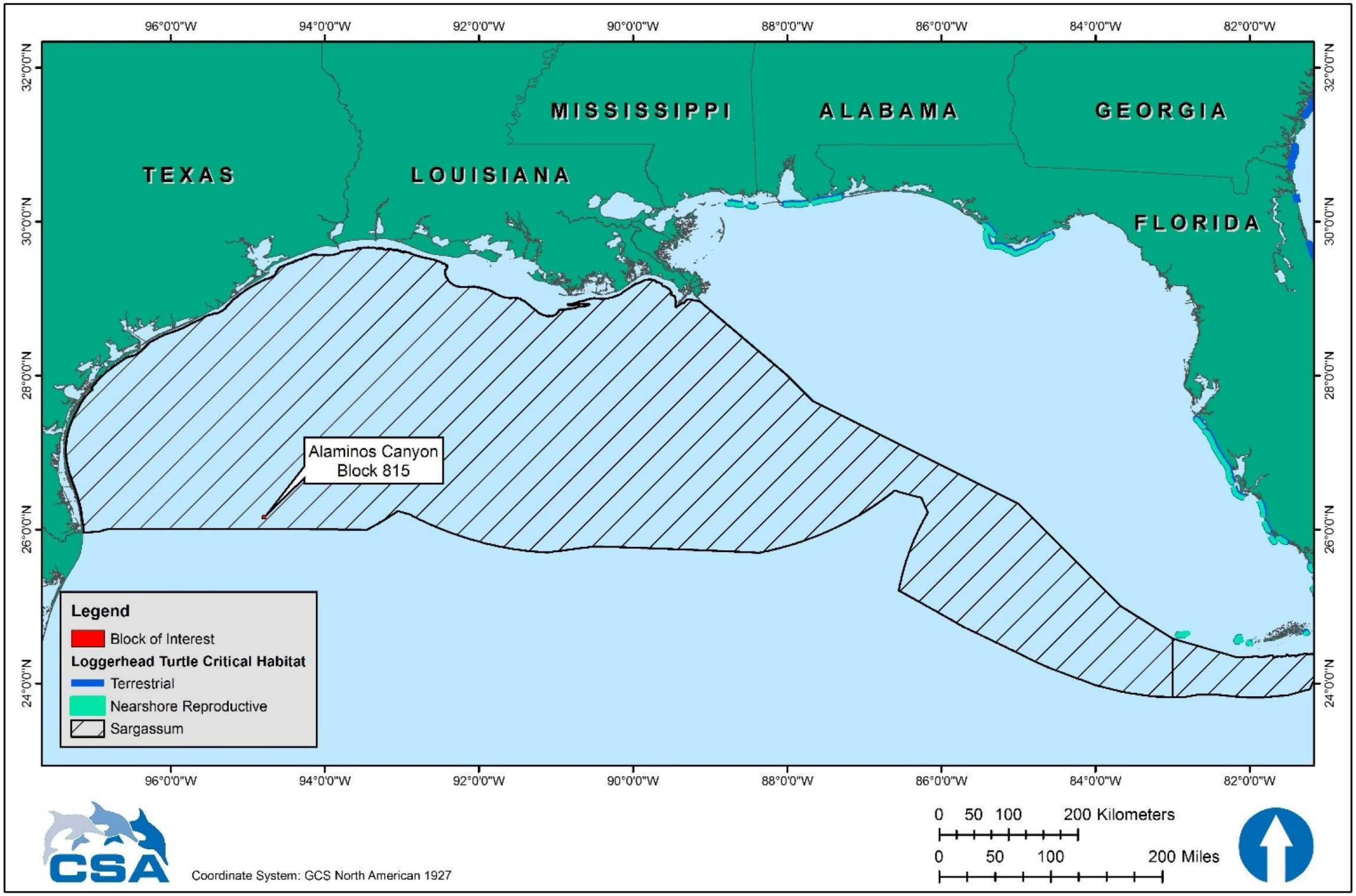


Figure 1. Location of loggerhead turtle designated critical habitat in relation to the lease area.

## 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 sea turtles (Samuel et al., 2005, Popper et al., 2014). Potential impacts could include behavioral disruption and displacement from the area near the sound source. There is scarce information regarding hearing and acoustic thresholds for marine turtles. The currently accepted hearing and response estimates are derived from fish hearing data rather than from marine mammal hearing data in combination with the limited experimental data available (Popper et al., 2014). NMFS Biological Opinions (NMFS, 2015) list sea turtle underwater acoustic injury and behavioral thresholds at 207 dB re 1 µPa and 166 dB re 1 µPa, respectively. No distinction is made between impulsive and continuous sources for these thresholds. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters in use during drilling, are not expected to produce received levels greater than 160 dB re 1 µPa beyond 25 m from the source. Certain sea turtles, especially loggerheads, may be attracted to offshore structures (Lohoefener et al., 1990, Gitschlag et al., 1997) and thus may be more susceptible to impacts from sounds produced during routine operations. Helicopters and service vessels may also affect sea turtles because of machinery noise or visual disturbances. Any impacts would likely be short-term behavioral changes such as diving and evasive swimming, disruption of activities, or departure from the area. Because of the limited scope and short duration of drilling activities, these short-term impacts are not expected to be biologically significant to sea turtle populations.

