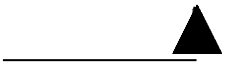

OCS EIS/EA
BOEM 2018-033

Sand Survey Activities for BOEM's Marine Minerals Program

Atlantic and Gulf of Mexico

Draft Environmental Assessment

U.S. Department of the Interior
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Table of Contents

1 Introduction

The Bureau of Ocean Energy Management's (BOEM) Marine Minerals Program (MMP) has prepared an Environmental Assessment (EA) to describe and evaluate the potential environmental impacts related to geological and geophysical (G&G) survey activities that support identification, delineation, monitoring, and scientific investigation of sand resources (herein referred to as sand survey activities) on the Atlantic and Gulf of Mexico (GOM) Outer Continental Shelf (OCS) (Figure 1-1). The proposed activities, funded or managed by BOEM, would occur within a small portion of BOEM's North Atlantic, Mid-Atlantic, South Atlantic, Straits of Florida, and the Gulf of Mexico's Eastern, Central, and Western Planning Areas. This EA provides an analysis to help determine whether significant impacts on Atlantic and GOM resources could occur as a result of the proposed sand survey activities and specifies mitigation measures that would be implemented to avoid, reduce, or minimize impacts.

BOEM has prepared this EA in compliance with the National Environmental Policy Act (NEPA) (42 United States Code [U.S.C.] §§ 4321 *et seq.*); the Council on Environmental Quality Regulations (Title 40 Code of Federal Regulations (CFR) parts 1500–1508); and U.S. Department of the Interior regulations (43 CFR part 46). This NEPA process has been integrated to achieve compliance with other environmental regulations to reflect relevant environmental concerns, avoid delays, and address potential conflicts or challenges.

Figure 1-1. Proposed Study Area for Sand Survey Activities in Support of BOEM's Marine Minerals Program

1.1 BACKGROUND

BOEM is responsible for managing the extraction of non-energy minerals (primarily sand and gravel) for, among other things, use in coastal resiliency and storm damage reduction projects, including beach nourishment and coastal restoration. As stewards of OCS sand and gravel resources BOEM, through its Marine Minerals Program (MMP), must carefully manage their use while supporting coastal resiliency initiatives to nourish eroded beaches, conserve sensitive wildlife areas, and restore barrier islands and wetlands that provide natural protection from storms. By proactively developing an inventory of OCS sand resources, BOEM is in the unique position to manage use conflicts and foster ecosystem health while supporting the following national interests:

- provide resources to Federal and state agencies and localities to reduce damages to coastal infrastructure;
- respond to emergency requests for use of OCS sand resources following storm events; and
- restore parkland, wildlife refuges and habitat, and other areas, which can promote the long-term sustainability of communities and ecosystems.

To determine which OCS areas contain compatible sand resources (generally based on sediment grain size, shape, sorting, color, mineralogy, sediment deposit volume and geometry, and proximity to project sites) and facilitate stewardship responsibilities, BOEM is proposing to conduct sand survey activities to identify, delineate, monitor, and research potential sand resources for future projects.

1.2 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed action is to identify potential sand resources for projects as well as facilitate access to and support management of OCS sand resources that may be needed in beach nourishment and coastal restoration projects. By collecting and analyzing sand survey data prior to an immediate or emergency need, BOEM can help proactively identify sand resources for enhancing coastal resiliency, better manage resources within its jurisdiction, and develop a more comprehensive understanding of available resources. Data collected may support programs such as the MMP's National Sand Inventory and Deepwater Horizon Gulf Restoration programs, which includes but is not limited to; the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act) and Natural Resource Damage Assessment and Restoration (NRDAR).

The proposed action is needed to identify additional OCS sand resources for beach nourishment and coastal restoration projects because sand resources in State waters are either diminishing or are of poor quality, or otherwise unavailable. Dredging sand closer to shore in State waters can also lead to more severe environmental effects. Using nearshore sand often occurs within the active coastal system, compromising long-term effectiveness of projects and failing to address the need to supplement a deficit in the coastal sand budget. Using OCS sand resources introduces new sand from outside of the active coastal system to decrease the coastal sand deficit, improving project sustainability and geomorphic function (Hilton and Hesp 1996).

1.3 REGULATORY FRAMEWORK

The Outer Continental Shelf Lands Act (OCSLA), as amended, provides DOI the authority to manage minerals on the United States OCS out to 200 nautical miles (nmi) (230 miles [m]; 370 kilometers [km]) from shore. Section 11 of the OCSLA, as amended, authorizes the Secretary of the Interior (Secretary), through BOEM, to approve the exploration of marine minerals (e.g., sand, gravel, and shell resources). OCSLA defines the term "exploration" as the process of searching for minerals, including geophysical surveys and geological sampling. Section 8(k) of the OCSLA allows BOEM to negotiate, on a noncompetitive basis, the rights to OCS sand, gravel, or shell resources for shore protection, beach or wetlands restoration projects, or use in construction projects funded in whole or in part by, or authorized by, the Federal Government. In addition, Section19(e) authorizes the use of cooperative agreements with affected States and eligible stakeholders to be meeting the requirements of the OCSLA, including the sharing of information, joint utilization of available expertise, and formation of joint monitoring arrangements to carry out applicable Federal and State laws, regulations, and stipulations relevant to OCS operations both onshore and offshore. BOEM uses cooperative agreements with Atlantic and Gulf Coast States to assist in the inventory of offshore sand resources.

BOEM strives to ensure that all actions on the OCS are undertaken in a technically safe and environmentally sound manner. This EA is being used to support associated consultations according to other environmental laws, including the Endangered Species Act (ESA), Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), Coastal Zone Management Act (CZMA), and National Historic Preservation Act (NHPA) (Chapter 4).

1.4 OBJECTIVES, SCOPE, AND STUDY AREA

The objectives of this EA are to complete the following:

- characterize proposed sand survey activities that support identification, delineation, monitoring, and research of sand resources on the Atlantic and Gulf of Mexico OCS;
- describe alternatives to the proposed action;
- identify and analyze direct, indirect, and cumulative impacts that could result from implementing the proposed action and alternatives; and
- evaluate mitigation measures that are practical and feasible to ensure impacts on the human and natural environments are avoided or minimized to the extent possible.

The Study Area lies within the Atlantic and GOM coastal waters out to 50 meters (m) (164 feet [ft]) deep (Figure 1-1) in addition to state waters investigated through state cooperative agreements. Sand survey activities would not occur across the entire Study Area simultaneously but would be of limited spatial extent at any one time. The Study Area includes adjacent transit corridors used for vessel mobilization, demobilization, and access to support bases. Sensitive and protected areas, such as Cape Cod Bay, Stellwagen Bank National Marine Sanctuary, and Florida Keys National Marine Sanctuary, are specifically excluded.

Prior to sand survey activities commencing, BOEM would coordinate with coastal states, Federal stakeholders, and relevant regional planning bodies at BOEM Sand Management Working Groups (SMWG) and other facilitated meetings to determine areas with the greatest potential need for OCS sand resources and the greatest data gaps, in order to identify priority survey sites. Detailed survey and sampling plans would be developed and coordinated as appropriate prior to undertaking any sand survey activities; these plans would define the geographic scope and relative timing of the proposed activities and consultations.

Similar activities could occur in adjacent State waters as an extension of OCS resource area identification and delineation, but unless these activities occur as part of a BOEM cooperative agreement, these are not considered in this analysis. Construction activities, including beach nourishment and wetlands reconstruction, are not considered connected actions and are not included in this analysis. Any such proposals would be considered individually and subjected to separate environmental reviews.

2 Description of the Proposed Action and Alternatives

2.1 RANGE OF ALTERNATIVES

The proposed action is a set of comprehensive sand survey activities using state-of-the-art technology and methods to identify, delineate, monitor, and research OCS sand resources. Sand survey equipment types used to support these activities were presented in previous BOEM documents (BOEM 2014a; BOEM 2014b; BOEM 2017) and are incorporated by reference, with some details summarized in Appendix A. Data will be collected in close coordination with or by States and will support both long-term and emergency planning goals of BOEM's Marine Minerals Program and would be distributed widely among coastal stakeholders for their planning purposes. A rigorous mitigation strategy to minimize environmental effects is included as a component of the proposed action (Appendix B). The proposed action would include three components: (1) reconnaissance-scale surveys to identify and delineate OCS sand resources; (2) site-specific, high-resolution geophysical surveys to further delineate borrow areas and investigate the presence of objects of archaeological significance, munitions of explosive concern (MEC), and hard bottom or other sensitive benthic habitat in the vicinity of potential borrow areas; and (3) research and/or monitoring surveys to detect geologic and morphological changes in sand resource areas. This NEPA analysis will stand in perpetuity, with an evaluation of accuracy and any necessary updates at least every five years, unless a change in the proposed action or new information warrants updating sooner.