Artificial lighting can disrupt the nocturnal orientation of sea turtle hatchlings (Witherington, 1997, Tuxbury and Salmon, 2005). 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, 2012b).

## Impacts of a Small Fuel Spill

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

The probability of a fuel spill will be minimized by Shell's preventative measures, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP is expected to mitigate and reduce the potential for impacts on sea turtles. **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 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 (NMFS, 2014a). However, due to the limited areal extent and short duration of water quality impacts from a small fuel spill, no significant impacts would be expected.

Effects of a small spill on *Sargassum* critical habitat for loggerhead turtles would be limited to the small area (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* critical habitat for loggerhead turtles in the northern Gulf of Mexico.

A small fuel spill in the lease area would be unlikely to affect sea turtle nesting beaches because the lease area is 147 miles (237 km) from the nearest shoreline (Texas), 458 miles (738 km) from the nearest designated loggerhead nearshore reproductive critical habitat. 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.

## Impacts of a Large Oil Spill

Impacts of oil spills on sea turtles can include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, dispersants, and beach cleanup activities). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes and smoke (e.g., from *in situ* burning of oil); ingestion of oil (and dispersants) directly or via contaminated food; and stress from the activities and noise of response vessels and aircraft. Complications of the above may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat, disruption of social structure, changing food availability and foraging distribution and/or patterns, changing reproductive behavior/productivity, and changing movement patterns or migration (MMC, 2011, NMFS, 2014b). In the unlikely event of a spill, implementation of Shell's OSRP is expected to mitigate and reduce the potential for these types of impacts on sea turtles. **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) estimates that between 4,900 and up to 7,600 large juvenile and adult sea turtles (Kemp's ridleys, loggerheads, and hardshelled sea turtles not identified to species) and between 56,000 and 166,000 small juvenile sea turtles (Kemp's ridleys, green turtles, loggerheads, hawksbills, and hardshelled sea turtles not identified to species) were killed by the Macondo spill. 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, of which 54,800 were likely 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.

The nearest terrestrial and nearshore reproductive critical habitat for loggerhead turtles is Horn Island, Mississippi, while Kemp's ridley turtles nest at Padre Island National Seashore. The 30-day OSRA results summarized in **Table 3** estimates that Texas and Louisiana shorelines that support limited sea turtle nesting could be contacted within 30 days (1% to 7% conditional probability). 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 are subject to the same types of oil spill exposure hazards as adults. Hatchlings that contact oil residues while crossing a beach can exhibit a range of effects, from acute toxicity to impaired movement and normal bodily functions (NMFS, 2007).

Due to the large area covered by the designated *Sargassum* habitat for loggerhead turtles, a large spill could result in oiling of a substantial part of the *Sargassum* habitat in the northern Gulf of Mexico. The catastrophic 2010 Macondo spill affected approximately one-third of the *Sargassum* habitat in the northern Gulf of Mexico (BOEM, 2016b). Although the lease area is located within the *Sargassum* habitat, it is unlikely that the entire *Sargassum* critical habitat would be affected by a large spill.

However, a spill occurring within the lease area could result in oiling an area of *Sargassum* relatively close to Padre Island National Seashore (Kleberg, Kenedy, and Willacy Counties, Texas), which is the only significant nesting area of Kemp's ridley turtles in the U.S. Six Texas counties are predicted to be contacted within 10 days of a spill. Eleven Texas counties and one Louisiana Parish are predicted to range from 1% to 10% chance of contact within 30 days of a spill.

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

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 (2017c).

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 145 miles (233 km) from the nearest shoreline designated as Piping Plover critical habitat. The 30-day OSRA modeling results summarized in **Table 3** predict that Texas and Louisiana shorelines designated as critical habitat for the wintering Piping Plover could be contacted by a spill within 30 days. The highest conditional probability of shoreline contact within 30 days is 7% for Matagorda County, Texas.

Piping Plovers could become externally oiled while foraging on oiled shores or become exposed internally through ingestion of oiled intertidal sediments and prey (BOEM, 2017c). 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.

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.

### C.3.6 Whooping Crane (Endangered)

The Whooping Crane (*Grus americana*) is a large omnivorous wading bird listed as an endangered species. Three wild populations live in North America (National Wildlife Federation, 2016b). One population winters along the Texas coast at Aransas NWR and summers at Wood Buffalo National Park in Canada. This population represents the majority of the world's population of free-ranging Whooping Cranes, reaching a record estimated population of 431 during the 2016 to 2017 winter (USFWS, 2017). Another reintroduced population summers in Wisconsin and migrates to the southeastern U.S. for the winter. Non-migrating populations were reintroduced in central Florida and southern Louisiana (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 on 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 modeling results summarized in **Table 3** predict that a large oil spill has a 3% probability of reaching critical habitat for Whooping Cranes within 30 days in the Aransas NWR located in Aransas and Calhoun Counties in Texas, approximately 179 miles (288 km) from the lease area.

In the event of oil exposure, Whooping Cranes could become externally oiled while foraging in oiled areas or internally exposed to oil through ingestion of contaminated crustaceans, shellfish, frogs, and fishes. It is possible that some death of Whooping Cranes could occur. Shell has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in the OSRP.

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 30 January 2018 (effective 30 March 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).

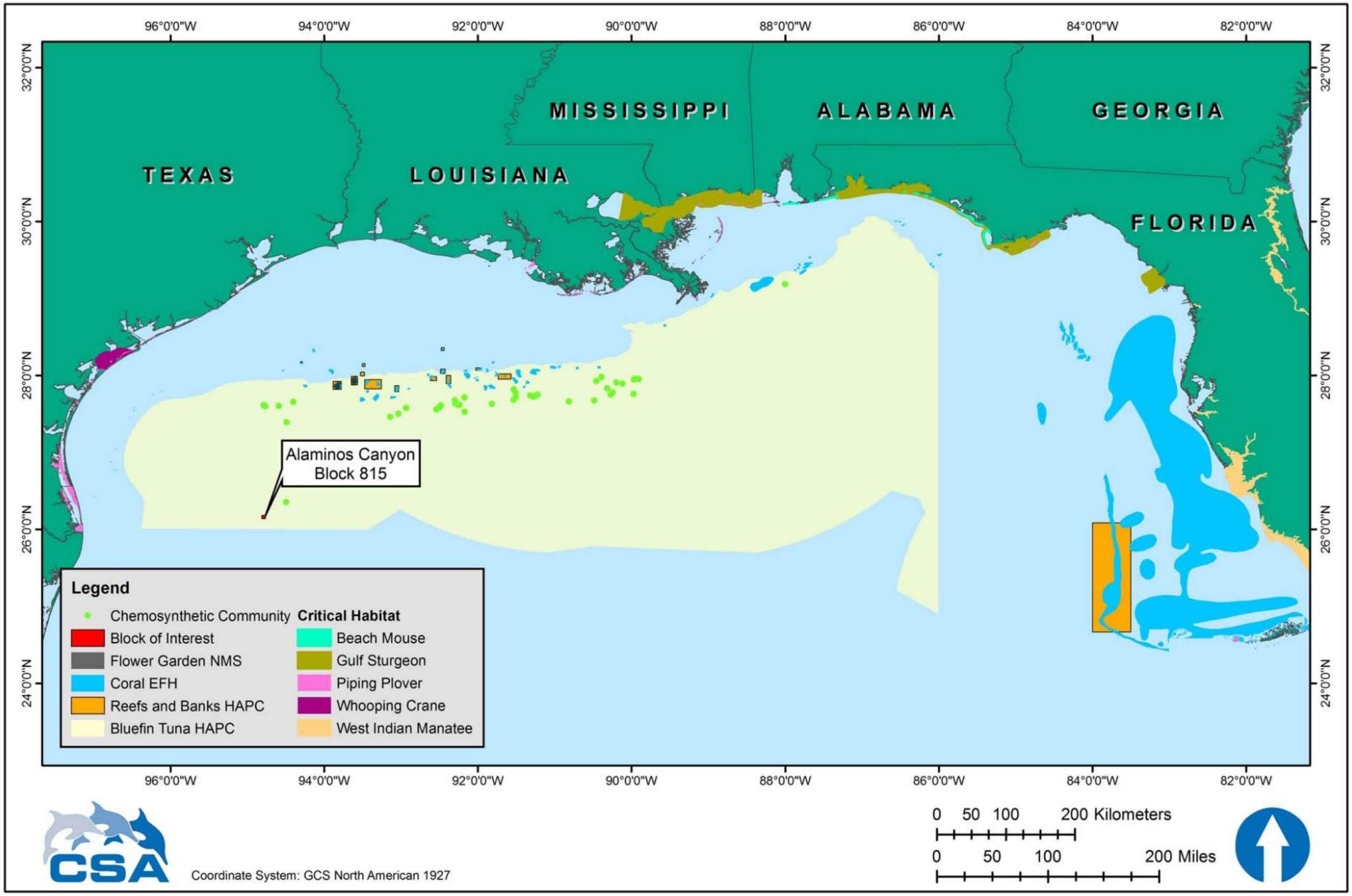


Figure 2. Location of selected environmental features in relation to the lease area. EFH = Essential Fish Habitat; HAPC = Habitat Area of Particular Concern; NMS = National Marine Sanctuary.

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., 2017). 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). Today, this range has contracted to encompass major rivers and inner shelf waters from the Mississippi River to the Suwannee River, Florida. Populations have been depleted or even extirpated throughout this range by fishing, shoreline development, dam construction, water quality changes, and other factors (Barkuloo, 1988, Wakeford, 2001). These declines prompted the listing of the Gulf sturgeon as a threatened species in 1991. The best known populations occur in the Apalachicola and Suwannee Rivers in Florida (Carr, 1996, Sulak and Clugston, 1998), the Choctawhatchee River in Alabama (Fox et al., 2000), and the Pearl River in Mississippi/Louisiana (Morrow et al., 1998). Rudd et al. (2014)

reconfirmed the spatial distribution and movement patterns of Gulf Sturgeon by surgically implanting acoustic telemetry tags. Critical habitat in the Gulf extends from Lake Borgne, Louisiana (St. Bernard Parish), to Suwannee Sound, Florida (Levy County) (NMFS, 2014c) (**Figure 2**). A species description is 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**).