The action alternatives are alike in scope and vary only by the sequence of data collection and in mitigation measures affecting the duration/time of operations and technology (summarized in Chapter 2.2 and detailed in Appendix B). Alternatives A and B address the purpose and need as outlined in Chapter 1.2, along with the No Action Alternative required by NEPA. Evaluated in this EA and described below are the following alternatives: A – The Proposed Action; B – Additional Operational Restrictions and Time-Area Closures; and C – No Action Alternative.

2.2 ALTERNATIVE A: PROPOSED ACTION

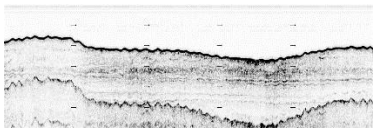
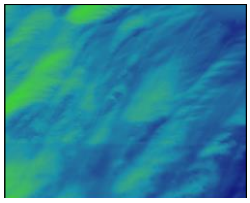
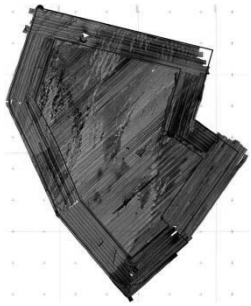
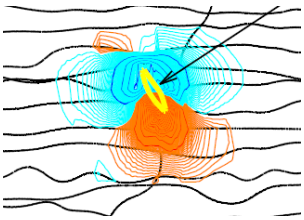
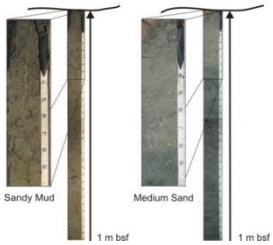
The proposed action is a comprehensive and systematic data collection approach to identify, delineate, monitor, and research Atlantic and Gulf of Mexico OCS sand resources. Historically BOEM has funded and conducted varying levels of effort on the OCS to identify sand resources and delineate potential borrow areas. In some areas, reconnaissance studies are still needed as a first step to identify potential sand resources. Reconnaissance studies use wider spaced survey lines over comparatively large areas (i.e., regional in scope) to identify sand bodies and characterize the shallow geological framework and surficial geology of potential sand resources. These surveys would help to ascertain if sand resources are of a certain quality (sediment type) and quantity to warrant further exploration. Site-specific studies use tighter line spacing over a smaller area to delineate the lateral and vertical extent of new borrow areas and to determine the presence of any limitations to the use of these resources (e.g., cultural resources, sensitive habitat, etc.). Additionally, surveys may occur before and after a dredge event to monitor any changes to a sediment resource and/or conduct specific research to understand the complexities of the environment (e.g., physical, biological, geological, etc.) and potential implications in accordance with BOEM's stewardship responsibilities.

In total, it is anticipated that approximately 70–85% of the survey work conducted under the proposed action would be reconnaissance in nature and that 15–30% would be site-specific, high-resolution surveys or associated with scientific investigation or project-specific monitoring. Sand survey activities, whether reconnaissance or site-specific in nature, could be conducted simultaneously or in sequence, depending upon the information needs, field conditions, and efficiency factors.

Two general survey types would be employed: geophysical surveys for mapping the geologic framework and seafloor condition and geological surveys to collect sediment samples and shallow sediment cores (20 ft [6.1 m] maximum length). The geophysical surveys obtain information about sedimentary architecture, shallow hazards (e.g., MEC or buried cables), archaeological resources, and sensitive benthic habitats and do not impact the seafloor; geological surveys collect information on sediment composition and textural properties and do impact the seafloor. Vessels would range from approximately 28 to 120 ft (9 to 37 m), depending on survey needs, and travel 3-5 knots (5.6-9.3 km/hr), but may travel 10-12 knots (19-22 km/h) in transit. Survey techniques and equipment are shown in Table 2.1 and Appendix A.

Surveys would aim to decrease the overall number of vessel mobilizations and reduce redundant data collection. The survey design and selection of technologies, deployment modes, and timing would balance data quality needs and avoid and minimize potential environmental impacts. To the extent possible, BOEM proposes to use the least number of lowest-energy (and highest-frequency) acoustic sources to obtain the necessary geophysical data, thereby reducing the potential for impacts to marine animals. Appendix A provides a more detailed characterization of these proposed sources and their sound propagation characteristics. No airguns or sparkers would be used.

Table 2-1. Geological and Geophysical Survey Techniques for Sand Surveys

Survey Purpose	Depiction of Acquired Data	Survey Technology	Platform/Equipment Used	Study Type
Identify near-bottom sedimentary architecture		Sub-bottom profiling: chirp or boomer	Vessel, chirp profiler or boomer, and hydrophone array (only with boomer source)	Reconnaissance, Site-Specific
Map seafloor bathymetry, image the seafloor, archaeological resources, and benthic habitat potential		Bathymetry: multibeam or interferometric swath	Vessel, multibeam, or interferometric transducer	Reconnaissance, Site-Specific
Image the seafloor, archaeological resources, benthic habitat potential, and relic landscapes		Side-scan sonar or acoustic backscatter from multibeam or interferometric swath	Vessel, side-scan sonar tow fish, multibeam, or interferometric transducer	Site-Specific, possibly Reconnaissance
Archaeological resources and hazards potential, including MECs		Magnetometer	Vessel, magnetometer tow fish	Site-Specific
Verify geophysical data, determine sediment attributes and beach compatibility, delineate borrow areas		Sediment samples: vibracoring or grab samples	Vessel, vibracore rig, core barrel (20-ft penetration maximum), limited anchoring if not using dynamic positioning or live-boating	Reconnaissance, Site-Specific

On average, up to about 70 line-miles (113 km) of geophysical data could be collected per day, assuming that site-specific survey data are not collected simultaneously with reconnaissance-level data. It is anticipated that 8,000-16,000 line-miles (12,875-25,750 line-km) of geophysical surveys could be collected for the entire Study Area in one year. For sediment samples, which are primarily used to ground-truth the geophysical data, approximately 15 vibracores and up to 50 benthic grabs per day could be collected, although it is anticipated that most would be vibracores, with a small portion being grab samples. A total of 2,000-3,000 geological samples could be collected in one year. All estimates are based on one vessel completing the surveys; however more than one vessel could be used. For a given survey, mobilization of the vessel and crew would occur, though frequency would depend on the location and scope of activities.

All activities would comply with relevant environmental laws, mitigation measures, and best practices including BOEM protocols and guidelines (Appendix B), such as:

- time-area restrictions for geophysical surveys in the Atlantic;
- a geophysical survey protocol;
- a vibracore sampling protocol;
- nighttime surveying and passive acoustic monitoring protocol;
- a vessel strike avoidance protocol;
- historic and pre-contact site avoidance and reporting requirements;
- sensitive benthic habitat and communities avoidance requirements;
- marine pollution control plan;
- marine debris awareness program; and
- navigational and commercial fisheries conflicts minimization requirements.

These measures are consistent with those from previous geological and geophysical NEPA documents (BOEM 2014a; BOEM 2014b; BOEM 2017) and are discussed in Appendix B. Strategies to track, monitor, and report the results of mitigations would be established during the development of the detailed survey plans on a project-by-project basis.

2.3 ALTERNATIVE B: ADDITIONAL OPERATIONAL RESTRICTIONS AND TIME-AREA CLOSURES

Under this alternative, the same suite of activities would occur with the implementation of the same mitigation suite as Alternative A, but additional mitigation requirements and restrictions would be employed. This alternative is designed to meet the underlying purpose and need, while incrementally reducing environmental impacts from survey activities. Mitigation measures applicable to proposed activities in Alternative B would include implementation of:

- additional operational restrictions for geophysical surveys; and
- additional site-specific, time-area closures in the Atlantic.

These mitigation measures are discussed in more detail in Appendix B.

2.4 ALTERNATIVE C: NO ACTION

Under the No Action Alternative (required under 40 CFR § 1502.14(d)), a comprehensive and programmatic approach to the inventory, study, and monitoring of sand resources in the Atlantic and Gulf of Mexico OCS would not occur. Instead, sand survey activities would undergo individual NEPA and environmental compliance, which would require substantially more time. This time cost may jeopardize the execution and feasibility of some activities, resulting in less information and data. The No Action Alternative would limit the effectiveness and efficiency of BOEM's management of OCS sediment since the understanding of the quantity and quality of this sediment would likely decrease. Without environmental coverage for sand survey activities in place, BOEM may also be delayed in emergency situations following extreme weather events when sand sources need to be identified and managed. Issuance of agreements for use of OCS sand would continue.