### Impacts of a Large Oil Spill

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

The lease area is approximately 441 miles (710 km) from the nearest Gulf sturgeon critical habitat. The 30-day OSRA modeling (**Table 3**) predicts that a spill in the lease area would have <0.5% conditional probability of contacting Gulf sturgeon critical habitat in St. Bernard Parish in Louisiana or Okaloosa County in Florida 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, subadult and adult Gulf sturgeon would be most vulnerable to a marine oil spill and would be vulnerable 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 Mice (Endangered)

Four subspecies of endangered beach mouse (*Peromyscus polionotus*) occur on the barrier islands of Alabama and the Florida Panhandle (BOEM, 2017c). They are the Alabama, Choctawhatchee, Perdido Key, and St. Andrew beach mouse. Critical habitat has been designated for all four subspecies; **Figure 2** shows the critical habitat combined for all four subspecies. Species descriptions are provided by (BOEM, 2017c).

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

### Impacts of a Large Oil Spill

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

The lease area is approximately 495 miles (797 km) from the nearest beach mouse critical habitat. The 30-day OSRA modeling results summarized in **Table 3** predict a <0.5% chance that a spill in the lease area would contact 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 contaminated food. Indirect impacts could include reduction of food supply, destruction of habitat, and fouling of nests. Impacts could also occur from vehicular traffic and other activities associated with spill cleanup (BOEM, 2017c).

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, 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.

### 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%. The nearest coral EFH, the West Flower Garden Bank, is approximately 125 miles (201 km) north-northeast of the lease area. A surface slick would not contact corals on the seafloor. If a subsurface plume were to occur, impacts on the Flower Garden Banks would be unlikely due to the difference in water depth. Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and typically would not carry a plume up onto the continental shelf edge. Valentine et al. (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 (2017c) 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, 2017c).

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

## C.4 Coastal and Marine Birds

### C.4.1 Marine and Pelagic Birds

A variety of seabirds may occur in the pelagic environment of the project areas (Clapp et al., 1982a, Clapp et al., 1982b, 1983, Peake, 1996, Hess and Ribic, 2000). Seabirds spend much of their lives offshore over the open ocean, except during breeding season when they nest on islands 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, **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 Gull, Royal Tern, Bridled Tern) (Hess and Ribic, 2000).

Common seabird species include Magnificent Frigatebird (*Fregata magnificens*), Northern Gannet (*Morus bassanus*), Masked Booby (*Sula dactylatra*), Brown Booby (*Sula leucogaster*), Cory's Shearwater (*Calonectris diomedea*), Greater Shearwater (*Puffinus gravis*), and Audubon's Shearwater (*Puffinus lherminieri*). Seabirds are distributed Gulf-wide and are not specifically associated with the lease area.

Relationships with hydrographic features were found for several seabird species, possibly due to effects of hydrography on nutrient levels and productivity of surface waters where birds forage. GulfCet II (Davis et al., 2000b) did not estimate bird densities; however, Powers (1987) indicates that seabird densities over the open ocean typically are <10 birds km$^{-2}$.

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 (Russell, 2005). Some birds may be attracted to offshore structures and vessels because of the lights and the fish populations that aggregate around these structures.

IPFs that could potentially affect marine and pelagic birds include 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 NTL BSEE 2015-G013 will minimize the potential for marine debris-related impacts on birds.

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

Birds that frequent platforms may be exposed to contaminants including air pollutants and routine discharges, but significant impacts are unlikely due to rapid dispersion of effluents and air pollutants. 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. In other cases, navigation may be disrupted by noise or lighting (Russell, 2005). Conversely, offshore structures may in some cases serve as suitable stopover habitats for trans-Gulf migratory 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 significantly disturb pelagic birds in open, offshore waters. It is likely that individual birds would experience, at most, only short-term behavioral disruption, and the impact would not be significant.

### Impacts of a Small Fuel Spill

Potential spill impacts on marine birds are discussed by BOEM (2012a, 2013a, 2014, 2015, 2016b, 2017c). 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 would be expected.

### Impacts of a Large Oil Spill

Potential spill impacts on marine and pelagic birds are discussed by BOEM (2012a, 2013a, 2014, 2015, 2016b, 2017c). 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. Powers (1987) indicates that seabird densities over the open ocean typically are <10 birds $km^{-2}$. The number of pelagic birds that could be affected in open, offshore waters would depend on the extent and persistence of the surface oil. 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. The Northern Gannet was among the species with the largest numbers of individuals affected by the spill (USFWS, 2011). 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).

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, 2017c).

The Brown Pelican (*Pelecanus occidentalis*) was delisted from federal endangered status in 2009 (USFWS, 2016b) and was delisted from state species of special concern status by the State of Florida in 2017 (Florida Fish and Wildlife Conservation Commission, 2017d). However, this species remains listed as endangered by both Louisianaand 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 (State of Louisiana Department of Wildlife and Fisheries, 2005, Louisiana Department of Wildlife and Fisheries, 2017) and Mississippi (Mississippi Natural Heritage Program, 2018). The bald eagle is also listed as threatened in Texas (Texas Parks and Wildlife Department, 2017). 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). 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, 2016b). In the event of a large oil spill reaching coastal habitats, cleanup personnel and equipment could create short-term disturbances to coastal birds. Indirect effects could occur from restoration efforts, resulting in habitat loss, alteration, or fragmentation (BOEM, 2017c). The 30-day OSRA modeling results summarized in **Table 3** predict that some shorelines of Texas and Louisiana, which include habitat for shorebirds and coastal nesting birds, could be affected within 30 days. Matagorda County, Texas, is the coastal area most likely to be affected (7% conditional probability of shoreline contact within 30 days).