3 Description of Affected Environment and Environmental Considerations

This chapter characterizes the environmental resources and describes the potential impacts on those Study Area resources that could occur from implementing the proposed action and alternatives.

3.1 RESOURCES DISMISSED FROM FURTHER ANALYSIS

BOEM reviewed several recent environmental documents that address potential effects from sand survey activities and other G&G sampling on physical, biological, and sociocultural resources (MMS 2004, NSF and USGS 2011, BOEM 2014a, BOEM 2014b, BOEM 2017, NOAA 2013, CSLC 2013). Impact-producing factors (IPFs) most relevant to the proposed activities include (1) noise from active sound sources and vessel operations, (2) strike risk associated with vessel presence/traffic, (3) vessel wastes and accidental discharges, and (4) seafloor disturbance.

CEQ instructs Federal agencies to focus the effects analysis on those effects and issues in a manner proportional to their relevance and potential significance. Negligible impacts are expected to result from the proposed activities to the five resource areas discussed below and will not be evaluated further:

- *Air Quality*: Small survey vessels involved in sand survey activities emit a variety of air pollutants including nitrogen oxides, sulphur oxides, particulate matter, volatile organic compounds, carbon monoxide, and greenhouse gas emissions (e.g., carbon dioxide). Emissions from vessel operations are expected to be far enough offshore and localized during transit that they would disperse rapidly, so as to not contribute to onshore air quality, ozone violations, and/or increase pollutants such that public health is affected.
- *Water Quality*: Water quality could be affected during survey operations following discharge of sanitary and domestic wastes and cooling water. Although accidental spills are unexpected, all operations would be conducted under a marine pollution control plan (Appendix B). An increase in turbidity may occur from geological sample collection, but these activities are temporary and short-term, therefore the effects are expected to be

negligible. Due to the operational and regulatory requirements, BOEM has determined that impacts on water quality would be very limited and localized.

- *Phytoplankton and Zooplankton*: Primary and secondary production supports higher trophic levels, including forage fishes, large fishes, seabirds, sea turtles, and marine mammals. Impacts on phytoplankton and zooplankton would be minimal and limited to the area immediately around sound sources or if water quality conditions were to become impaired.
- *Aesthetics*: The presence of intermediate-size survey vessels (typically 50-150 ft [15-46 m] in length) is not unusual offshore the Atlantic and Gulf of Mexico seaboards. Sand survey vessels would be far enough offshore, with some beyond the visibility of the shoreline, and operations are spread over a relatively large inner shelf area for a limited time, which would minimize visual impacts at any specific location. Also, survey operations occur more during daylight hours so lighting during nighttime operations would be minimized.
- *Environmental Justice*: The proposed activities are not expected to result in disproportionate impacts on minority or low-income populations because effects on the coastal environment, especially in the vicinity of ports and coastal inlets, would be very limited, short-term, and far enough offshore and disbursed over a large geographic area so as to not contribute to environmental justice issues for a specific community.

3.2 DESCRIPTION OF IMPACT LEVELS

This EA addresses the environmental consequences of each alternative by resource area, considering the unique attributes of the resource being evaluated. Effects could be direct, indirect, and cumulative. Direct impacts are caused by the activity and occur at the same time and place. Indirect impacts are caused or induced by the activity and occur later in time, or are removed spatially from the location of the activity. Cumulative impacts are those that result from the incremental effect of the activity in combination with other past, present, or reasonably foreseeable future actions. For the purposes of this analysis, impacts are classified as one of four levels.

- **Negligible:** Little or no measurable/detectable impact.
- **Minor:** Impacts are detectable, short-term, extensive or localized, but not severe.
- **Moderate:** Impacts are detectable, short-term, extensive, and severe; impacts are detectable, short-term or long-lasting, localized, and severe; or impacts are detectable, long-lasting, extensive or localized, but less than severe.
- **Major:** Impacts are detectable, long-lasting, extensive, and severe.

3.4 AFFECTED RESOURCES AND ENVIRONMENTAL CONSEQUENCES

3.4.1 Atlantic

A previous analysis (BOEM 2014b) includes a comprehensive description of Atlantic resources and an analysis of nearly identical proposed sand survey activities. To streamline the current analysis, the previous work has been incorporated by reference and summarized in Table 3-1. Several updates have been identified for: (1) marine mammals, (2) fish and Essential Fish Habitat (EFH), (3) benthic habitat and communities, (4) sea turtles, and (5) marine and coastal birds. Cumulative effects, for both the Atlantic and GOM, can be found in Chapter 3.5.

Table 3-1. Summary of Atlantic Resources and Sand Survey Activity Impacts Previously Analyzed (BOEM 2014b)

Resource	Description Summary	Environmental Consequences		
		Alternative A: The Proposed Action	Alternative B: Additional Operational Restrictions and Time-Area Closures	Alternative C: No Action
Marine Mammals	A total of 39 marine mammals occur in the Atlantic, representing three taxonomic orders: Cetacean, Sirenia, and Carnivora. Seven of these marine mammals species are federally listed as endangered, of which only the manatee (*Trichechus manatus latirostris*), North Atlantic right whale (*Eubalaena glacialis*), fin whale (*Balaenoptera physalus*), and humpback whale (*Megaptera novaeangliae*) are likely to occur.	Potential impacts from active acoustic and vessel noise, vessel presence/traffic, vessel wastes and discharges, and bottom disturbance would be negligible to minor because of the implementation of established comprehensive survey protocols and mitigation measures, particularly to limit exposure of marine mammals to noise.	Similar to Alternative A. Additional operational restrictions may lead to more vessel trips resulting in increased exposure to acoustic noise and a greater chance of vessel collisions. Time-area closures may lead to fewer incidental acoustic and marine noise impacts; however, closures could concentrate exposure and impacts within a different season.	The proposed action would be limited. Therefore, there would be fewer potential impacts on marine mammals.
Fish and Essential Fish Habitat	Two marine fish species that occur in the Study Area, the smalltooth sawfish (*Pristis pectinata*) and the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), are currently listed as endangered. Many specific Habitat Areas of Particular Concern (HAPCs) have been identified for fishes in the Atlantic Region.	Potential impacts from active acoustic and vessel noise, vessel presence/traffic, vessel wastes and discharges, and bottom-disturbance impacts are expected to be negligible to minor due to proximity, mobility, and frequency of occurrence.	Additional mobilizations would increase the potential impacts of vessel noise to pelagic, demersal, and highly migratory fish resources and EFH; however, impacts from sound sources and vessel and equipment noise would still be considered negligible to minor.	The proposed action would be limited. Therefore, there would be fewer potential impacts on pelagic, demersal, and highly migratory fish resources and associated EFH.
Benthic Habitat and Communities	The Study Area is comprised of many different bottom compositions with two species of coral, elkhorn (*Acropora palmata*) and staghorn (*Acropora cervicornis*), located in Florida listed as threatened under the ESA.	Short-term, direct, and indirect impacts on soft bottom benthic resources, primarily through seafloor disturbance due to geologic sampling or anchoring would be expected to be negligible, as disturbed areas would be small and sampling would be spaced out	Impacts on benthic resources from implementing Alternative B would be similar to those described for Alternative A.	The proposed action would be limited. Therefore, there would be fewer potential impacts to soft bottom benthic resources.

Resource	Description Summary	Environmental Consequences		
		Alternative A: The Proposed Action	**Alternative B: Additional Operational Restrictions and Time-Area Closures**	**Alternative C: No Action**
		so that impacts on benthic communities would be localized and limited.		
Sea Turtles	Five sea turtle species (loggerhead [*Caretta caretta*], green [*Chelonia mydas*], Kemp's ridley [*Lepidochelys kempi*], hawksbill [*Eretmochelys imbricata*], and leatherback [*Dermochelys coriacea*)]) occur in the Study Area during certain time periods and life stages. All species are protected under Section 7 of the ESA.	Potential impacts from active acoustic and vessel noise, vessel presence/traffic, vessel waste and discharges, and seafloor disturbance. Activities would be expected to have negligible impacts on sea turtles, because mitigation measures would reduce the risk of vessel strike and noise impacts.	Additional operational restrictions may lead to more vessel trips, resulting in additional marine noise exposure and a greater chance for vessel collisions. However, eliminating nighttime surveys and additional time-area closures could result in a reduction in the likelihood of strikes and noise-related effects depending on location, time of year, and characteristic behavior.	The proposed action would be limited. Therefore, there would be fewer potential impacts to sea turtles.
Marine and Coastal Birds and Bats	Four avian species listed under the ESA (piping plover [*Charadrius melodus*], roseate tern [*Sterna dougallii*], Bermuda petrel [*Pterodroma cahow*], and Kirtland's warbler [*Setophaga kirtlandii*]) are either within or in close proximity to the Study Area. Additionally, there are three taxonomic and ecological avian groups of concern that are found within the Study Area including seabirds, waterfowl, and shorebirds, all of which are protected under the Migratory Bird Treaty Act.	Impacts from noise, vessel operations, accidental spills, or discharge associated with the proposed activity are expected to be negligible to minor for birds and bats, including at-risk species, because of the localized footprint of activities relative to available foraging and resting areas.	Increased impacts on avian resources could occur from increased disturbance and accidental releases of trash, debris, and fuel or other vessel fluids. However, the overall intensity of effects would not be substantially different from Alternative A.	The proposed action would be limited. Therefore, there would be fewer potential impacts on birds and bats.
Historic/Pre-Contact Resources	Submerged cultural resources within	Potential impacts from	Impacts could be slightly	The proposed action