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). Pelagic eggs and larvae become part of the planktonic community for various lengths of time (10 to 100 days, depending on the species) (BOEM, 2012a). A study by Ross et al. (2012) on midwater fauna to characterize vertical distribution of mesopelagic fishes in selected deepwater areas in the Gulf of Mexico substantiated high species richness, but numerical abundance was dominated by relatively few families and species.

IPFs that could potentially affect pelagic communities and ichthyoplankton include 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-attracting device (FAD). In oceanic waters, the FAD effect would be most pronounced for epipelagic fishes such as tunas, dolphin, billfishes, and jacks, which are commonly attracted to fixed and drifting surface structures (Holland, 1990, Higashi, 1994, Relini et al., 1994). This FAD effect could possibly enhance the 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, Bruintjes 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 $\mu Pa^2 \cdot s$ but resulted in no increased mortality between the exposure and control groups. Non-impulsive noise sources (such as MODU operations) are expected to be far less injurious than impulsive noise. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters in use during drilling, are not expected to produce received levels greater than 160 dB re 1 µPa beyond 25 m from the source. Because of the limited propagation distances of high sound pressure levels and the periodic and transient nature of ichthyoplankton, no impacts to these life stages are expected.

### Impacts of Effluent Discharges

Discharges of treated SBM-associated cuttings will produce temporary, localized increases in suspended solids in the water column around the MODU. In general, turbid water can be expected to extend between a few hundred meters and several kilometers down current from the discharge point (National Research Council, 1983, Neff, 1987). NPDES permit limits regulate the discharges.

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

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

Deck drainage may have a slight effect on the pelagic environment in the immediate vicinity of these discharges. Deck drainage from contaminated areas will be passed through an oil and water separator prior to release, and discharges will be monitored for visible sheen. The discharges may have slightly elevated levels of hydrocarbons but will be diluted 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.

### Impacts of a Small Fuel Spill

Potential spill impacts on fisheries resources are discussed by BOEM (2016b, 2017c). 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 (2012a, 2013a, 2014, 2015, 2016b, 2017c).

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, 2016b). Adult and juvenile fishes could also be impacted through the ingestion of oiled prey (USFWS, 2017). 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 (Gulf of Mexico Fishery Management Council, 2005). The EFH for most of these GMFMC-managed species is on the continental shelf in waters shallower than 600 ft (183 m). The shelf edge is the outer boundary for coastal migratory pelagic fishes, reef fishes, and shrimps. EFH for corals and coral reefs includes some shelf-edge topographic features on the Texas-Louisiana OCS, the nearest of which is located 119 miles (191 km) north-northeast of the lease area.

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, 2017c). The EFH assessment was completed and there is ongoing coordination among NMFS, BOEM, and BSEE, including discussions of mitigation (BOEM, 2016c).

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 at or near the lease area include the following (NMFS, 2009b):

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

Research indicates the central and western Gulf of Mexico may be important spawning habitat for Atlantic bluefin tuna, 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$^2$ (300,000 km$^2$). The prevailing assumption is that Atlantic bluefin tuna follow an annual cycle of foraging in June through March off the eastern U.S. and Canadian coasts, followed by migration to the Gulf of Mexico to spawn in April, May, and June (NMFS, 2009b). The Atlantic bluefin tuna has also been designated as a species of concern (NMFS, 2011).

Other HAPCs have been identified in the Gulf of Mexico Fishery Management Council (2005, 2010), including the Florida Middle Grounds, Madison-Swanson Marine Reserve, Tortugas North and South Ecological Reserves, Pulley Ridge, and several individual reefs and banks of the northwestern Gulf of Mexico (**Figure 2**). The GMFMC is currently considering options on protecting deep-sea corals to add to the HAPCs previously identified (Fisheries Leadership and Sustainability Forum, 2015). The nearest of these is West Flower Garden Bank, located approximately 125 miles (201 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). This 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, Bruintjes and Radford, 2013, McLaughlin and Kunc, 2015). Any impacts on EFH for highly migratory pelagic fishes 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 $\mu Pa^2 \cdot s$ but resulted in no increased mortality between the exposure and control groups. Non-impulsive noise sources (such as MODU operations) are expected to be far less injurious than impulsive noise. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters in use during drilling, are not expected to produce received levels greater than 160dB re 1 µPa beyond 25 m from the source. Because of the limited propagation distances of high sound pressure levels and the periodic and transient nature of ichthyoplankton, no impacts to these life stages are expected.

### Impacts of Effluent Discharges

Other effluent discharges affecting EFH by diminishing ambient water quality include drilling mud and cuttings, treated sanitary and domestic wastes, deck drainage, 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 (2012a, 2013a, 2014, 2015, 2016b, 2017c). 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$^2$ (300,000 km$^2$) of the Gulf of Mexico. Therefore, no significant spill impacts on EFH for highly migratory pelagic fishes are expected.

A small fuel spill would not affect EFH for corals or coral reefs; the nearest coral EFH is located 119 miles (191 km) west-northwest of the lease area. A small fuel spill would float and dissipate on the sea surface and would not contact these features. Therefore, no significant spill impacts on EFH for corals and coral reefs are expected.