Resource	Description Summary	Environmental Consequences		
		Alternative A: The Proposed Action	Alternative B: Additional Operational Restrictions and Time-Area Closures	Alternative C: No Action
	the Study Area primarily include shipwrecks that date from early exploration and settlement of North America by Europeans through World War II and the Cold War period. Offshore archaeological resources that may exist within the Study Area may also include submerged pre-contact sites or relict landforms that have a potential to contain these sites.	geological sampling and anchoring. It is highly unlikely that impacts would occur on submerged cultural resources or archaeological resources from seafloor disturbance because of mitigation measures to avoid these resources.	greater than Alternative A due to multiple surveys occurring in one location, which increases the possibility of anchoring or other seafloor-disturbing activities that could impact submerged cultural resources.	would be limited. Therefore, there would be fewer potential impacts on historic/pre-contact resources.
Recreation	The scenic and aesthetic values of these diverse coastal areas play an important role in attracting visitors, providing a rich recreational and tourist experience, and driving the economies of coastal communities.	Effects on recreation due to the proposed action could result from temporary changes in the viewshed and an increase in vessel traffic, though this is expected to be negligible because activities would be temporary.	Additional operational restrictions may lead to more vessel trips and increased vessel traffic, which could introduce additional viewshed impacts.	The proposed action would be limited. Therefore, there would be fewer potential impacts on recreation.
Recreational and Commercial Fishing	The Study Area is used for both recreational and commercial fishing. Along the Atlantic coastal states, recreational and commercial fishing significantly contribute to marine economies and coastal communities. However, only about 6% of fishing includes taking trips offshore 3-200 nmi (4-230 mi; 6-370 km).	Potential multiple-use effects on recreational and commercial fishing include short-term displacement of fishing activities and potential damage to fishing equipment. Any effect on fishing, including space-use conflicts, would be minimized to negligible levels because of mitigation measures, such as advance public notification through the use of Notices to Mariners.	Additional operational restrictions may lead to more vessel trips and additional vessel traffic to conduct sequential survey work, which could temporarily exclude fishermen from specific areas that could be fished. However, these impacts would be short-term and negligible.	The proposed action would be limited. Therefore, there would be fewer potential impacts on recreational and commercial fishing.

Resource	Description Summary	Environmental Consequences		
		Alternative A: The Proposed Action	Alternative B: Additional Operational Restrictions and Time-Area Closures	Alternative C: No Action
Marine Transportation	The coastal zone and inner shelf offshore the U.S. East Coast is heavily traveled by marine vessels, including commercial shipping traffic transiting to and from major coastal ports. Recreational boaters are regularly found in the same area.	Any effect on vessel traffic outside of established waterways and airways, including potential delays from rerouting, would be minimized to negligible levels because of mitigation measures and advance public notification through the use of Notices to Mariners.	Additional operational restrictions may lead to more vessel trips and additional vessel traffic, which would result in increased impacts on marine transportation. However, impacts would be short-term and negligible and further reduced through mitigation measures.	The proposed action would be limited. Therefore, there would be fewer potential impacts on marine transportation.
Military and Civilian Space Program Uses	Military activities can include various air-to-air, air-to-surface, and surface-to-surface naval fleet, submarine, and antisubmarine training exercises.	Direct impacts on military and civilian space program activities could occur as a result of the incremental increase in vessel traffic from survey vessels, but the effect should be minor and short-term, because of the limited footprint and duration of the survey activity.	Additional operational restrictions may lead to more vessel trips and additional vessel traffic, which would introduce impacts that would generally be similar to, but slightly greater than, those discussed under Alternative A.	The proposed action would be limited. Therefore, there would be fewer potential impacts on military and civilian space program uses.
Cumulative Effects	Climate change, noise, oil and gas exploration, renewable energy site assessment, dredging of marine minerals, commercial and recreational fishing, military and space-use programs, transportation, dredged material disposal, and new cable infrastructure.	The proposed activities could incrementally affect underwater noise, vessel traffic and noise, discharges and accidental releases, and seafloor disturbance. The incremental contribution of the proposed action to cumulative effects is expected to be negligible to minor because of protocols and mitigations during the proposed activities to minimize impacts.	Cumulative effects of the proposed action would be similar to those discussed for Alternative A.	Limited activities contributing to cumulative effects would be expected.

Marine Mammals

The humpback whale's listing under the ESA was amended in 2016 from endangered to a Distinct Population Segment (DPS) that is not at risk in the Study Area (81 FR 62259). North Atlantic right whale critical habitat was expanded in 2016 (81 FR 4837); there is a northeast and southeast U.S. component (Figure 3-1). Seasonal Management Areas (SMAs) with mandatory speed restrictions are located along the U.S. East Coast. Additionally, Dynamic Management Areas (DMAs) with voluntary speed restrictions may be established in the presence of these whales (e.g., NMFS 2018). Population data from 2012 indicate an estimated stock size of 440 individuals, which is the minimum recently recorded (NMFS 2017c).

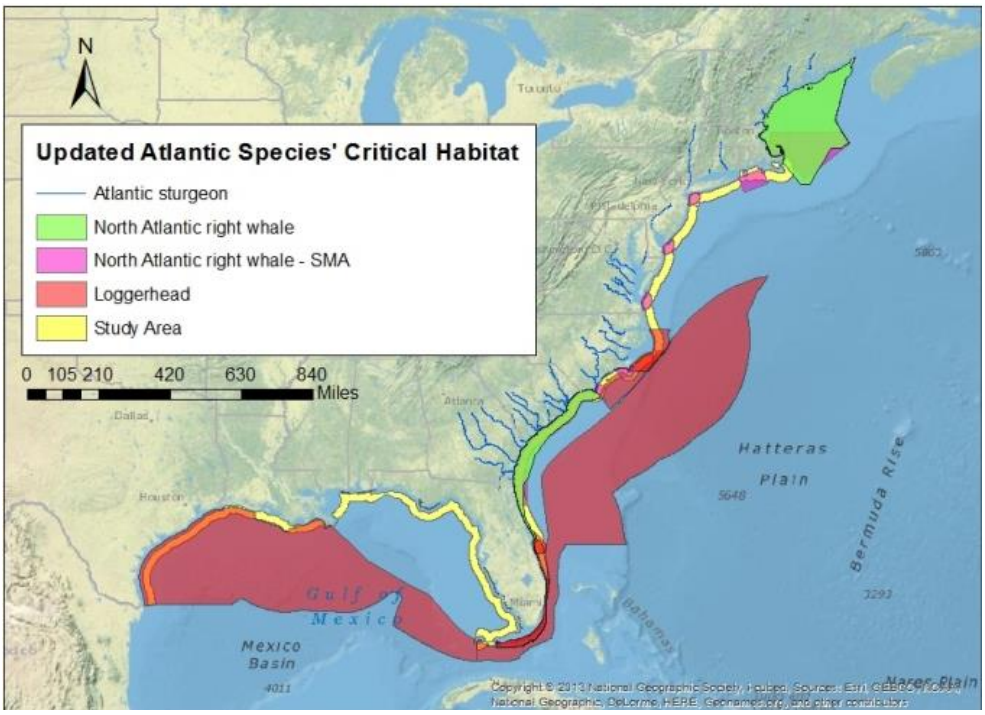


Figure 3-1. Critical Habitat Updates for Atlantic Species

Various impacts to marine mammals from similar sand survey activities were analyzed extensively by BOEM (2014b), but updates have occurred for acoustic impacts. Anthropogenic noises can disrupt animal movement, communication, foraging, and spawning (Hawkins and Popper 2016, Popper and Fay 2011, Southall et al. 2007). Acoustic impacts from geophysical and geological surveys to marine animals have been analyzed extensively (BOEM 2014b; BOEM 2012), with multiple mitigations commonly applied, particularly for the North Atlantic right whale (Appendix B). NOAA recently released acoustic guidance that discusses the levels of received sound that would result in temporary or permanent threshold shifts (TTS or PTS), or changes to the lowest-amplitude sounds that an animal can detect, in five hearing groups of marine mammals (Table 3-2; NOAA 2016). The PTS serves as the basis for the onset of Level A harassment impacts; Level B harassment occurs at 160 dB.