### Impacts of a Large Oil Spill

Potential spill impacts on EFH are discussed by BOEM (2016b, 2017c). 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 (Gulf of Mexico Fishery Management Council, 2005, NMFS, 2009b), some impact on EFH would be unavoidable.

A large spill could affect the EFH for many managed species, including shrimps, stone crab, spiny lobster, corals and coral reefs, reef fishes, coastal migratory pelagic fishes, red drum, and highly migratory pelagic fishes. 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 contaminated and result in persistent degradation of the seafloor habitat for managed demersal fish and invertebrates.

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

The nearest feature designated as EFH for corals is located 119 miles (191 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.

The lease area is not on the list of archaeological survey blocks determined to have a high potential for containing archaeological properties (BOEM, 2011). The wellsite assessments did not detect any archaeologically significant sonar contacts within 2,000 ft (610 m) of the proposed wellsites (Geoscience Earth & Marine Services, 2003, 2007, Berger Geosciences, 2015, C&C Technologies, 2015). However, one sonar contact was identified within 1,000 ft (305 m) of the proposed wellsite F and was classified as modern debris or natural in origin. Berger Geosciences (2015) did not recommend a geohazards avoidance for the sonar contact. No archaeological impacts are expected from routine activities in the lease area.

Because no historic shipwreck sites are present in the lease area (**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 from 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 this radius, there is the potential for impacts from oil, dispersants, and depleted oxygen levels (BOEM, 2017c). These impacts could include chemical contamination as well as alteration of the rates of microbial activity (BOEM, 2017c). 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.

Although there are no known historic shipwrecks in the lease area, the wellsite assessments did not detect any archaeologically significant sonar targets within 2,000 ft (610 m) of the proposed wellsites (Geoscience Earth & Marine Services, 2003, 2007, Berger Geosciences, 2015, C&C Technologies, 2015). However, one sonar contact was identified within 1,000 ft (305 m) of the proposed wellsite F and was classified as modern debris or natural in origin. Berger Geosciences (2015) did not recommend a geohazards avoidance for the sonar contact. No archaeological impacts are expected from routine activities in the lease area.

A spill entering shallow coastal waters could conceivably contaminate undiscovered or known historic shipwreck sites. The 30-day OSRA modeling summarized in **Table 3** predicts 11 Texas counties and two Louisiana parishes' shorelines could be contacted by a spill within 30 days. The coastal area most likely to be affected would be Matagorda County, Texas (7% conditional probability of shoreline contact within 30 days). If an oil spill contacted a coastal historic site, such as a fort or a lighthouse, the impacts may be temporary and reversible (BOEM, 2017c).

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

At a water depth of 8,997 to 9,184 ft (2,742 to 2,799 m), the lease area 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. 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 prehistoric archaeological sites are not found in the lease area, they would not be affected by the physical effects of a subsea blowout. BOEM (2012a) estimates that a severe subsurface blowout could resuspend and disperse sediments within a 984 ft (300 m) radius.

Along the northern Gulf Coast, prehistoric sites occur frequently along the barrier islands and mainland coast and along the margins of bays and bayous (BOEM, 2012a). The 30-day OSRA modeling summarized in **Table 3** predicts that 11 Texas counties and two Louisiana parishes' shorelines could be contacted by a spill within 30 days. 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 (2017c) 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, 2013a, 2014, 2015, 2016b, 2017c) and in a literature review by Collard and Way (1997). Sensitive coastal habitats are also tabulated in the OSRP. Coastal habitats inshore of the project area include coastal and barrier island beaches and dunes, wetlands, oyster reefs, and submerged seagrass beds. Generally, most of the northern Gulf of Mexico is fringed by coastal and barrier island beaches, with wetlands, oyster reefs, and/or submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries.

Due to the distance from shore, there are no IPFs associated with routine activities occurring in the lease area that are likely to affect beaches and dunes, wetlands, oyster reefs, seagrass beds, coastal wildlife refuges, wilderness areas, or any other managed or protected coastal area. The support bases are not located in wildlife refuges or wilderness areas. Potential impacts of support vessel traffic are briefly addressed in this section.

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

### Impacts of Support Vessel Traffic

For OCS activities in general, support operations, including the crew boat and supply boats, may have a minor incremental impact on coastal habitats. Over time with a large number of vessel trips, vessel wakes can erode shorelines along inlets, channels, and harbors. Support operations, including the crew boat and supply boats as detailed in **EP Section 14**, may have a minor incremental impact on coastal habitats, seagrass beds, wetlands, oyster reefs, or protected areas. Impacts will be minimized by following the speed and wake restrictions in harbors and channels.

### Impacts of a Large Oil Spill

Potential spill impacts on coastal habitats are discussed by BOEM (2016b, 2017c). 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.

The 30-day OSRA results summarized in **Table 3** predicts that 11 Texas counties and two Louisiana parishes’ shorelines could be contacted by a spill within 30 days. Nearshore waters and embayments of Matagorda County in Texas has the highest probability of contact within 30 days (7% probability).