Table 3-2. Marine Mammal Hearing Group Permanent Threshold Shifts (PTS) Onset (NOAA 2016)

Hearing Group	Hearing Range	Non-impulsive (dB)
		24-hr ($L_{E,LF/MF/HF/PW/OW,24h}$)
Low-frequency (LF) cetaceans (baleen whales)	7 Hz – 35 kHz	199
Mid-frequency (MF) cetaceans (dolphins, toothed whales)	150 Hz – 160 kHz	198
High-frequency (HF) cetaceans (true porpoises)	275 Hz – 160 kHz	173
Phocid pinnipeds (PW) (true seals)	50 Hz – 86 kHz	201
Otariid pinnipeds (OW) (sea lions, fur seals)	60 Hz – 39 kHz	219

During geophysical surveys, non-impulsive sound sources are used to identify sand resources. Most of the technology that creates non-impulsive noise during geophysical surveys will be nominally operated above 180 kHz, beyond the hearing range of cetaceans, manatees, seals, sea turtles, and most fishes (BOEM 2014a, BOEM 2014b). Therefore, only the boomer and chirp geophysical sources may be detected by marine animals. These sources would have a peak source level of 220 decibels (dB) (re 1 µPa) or less and would be operated at the lowest setting to minimize sound levels while still fulfilling data needs (Crocker and Fratantonio, 2016). For both chirp and boomer sources, the 100-m (328-ft) acoustic exclusion zone (Appendix B) would provide an effective distance from marine mammals such that none of the marine mammal hearing groups would be exposed to Level A (Sound Levels of PTS Onset in Table 3-2) or Level B (160 dB) Harassment (Appendix A; see Table A-2). With mitigation measures, particularly a 100-m (328-ft) visual monitoring of an acoustic exclusion zone and startup/shutdown procedures, the effects of survey noise are expected to be short-term, localized, and negligible, which is consistent with a previous conclusion for similar activities by BOEM (2014b).

Geological surveys (i.e., vibracores) may create some broadband (typically non-impulsive) noise, with source levels much less than 180-190 dB (Reiser et al. 2011). The geophysical protocol, including an acoustic exclusion zone, would minimize marine animals' (particularly marine mammals and sea turtles) exposure to sound. In one square mile, approximately 15 vibracores could be collected in a 24-hour period. Accounting for both peak and cumulative exposure, the mitigation measures will be applied such that impacts from geological sampling are short-term, localized, and negligible. The proposed action may affect but is not likely to adversely affect ESA-listed whales that occur in the Atlantic Study Area. Protected manatees that may occur in the Atlantic or GOM are not expected to be affected.

Fish and Essential Fish Habitat

New ESA and EFH designations have occurred since the previous analysis (BOEM 2014b). Atlantic sturgeon have five DPSs along the U.S. East Coast (77 FR 5880; 77 FR 5914). Critical habitat, designated in 31 freshwater streams in 2017, does not overlap with the Study Area (81 FR 39160; Figure 3-1). Atlantic sturgeon are commonly found along the coast. For example, in 2017, an acoustic telemetry array detected 479 Atlantic sturgeon around the Sandbridge Shoal borrow area off of Virginia Beach; the majority of these occurred from November to April (B. Hooker, pers. comm.).

The threatened scalloped hammerhead shark's (*Sphyrna lewini*) Central and Southwest DPS, listed in 2014, occurs in the Study Area in the Atlantic (79 FR 38213). This pelagic species is found in warm temperate and tropical seas from the coast to open ocean. The giant manta ray (*Manta birostris*) is a

large, slow-growing filter-feeder that can be found in both shallow and pelagic waters around the world, including both the Atlantic and GOM; this species was recently listed as threatened (83 FR 2916). Another threatened species found in both the Atlantic and GOM is the oceanic whitetip shark (*Carcharinus lonigmanus*), which is a long-lived pelagic species (83 FR 4153).

Noise produced by sand survey activities are beyond most fishes' hearing ranges and are therefore not expected to impact fish or EFH. Any minor behavioral changes (e.g., moving away from a sound source) would affect a very small number of fish, including protected species, and is not expected to interrupt the ability of an individual to forage, rest, or migrate, or ultimately impact an animal's fitness. Bottom disturbance and turbidity would be extremely localized and only occur briefly, so fish are not expected to be affected. Impacts to fish could be negligible to minor depending on the overlap of activities with sensitive species, which does not differ from the previous analysis of similar activities (BOEM 2014b). For fish protected under the ESA, including Atlantic sturgeon, scalloped hammerheads, giant manta rays, oceanic whitetips, and smalltooth sawfish, no effects of the proposed action are expected, due to the small spatial overlap and ability of species to move away from any potential disruptions.

Minor changes to EFH and Habitat Areas of Particular Concern (HAPC) designations have occurred in the Atlantic, some of which overlap with the Study Area (NEFMC 2017; NMFS 2017a). However, surveys would occur over a short duration in a localized area; therefore, with mitigation measures to avoid sensitive habitats, impacts to EFH and HAPCs are expected to be negligible (Appendix C).

Benthic Habitat and Communities

Since the previous analysis by BOEM (2014b) that included two coral species, 20 coral species were listed as threatened (79 FR 53852). Of these, five coral species (*Dendrogyra cylindrus, Orbicella annularis, Orbicella faveolata, Orbicella franksi,* and *Mycetophyllia ferox*) occur in the Caribbean and Southeast U.S and may overlap the Study Area. These species have either low or declining abundance, often coupled with slow growth and low recruitment. Similar to other corals, these five species are threatened by a variety of impacts like climate change, fishing, and pollution; disease and ocean warming are particularly stressful to these delicate organisms (NMFS 2015). Seafloor disruption from the proposed activity could potentially indirectly affect these five protected coral species via resuspension of sediment; however, mitigation measures would prevent activity in sensitive benthic habitats and avoid direct impacts. Therefore, negligible impacts are expected. The proposed action is not expected to affect the seven ESA-listed coral species in the Study Area.

Sea Turtles

Updates to ESA designations have occurred since BOEM's previous analysis of sand survey activities (BOEM 2014b). The threatened Northwest Atlantic DPS of loggerhead swims and forages along the entire Atlantic Coast but nests in warmer latitudes south of Virginia (NMFS 2017b). Since BOEM's most recent EA analyzing impacts of surveys to loggerhead sea turtles (BOEM 2014b), they have been listed as nine DPSs (76 FR 58868); the threatened Northwest Atlantic DPS occurs in the Study Area. Additionally, critical habitat for loggerheads for different stages (e.g., migration) has been designated in select areas from nesting beaches to open ocean, ranging from North Carolina to Florida (79 FR 39856; Figure 3-1).

The North Atlantic threatened DPS of green turtles, listed as 11 DPSs worldwide in 2016 (81 FR 20057), ranges from Massachusetts to Florida, overlapping with the Study Area (NMFS 2016). Nesting beaches

for protected green sea turtles are found in southeastern U.S. Sound sources are expected to be outside of sea turtles' hearing ranges, though some minor behavioral adjustments may occur. Impacts to sea turtles from proposed activities are expected to be negligible, because mitigation measures will decrease risks of impacts, particularly those from noise and vessel traffic, as described in Table 3-1 and previously by BOEM (2014b). As ESA-listed species, the proposed action may affect, but is not likely to adversely affect, sea turtles since mitigation measures are included to decrease acoustic impacts and vessel strike risk. Recently designated loggerhead critical habitat is not expected to be affected because proposed activities will occur over a short duration in a localized area and is not expected to impact prey species.

Marine and Coastal Birds

Since the previous analysis (BOEM 2014b), the Rufa red knot (*Calidris canutus rufa*), a coastal shorebird, was listed as threatened in 2015 (79 FR 73706). This medium-sized bird migrates between breeding areas in the Arctic to wintering areas in the U.S. Southeast, Gulf of Mexico, and points south. During both spring and fall migrations, these birds stopover to rest and forage along their path, frequenting coastal barrier islands. Because there is low spatial overlap with the proposed action, impacts to the Rufa red knot are expected to be negligible. This finding applies to other birds and bats, including protected species, in the Study Area. The proposed action is expected to have no effect on the five ESA-listed birds that occur in the Study Area.

3.4.2 Gulf of Mexico

The impacts on GOM resources of certain G&G work similar to the proposed sand survey activities have been extensively analyzed by BOEM (2017). Activities would include surveys and sampling that would support development of a Gulf of Mexico portion of the National Offshore Sand Inventory conducted through BOEM-funded state cooperative agreements. While the majority of the cooperative agreements' research would be conducted on the OCS, some of the data collection activities may also occur in offshore State waters, especially if mapping continuous geologic features. Unlike the Atlantic summary (Table 3-1) that was based on a previous analysis of similar activities (BOEM 2014b), the GOM does not have a background NEPA document to incorporate by reference; therefore, a more detailed analysis in text below establishes the GOM affected environment and impacts associated with the proposed action. Under both Alternatives A and B, certain mitigations (Appendix B) would apply to all activities in both the GOM and the Atlantic, however under Alternative B time-area closures that would apply in the Atlantic would not apply in the GOM, because they were developed for the critically endangered North Atlantic right whale, a marine mammal which rarely occurs in the Gulf of Mexico region.

Biological Resources

Marine Mammals

In the GOM, there are 21 marine mammal species likely to occur within the Study Area, based on current distributional data (Davis and Fargion 1996, Jefferson et al. 2008, Southall et al. 2007, Waring et al. 2013, Waring et al. 2014, Waring et al. 2015, Würsig et al., 2000). These species represent two taxonomic orders: Cetacea (whales and dolphins) and Sirenia (manatees). Marine mammals within the GOM may generally be divided into a continental shelf community and an oceanic community. The continental shelf community includes two cetacean species, the common bottlenose dolphin (*Tursiops truncatus*) and the Atlantic spotted dolphin (*Stenella frontalis*), with occasional sightings of the Florida manatee in coastal and near-coastal waters. Oceanic cetacean species may occur within the GOM, but

they are considered rare or extralimital within the Study Area (i.e., their presence would be outside of their normal distributional range [Waring et al., 2014]). As irregular inhabitants of the Study Area, they are not considered further in this analysis.

All marine mammal species within U.S. waters are protected under the MMPA. Two species, the sperm whale (*Physeter macrocephalus*) (Northern Gulf of Mexico Stock) and the Florida subspecies of the West Indian manatee, are federally listed as endangered species and receive further protection under the ESA (Waring et al. 2010).

Environmental Consequences

Alternative A: Proposed Action

The various marine mammal species could be exposed to sound from electromechanical and geophysical sources used during sand survey activities. The discussion of survey-related acoustic impacts on marine animals, particularly marine mammals, in Chapter 3.4.1 applies to GOM species as well.

In addition to equipment noise, survey vessels generate noise. The dominant noise source from vessels is from propeller operation, including cavitation, singing, and propulsion, with the intensity of this noise largely related to ship size and speed. Survey vessels, which generate the most project-related vessel traffic under Alternative A, survey at a reduced speed of approximately 4.5 knots (8.3 km/hr). This slower speed would reduce vessel-associated noise, especially related to operation and hull-wave slap.

The potential impact on marine mammal benthic food resources from physical disturbance of the seafloor is expected to be negligible based on the availability of similar undisturbed resources within the region.

With mitigation measures, as outlined in Appendix B, including speed restrictions, observer requirements, marine pollution, and marine debris guidance, the effects of project-related noise, debris and waste/discharge, and potential collisions with marine mammals within the Study Area are expected to be negligible. Any potential impacts would be limited to short-term disruption of behavioral patterns or displacement of individual marine mammals from discrete areas within the Study Area. Like the manatee (refer to Chapter 3.4.1), the ESA-listed sperm whale is not expected to be affected by the proposed action.

Alternative B: Additional Operational Restrictions and Time-Area Closures

The potential impacts under Alternative B on each of the marine mammal species are largely similar as the impacts described under Alternative A.

Under this alternative, the same suite and level of survey activities would occur but with additional restrictions, which may result in more vessel trips. Sequential sand surveys with multiple mobilizations could lead to increased noise exposure and a greater chance for vessel collisions or debris interactions to occur relative to Alternative A.

Alternative C: No Action Alternative

Under the No Action Alternative, sand survey activities would be limited. Because there would be less noise, vessel traffic, or seafloor disruption, there would be fewer impacts to marine mammals.

Fish and EFH

The GOM Study Area's marine habitats encompass coastal marshes, shelf demersal habitat, and pelagic habitat, supporting an abundant and diverse group of fishes. Individual fish species distributions vary in

relation to environmental factors such as water depth, salinity, temperature, and habitat type. Many commercial fish species spend all or part of their life cycle in the Study Area, resulting in a high density of EFH in the Study Area (Appendix C).

Though two protected fish species (Gulf sturgeon [*Acipenser oxyrhynchus desotoi*] and smalltooth sawfish) are found near the Study Area, they inhabit and have critical habitat in nearshore waters. A third protected species, Nassau grouper (*Epinephalus striatus*), has been documented as a transient or rarely occurring species in the Study Area. The protected giant manta ray and oceanic whitetip shark, described in Chapter 3.4.1 of the Atlantic, are also found in the GOM but are migratory pelagic species that occur sporadically offshore. All of these species are considered to experience negligible impacts due to the proposed action because they have a low likelihood of overlap with the activities and associated IPFs.

Fish species in the Study Area most likely to be impacted by the proposed activities include soft bottom fishes and coastal pelagic fishes. The demersal or bottom-dwelling fish fauna of the continental shelf separate broadly into soft bottom and hard bottom assemblages. The soft bottom fish fauna varies both along (east to west) and across (north to south) the GOM shelf (Chittenden and McEachran 1976, Darnell et al. 1983, Darnell and Kleypas 1987). Environmental factors like sedimentary characteristics, water temperature, dissolved oxygen, salinity, and water depth influence the distribution and abundance of soft bottom fishes (e.g., Switzer et al., 2006). In the eastern GOM (primarily the expansive west Florida shelf), relatively clear water and coarse carbonate sediments on the open shelf support seabasses, mojarras, porgies, grunts, and sand flounders. The west Florida shelf also has vast areas of soft bottom covered by seagrasses and macroalgae. West of the Florida Panhandle, carbonate sediments of the open shelf give way to more coarse sand and shell hash. Here, in water depths ranging from 20-40 m (66-131 ft) from Alabama to west of the Mississippi River delta, soft bottom fish assemblages are composed of searobins, seabasses, porgies, flatfishes, goatfishes, and snake eels. This particular horizon extends in a semi-continuous fashion to the west Texas shelf. In coastal waters from 20 m (66 ft) to the shoreline, sediments become fine and muddy, reflecting the massive discharges of Mobile Bay, the Mississippi River, and Atchafalaya River. This region, which is centered on the Mississippi River delta and often called the “fertile crescent,” supports a dense assemblage of catfishes, drums, cutlassfish, croakers, and seatrouts.

The primary water column fish assemblage found in coastal and shelf waters of the GOM is termed coastal pelagic. Major coastal pelagic fishes occurring in the GOM are sharks, rays, ladyfish, anchovies, herrings, mackerels, jacks, mullets, bluefish (*Pomatomus saltatrix*), and cobia (*Rachycentron canadum*). The distribution of most species depends upon water column structure in temperature, salinity, and dissolved oxygen, which vary spatially and seasonally. The species discussed thus far are inhabitants of the open shelf in water depths >10 m (33 ft).

Fishery resources within the Study Area are primarily managed by the Gulf of Mexico Fishery Management Council (GMFMC) in seven Fishery Management Plans (FMPs), which manage 182 fishery species. Migratory pelagic fish species are jointly managed by the GMFMC and South Atlantic Fishery Management Council (SAFMC). In addition to regional FMPs, the National Marine Fisheries Service (NMFS) manages 39 highly migratory species that occur in the GOM. The aforementioned species all occur in the GOM for at least a portion of their life cycles. Habitat Areas of Particular Concern (HAPCs) are located within the defined Study Area for all life stages as outlined by the management entities.