The shorelines within the geographic range predicted by the OSRA modeling include extensive barrier beaches and wetlands, oyster reefs, with submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries. NWRs and other protected areas such as Wildlife Management Areas (WMAs) along the coast are discussed in the lease sale EIS (BOEM, 2017c) and Shell’s OSRP. Coastal wildlife refuges, wilderness areas, and state and national parks within the geographic range of the potential shoreline contacts after 30 days are listed in **Table 6**.

Table 6. Wildlife refuges, wilderness areas, and state and national parks within the geographic range of the potential shoreline contacts within 30 days based on the 30-day Oil Spill Risk Analysis modeling.

| County or Parish, State | Wildlife Refuge, Wilderness Area, or State/National Park |
|---|---|
| Cameron, Texas | Boca Chica State Park |
| | Brazos Island State Park |
| | Laguna Atascosa National Wildlife Refuge |
| | Laguna Madre Gulf Ecological Management Site |
| | Las Palomas Wildlife Management Area |
| | Lower Rio Grande Valley National Wildlife Refuge |
| Willacy, Texas | Laguna Atascosa National Wildlife Refuge |
| | Laguna Madre Gulf Ecological Management Site |
| | Padre Island National Seashore |
| Kenedy, Texas | Laguna Madre Gulf Ecological Management Site |
| | Padre Island National Seashore |
| Kleberg, Texas | Laguna Madre Gulf Ecological Management Site |
| | Padre Island National Seashore |
| Nueces, Texas | I.B. Magee Beach Park |
| | Laguna Madre Gulf Ecological Management Site |
| | Mission-Aransas National Estuarine Research Reserve |
| | Mustang Island State Park |
| | Port Aransas Nature Preserve |
| | Roberts Point Park |
| Aransas, Texas | Aransas National Wildlife Refuge |
| | Goose Island State Park |
| | Lydia Ann Island Audubon Sanctuary |
| | Mission-Aransas National Estuarine Research Reserve |
| | Rattlesnake Island, Ayres Island, and Roddy Island Audubon Sanctuary |
| | Redfish Bay State Scientific Area |
| Calhoun, Texas | Aransas National Wildlife Refuge |
| | Chester Island Bird Sanctuary |
| | Guadaloupe Delta Wildlife Management Area |
| | Matagorda Island Wildlife Management Area |
| | Welder Flats Wildlife Management Area |
| Matagorda, 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, Texas | Brazoria National Wildlife Refuge |
| | Christmas Bay Coastal Preserve |
| | Justin Hurst Wildlife Management Area |
| | San Bernard National Wildlife Refuge |
| Galveston, Texas | Anahuac National Wildlife Refuge |
| | Bolivar Flats Shorebird Sanctuary |
| | Fort Travis Seashore Park |
| | Galveston Island State Park |
| | Horseshoe Marsh Bird Sanctuary |
| | Mundy Marsh Bird Sanctuary |
| | R.A. Apffel Park |
| | Seawolf Park |
| Jefferson, Texas | McFaddin National Wildlife Refuge |

Table 6. (Continued).

| County or Parish, State | Wildlife Refuge, Wilderness Area, or State/National Park |
|---|---|
| | Sea Rim State Park |
| | Texas Point National Wildlife Refuge |
| Cameron, Louisiana | Peveto Woods Sanctuary |
| | Rockefeller State Wildlife Refuge and Game Preserve |
| | Sabine National Wildlife Refuge |
| Vermilion, Louisiana | Paul J. Rainey Wildlife Refuge and Game Preserve |
| | Rockefeller State Wildlife Refuge and Game Preserve |
| | State Wildlife Refuge |

The 30-day OSRA results in **Table 3** include only shoreline segments with contact probabilities greater than 0.5% within 30 days; other coastal areas could be affected at lower contact probabilities within 30 days, or beyond 30 days from the spill. Additional NWRs and managed wildlife areas occur along the Gulf Coast. These areas include habitats such as barrier beach and dune systems, wetlands, and submerged seagrass beds that support diverse wildlife, including endangered or threatened species.

The level of impacts from oil spills on coastal habitats depends on many factors, including the oil characteristics, the geographic location of the landfall, and the weather and oceanographic conditions at the time (BOEM, 2017c). Oil that makes it to beaches may be either liquid weathered oil, an oil-and-water mousse, or tarballs (BOEM, 2012a, 2017c). 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, 2017c).

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 (Beazley et al., 2012, Lin and Mendelssohn, 2012, 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, 2017c). 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, 2017c). 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 (2017c). The main commercial fishing activity in deep waters of the northern Gulf of Mexico is pelagic longlining for tunas, swordfishes, and other billfishes (Continental Shelf Associates, 2002). Pelagic longlining has occurred historically in the project area, primarily during spring and summer.

It is unlikely that any commercial fishing activity other than longlining occurs at or near the project area. Benthic species targeted by commercial fishers occur on the upper continental slope, well inshore of the project area. Royal red shrimp (*Pleoticus robustus*) are caught by trawlers in water depths of approximately 820 to 1,804 ft (250 to 550 m). Tilefishes (primarily *Lophalotilus chamaeleonticeps*) are caught by bottom longlining in water depths from approximately 540 to 1,476 ft (165 to 450 m) (Continental Shelf Associates, Inc., 2002). The water depths at the proposed wellsites range from 8,997 to 9,184 ft (2,742 to 2,799 m). No conflict with commercial fishing activity other than longlining is expected to occur.