Environmental Consequences

Alternative A: Proposed Action

Sound sources associated with the proposed action generate noise that may elicit behavioral responses, mask sounds, or result in physical effects or mortality on fishes. The severity of these effects relates to sound levels and frequencies, distance from sound source, and species-specific hearing sensitivity. In general, fishes would be most susceptible to low-frequency sound sources, such as sub-bottom profilers. The use of electromechanical sources would be mostly from moving vessels, and individual surveys would be temporary and spatially limited. The potential for impacts as a result of sound emitted from the vibracore would be localized and short in duration. Seafloor disturbance from the placement of anchors and bottom sampling using grab samplers and/or cores would avoid sensitive hard bottom; therefore, associated fish resources will be avoided based on mitigations (Appendix B). Bottom disturbance in other areas (e.g., soft bottom) would make direct contact with the seafloor; the removal or decrease of benthic prey resources may temporarily displace bottom-feeding fishes from a small area. Fishes are expected to find available foraging grounds nearby. Pelagic and highly migratory species are transient and mobile, such that noise impacts would be temporary and avoidable. Since this group is not associated with the seafloor, bottom-disturbing activities would not create impacts.

Since seafloor disturbance by projected survey activities would be highly localized, temporary, and short-term, and noise stress would be mitigated, the impacts on demersal soft bottom fish resources and associated EFH are expected to be negligible to minor. The impacts on pelagic and highly migratory fish resources and associated EFH are expected to be negligible. In addition to the protected fish species that occur in both the Atlantic and GOM (Chapter 3.4.1), the Gulf sturgeon and Nassau grouper are also not expected to be affected by the proposed action due to the low spatial overlap.

Alternative B: Additional Operational Restrictions

Under this alternative, the same suite and level of survey activities would occur but with additional restrictions, which may require sequential surveys with multiple mobilizations to an area. While there could be additional vessel presence and noise as a result, bottom-disturbing activities are not expected to increase. Additional mobilizations would increase the potential impacts of vessel noise to fish resources and EFH under Alternative B relative to Alternative A; however, impacts from noise and bottom disturbance would still be considered minor.

Alternative C: No Action Alternative

Under the No Action Alternative, the proposed action would be limited; therefore, there would be fewer impacts on fish resources and EFH.

Benthic Habitat and Communities

The study area encompasses a number of habitats in OCS water less than 50 m (164 ft) along the five states bordering the Gulf Mexico. Across the GOM, the slope and shelf consists of fine, muddy, and sandy sediments that support high-diversity, low-density benthic communities (Rowe and Kennicutt 2001). Sediments in the eastern Gulf of Mexico consist primarily of sand, while sand, silt and clay dominate sediment in the central and western Gulf of Mexico (Brooks and Darnell 1991). Grain size is the most important substrate characteristic affecting the distribution of benthic fauna (Vittor 2000). While less common than ubiquitous soft-bottom environments in the GOM, hard bottom environments are scattered across the Gulf of Mexico, with low-relief hard and live bottom habitats concentrated in the central and eastern GOM. Hard bottom areas made of sedimentary rock are found in shallow waters

(18-40 m [60-130 ft]) along the inner and middle Mississippi-Alabama shelf. These hard bottom areas include many different habitat types, including reef-like structures, rubble fields, flat rocks, limestone ledges, rocky outcrops, and clustered reefs, among others (Schroeder 2000). Along the West Florida Shelf, which is composed of siliciclastic and carbonate sediments, diverse coral habitats are interspersed and support a variety of invertebrates and fishes (GMFMC 2016).

Ephemeral hard bottom exists in many areas due to seasonally shifting sands that periodically expose the underlying bedrock. Faunal cover is usually limited on these ephemeral hard bottom patches, but some species of sea whips and gorgonians can grow quickly enough and survive despite occasional partial burial (BOEM 2012, BOEM 2013a). The seven coral species protected under the ESA described in the Atlantic (Chapter 3.4.1) also occur in the Gulf of Mexico.

Environmental Consequences

Alternative A: Proposed Action

Implementation of the proposed action would result in short-term, negligible, direct and indirect impacts on soft bottom benthic resources, primarily through seafloor disturbance. Under the proposed action, seafloor disturbance would occur due to geologic sampling or anchoring. Direct mortality of benthic organisms could occur in areas of seafloor disturbance, such as during geologic sampling or anchoring. However, the disturbed areas would be limited to the size of the sampling gear or anchor and sampling would be spaced out so that impacts on benthic communities would be localized and limited. Effects on benthos from seafloor disturbance would be greatest among species with low mobility or those that are sessile, which include echinoderms.

The potential impacts on benthic communities from survey noise are thoroughly discussed in BOEM (2017). While some available data assessing physiological effects or biochemical responses of marine invertebrates to acoustic noise do not indicate serious pathological or physiological effects (LGL 2011), other species may experience impacts (Wale et al. 2013). Based on results of studies of invertebrate communities following acoustic exposure, only limited impacts on benthic organisms would be expected to be detectable, especially given the short duration of sound exposure, and no overall changes in species composition, community structure, and/or ecological functioning benthic communities are expected.

Sensitive areas like live bottoms (e.g., coral reefs, worm reefs, and artificial reefs) would be avoided to protect these resources and also because sand resources would not be present or extractable in these areas (Appendix B). Seafloor disturbance could result in very localized and short-term sediment resuspension, some of which could extend beyond the footprint of the bottom sampling, leading to short-term, indirect effects that could impact the benthic community due to the burial of adults/recruits (Miller et al. 2002) and/or the temporary prevention of effective suspension feeding (Rhoads and Young 1970).

No ESA-listed corals, unlisted corals, or other hard/live bottom communities are likely to be impacted because BOEM will separate bottom-disturbing activity from sensitive seafloor features. Potential impacts from sand surveys on soft bottom benthic communities under this alternative would not be detectable and therefore would be negligible.

Alternative B: Additional Operational Restrictions

Impacts on benthic resources from Alternative B would be similar to those described for Alternative A because there would be no time-area closures in the GOM. The number of geological samples anticipated

to occur under Alternative B would be the same as those for the proposed action and, therefore, the area of seafloor disturbance would be essentially the same.

Alternative C: No Action Alternative
Under the No Action Alternative, sand survey activities would be limited. Because there would be fewer seafloor-disturbing activities, there would be fewer impacts to benthic resources.

Sea Turtles
Five species of sea turtles (i.e., loggerhead, green, Kemp's ridley, hawksbill, and leatherback) occur at least seasonally in the northern GOM; all are listed as threatened or endangered under the ESA. Three types of critical habitat, all for loggerhead (Figure 3-1), are found in the northern GOM: breeding critical habitat in the GOM is restricted to the waters extending from the Florida Strait to the Dry Tortugas; nearshore reproductive critical habitat is located in the waters of Mississippi, Alabama, and Florida; and *Sargassum* critical habitat is located in the oceanic waters of the Study Area.

Environmental Consequences
Alternative A: Proposed Action
Sea turtles are thought to detect low-frequency sound, with an expected hearing range with a peak sensitivity of 200-700 Hz. However, the potential effects of sound exposure on sea turtle biology and behavior remain largely unknown (Samuel et al. 2005). Without the implementation of monitoring and mitigation measures, active acoustic sound sources could have a range of effects on sea turtles, including physical injury, hearing threshold shift, auditory masking, and behavioral responses.

The exposure of sea turtles to sound from the sand surveys would largely be avoided with the proposed mitigations implemented. Some hearing sensitivity at lower received levels, though, may result in temporary and localized exposure and is based on the audibility of the source to sea turtles (which is a function of both hearing ability and distance between the source and the turtle(s)), in addition to the duration of the surveys. Any behavioral response, potentially including avoidance, changes in dive patterns or course, or changes in foraging behavior, would be very brief and limited to the area of ensonification (or area that fills with sound). There is not expected to be any increase in energy expenditure that has any detectable effect on the physiology of any individuals or any future effect on growth, reproduction, or general health. Sound generated from the sand survey activities will primarily take place at least 3 mi (5 km) offshore and would therefore have negligible impacts on nesting or nearshore foraging sea turtles. Vessel and equipment noise from the proposed action would contribute incrementally to overall ambient noise levels within the Study Area. Proposed mitigations (Appendix B), visual monitoring coupled with restrictions on noise and speed, would be expected to decrease these risks to a negligible impact on sea turtles. As described in Chapter 3.4.1, the proposed activities may affect, but are not likely to adversely affect, sea turtles.

Alternative B: Additional Operational Restrictions
Similar impacts on sea turtles as discussed for Alternative A would be expected. Under Alternative B, the same suite and level of sand survey activities would occur with mitigations, but additional mitigation requirements and restrictions on sand survey operations may lead to additional marine noise exposure and a greater chance for vessel collisions because of the increased number of vessel trips to occur than outlined in Alternative A. Impacts, however, are still expected to be negligible.

Alternative C: No Action Alternative
Under the No Action Alternative, the proposed action would be limited, and there would be fewer potential impacts to sea turtles.