Most recreational fishing activity in the region occurs in water depths less than 656 ft (200 m) (Continental Shelf Associates, 1997, 2002). In deeper water, the main attraction to recreational fishers would be petroleum platforms in offshore waters of Texas and Louisiana.

The only routine IPF that could potentially affect fisheries 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 (2012a, 2013a, 2014, 2015, 2016b, 2017c). 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, 2010a). At its peak on 12 July 2010, closures encompassed 84,101 miles$^2$ (217,821 km$^2$), or 34.8% of the U.S. Gulf of Mexico EEZ. BOEM (2012a) notes that fisheries closures from a large spill event could have a negative effect on short-term fisheries catch and marketability.

According to BOEM (2012a, 2017c), 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, 2016a). 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, 2017c, b). 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. 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 (2012a, 2013a, 2014, 2015, 2016b, 2017c). 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, 2017c). Net employment impacts from a spill would not be expected to exceed 1% of baseline employment in any given year (BOEM, 2017c).

The lease area is 147 miles (237 km) from the nearest shoreline. Based on the 30-day OSRA modeling predictions (**Table 3**), coastal areas of Matagorda County in Texas are the most likely to be contacted by a spill.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **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 this activity. There are no known recreational uses of 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 will minimize the chance of trash or debris being lost overboard from the MODU and subsequently washing up on beaches. There are no known recreational or tourism activities occurring in the lease area, and 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 (2017c). 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. The 30-day OSRA modeling results summarized in **Table 3** predict that shorelines in 11 Texas counties and two Louisiana parishes could be contacted by a spill within 30 days. Nearshore waters and embayments of Matagorda County in Texas have the highest probability of contact within 30 days (7% probability).

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

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. 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 (2012a, 2013a, 2014, 2015, 2016b, 2017c). There are no routine IPFs potentially affecting land use. The project will use existing onshore support facilities in Louisiana and Texas. 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 (2016b) state that landfill capacity would probably not be an issue at any phase of an oil spill event or the long-term recovery. In the case of the 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 or shipping lane. The lease area is in Military Warning Area W-602. Shell will comply with BOEM requirements and lease stipulations to avoid impacts on uses of the area by military vessels and aircrafts.

The shallow hazard assessments identified existing wells within 2,000 ft (610 m) of the proposed wellsites SA005, SA005 Alt-A, and SA005 Alt-B. (Geoscience Earth & Marine Services, 2003, 2007, C&C Technologies, 2015). An existing well is located approximately 775 ft (236 m) and a producing well is located approximately 1,390 ft (424 m) from the proposed wellsites SA005, SA005 Alt-A, and SA005 Alt-B.

There are no IPFs from routine project activities that are likely to affect shipping or other marine uses. 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. 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, 2012b, 2013a, 2014, 2015, 2016a, 2016b, 2017c). 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, 2013a, 2014, 2015, 2016b, 2017c).

Cumulative Impacts of Activities in the Supplemental Exploration Plan. The BOEM (2017c) 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, 2013a, 2014, 2015, 2016b, 2017c). 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. $CO_2$ and $CH_4$ emissions from the project would constitute a negligible contribution to greenhouse gas emissions from all OCS activities. According to BOEM (2013a), greenhouse gas emissions from all OCS oil and gas activities make up a very small portion of national $CO_2$ emissions, and BOEM does not believe that emissions directly attributable to OCS activities are a significant contributor to global greenhouse gas levels. Greenhouse gas emissions identified in this 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 block is not on the list of archaeology survey blocks (BOEM, 2011) and no known shipwrecks or other archaeological artifacts were identified during the wellsite geohazard assessments (Geoscience Earth & Marine Services, 2003, 2007, Berger Geosciences, 2015, C&C Technologies, 2015). 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, 2013a, 2014, 2015, 2016a, b, 2017c) 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. 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, 2013a, 2014, 2015, 2016b, 2017c).

Threatened, Endangered, and Protected Species. Threatened, endangered, and protected species that could occur in the lease area include one species of marine mammals 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, 2013a, 2014, 2015, 2016a, b, 2017c) 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, 2013a, 2014, 2015, 2016b, 2017c). 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, 2013a, 2014, 2015, 2016a, b, 2017c) has been incorporated into the EIA, where applicable.

# D. Environmental Hazards

## D.1 Geologic Hazards

Geoscience Earth & Marine Services, Berger Geosciences, and C & C Technologies prepared several geological and hazards reports for the lease area (Geoscience Earth & Marine Services, 2003, 2007, Berger Geosciences, 2015, C&C Technologies, 2015). The wellsite assessments concluded that the proposed 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 states, wind speed, ocean currents, etc., will also be continuously monitored. Under most circumstances, physical oceanographic conditions are not expected to have any effect on the proposed activities. Strong currents (caused by Loop Current eddies and intrusions) and large waves were considered in the design criteria for the 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 2f**.

## G. Consultation

No persons beyond those cited as Preparers (**Section H., Preparers**) or agencies were consulted regarding potential impacts associated with the proposed activities during the preparation of the EIA.

## H. Preparers

The EIA was prepared for Shell Offshore Inc. by its contractor, CSA Ocean Sciences Inc. Contributors included the following:

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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
Section 3G High-Resolution Seismic Lines & Top Hole Progs

## B. Bibliography

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