Marine and Coastal Birds
The GOM supports diverse avifauna and includes members from three taxonomic orders: Charadriiformes (gulls and terns); Pelicaniformes (pelicans, frigatebirds, gannets, boobies, tropicbirds, and cormorants); and Procellariiformes (petrels, storm petrels, and shearwaters). Certain waterfowl taxa commonly termed sea ducks (Order Anseriformes) feed and rest within coastal (nearshore and inshore) waters outside of their breeding seasons. Members of the order Gaviiformes (loons) may also be present in coastal waters. Of the two threatened and endangered species of marine and coastal birds within the Study Area, piping plover and roseate tern, the roseate terns are the only species that forage offshore and feed by plunge-diving, often submerging completely when diving for fish.

Environmental Consequences

Alternative A: The Proposed Action
Marine and coastal birds would be most susceptible to impacts from the use of the proposed survey equipment when seabirds and waterfowl dive below the water surface and would be exposed to underwater noise (Turnpenny and Nedwell 1994). The noise generated by individual vessels, engine noise, propeller cavitation, and proposed geophysical survey equipment (e.g., sub-bottom profilers) would fall within the airborne hearing range of birds, whereas noise generated by other types of survey equipment would be outside of their airborne hearing range and is likely to be inaudible to birds underwater. Impacts would be minimized as the level of vessel activity per survey event is not expected to substantially increase the background vessel noise. The vessels move at slow speeds, minimizing source levels, and noise levels dissipate quickly with distance from the vessel. Based on these measures and the lower-frequency equipment used for sand surveys, it is expected that there would be no mortality or life-threatening injury and limited disruption of behavioral patterns or other effects on diving seabirds or waterfowl, resulting in a negligible impact. As was concluded for the Atlantic, ESA-listed birds would not be affected by the proposed action.

Alternative B: Additional Operational Restrictions
If multiple mobilizations to the same area are required under this alternative, it is possible that increased impacts on avian resources could occur from increased disturbance but it would otherwise be similar to impacts from Alternative A.

Alternative C: No Action Alternative
Under the no action alternative, the proposed action would be limited and there would be fewer vessels and less noise causing disturbances to avian resources, resulting in fewer impacts.

Sociocultural Resources

Historic/Pre-Contact Resources
Submerged cultural resources within the Study Area include shipwrecks dating from the 16th and 17th centuries during European exploration and settlement of North America to those associated with World War II and the Cold War. Submerged pre-contact period sites and landforms with the potential to contain these sites, dating between 14,550 and 7,500 B.P. (the beginning of the Paleoindian through the end of the

Early Archaic culture periods), may also be present within the Study Area, depending on regional landform and sea-level rise variation (Halligan et al. 2016).

Based on the current understanding of sea level rise and the earliest date of human occupation, any existing pre-contact period sites on the OCS would be located in the nearshore zone (< 60 m [197 ft] water depth). Additionally, pre-contact period sites would be most likely found in the vicinity of paleo-channels or river terraces that offer the highest potential of site preservation; however, preservation conditions are variable and depend on local geomorphological conditions and the speed of sea-level rise. Current research also indicates that historic period shipwrecks and aircraft could be located within any portion of the Study Area.

Environmental Consequences

Alternative A: Proposed Action

Because of the rich maritime history and potential for submerged pre-contact resources in the Study Area, all activities that disturb the seafloor have the potential to impact previously unrecorded cultural resources. Potential impacts on cultural resources resulting from sand survey activities would likely be associated with geological sampling and anchoring. Bottom sampling, coring activities, anchor placement, and anchor dragging across the seafloor have the potential to damage archaeological resources. Areas identified during geophysical surveys as having archaeological resources would be assigned an avoidance buffer zone for all activities. Adherence to mitigation measures, as outlined in Appendix B, ensures that historic and pre-contact period submerged cultural resources would not be impacted.

Alternative B: Additional Operational Restrictions

Impacts would be similar to those discussed under Alternative A. Due to the potential for multiple surveys occurring in one location, there could be a slight increase in the possibility of anchoring or other seafloor-disturbing activities that could impact submerged cultural resources. As stated above, however, adherence to mitigation measures ensures that submerged cultural resources would not be impacted.

Alternative C: No Action Alternative

Under the No Action Alternative, limited sand survey activities would be conducted. It is anticipated that any surveys would adhere to similar avoidance mitigations proposed for Alternatives A and B such that impacts to historic or pre-contact period cultural resources would not occur.

Recreational and Commercial Fishing

The Study Area supports regionally and nationally important commercial and recreational fisheries. Commercial fisheries support not only numerous directly related jobs (fishing crews) but also many indirectly related industries, such as seafood distributors, restaurants, and suppliers of commercial fishing gear. Because the fishing industry is so integrated with local business, these commercial fishing ports often support entire coastal fishing communities.

Environmental Consequences

Alternative A: Proposed Action

Potential multiple-use effects on recreational and commercial fishing include short-term displacement of fishing activities and potential damage to fishing equipment. Any physical disturbance in the ocean or on the ocean floor, such as deployment of the vibracore rig, use of a towed system, or anchoring could inadvertently damage submerged fishing equipment and gear. Areas in which commercial and

recreational fishermen would be temporarily excluded are relatively small in relation to the overall fishing grounds, and required changes to navigation necessary to reach fishing areas are expected to be minimal. BOEM would require survey vessels to report Automatic Information System (AIS) location data real-time, be flagged and use USCG lighting schemes during survey activities, communicate with observed fishing vessels, and avoid fishing gear by a minimum distance. Any effect on fishing would be further minimized to negligible levels with advance public notification through the use of Notices to Mariners and other mitigations (Appendix B).

Alternative B: Additional Operational Restrictions
Alternative B could increase vessel traffic for sequential surveys, which could add a temporary exclusion of fishermen from fishing grounds. However, these impacts would be short-term and negligible.

Alternative C: No Action Alternative
Under the No Action Alternative, the proposed action would be limited. There would be fewer impacts on recreational and commercial fishing.

Multiple-Use Conflicts
Other uses of the Study Area, as identified by the Multipurpose Marine Cadastre (2018 include shipping and marine traffic, commercial traffic from seven deepwater commercial ports, military warning areas, sand and gravel mining, renewable energy development, ocean dredged material disposal, and oil and gas exploration and production. Most of the Study Area is within a military warning area that allows military forces to conduct training and testing activities. Military activities can include various air-to-air, air to-surface, and surface-to-surface Naval fleet training, submarine and antisubmarine training, and Air Force exercises. There are also 26 sites that contain unexploded ordnances, submerged explosives, depth charges, torpedoes, or other obstructions; or that are identified as discontinued dump sites for explosives or other wastes. These hazard areas are distributed across the GOM Study Area, cumulatively covering 8,943 km^2 (3,453 mi^2) of seafloor. Lastly, an extensive network of wells and pipelines in the GOM support oil and gas exploration and development by carrying oil and gas from offshore to refineries and terminals onshore.

Environmental Consequences

Alternative A: Proposed Action
Impacts on other activities in the GOM could occur as a result of the incremental increase in vessel traffic from sand survey vessels, but the effect is expected to be minor and short-term given the limited footprint and duration of the survey activity. The few comparatively small and highly maneuverable survey vessels that would be used during sand survey activities would not measurably increase vessel traffic density or hinder other uses of the OCS. Prior to geological surveys, reconnaissance and coordination would be undertaken in areas known to contain oil and gas infrastructure, including pipelines, to reduce the likelihood of encounter during surveys.

Alternative B: Additional Operational Restrictions
Under Alternative B, sequential, additional mobilizations and vessel traffic may be needed, which may increase impacts on marine transportation and potentially other uses of the OCS relative to impacts discussed in Alternative A. However, impacts are expected to be short-term and negligible.

Alternative C: No Action Alternative
Under Alternative C, the proposed action would be limited; therefore, fewer impacts on other uses of the OCS would be anticipated.

3.5 CUMULATIVE EFFECTS

Cumulative effects as applied in NEPA are an incremental environmental impact of the proposed action relative to other reasonably foreseeable actions (40 CFR § 1508.7); these impacts may result from the accumulation or synergism of effects. The past, present, and reasonably foreseeable future actions that could contribute to cumulative effects in the spatial footprint of the proposed action include those listed below.

- *Oil and Gas*: The GOM has a well-developed industry, while the Atlantic has no current oil and gas activity. Areas of the Atlantic and GOM have been proposed for exploration and development under the 2019-2024 Draft Proposed Program (BOEM 2018).
- *Renewable Energy*: The first commercial wind turbines have been constructed in Rhode Island state waters, and it is possible that further development could occur in Federal waters, particularly those in the Atlantic.
- *Marine Minerals*: Sand dredging for beach nourishment has generally occurred at depths of 10-30 m (33-98 ft) from New Jersey to Florida and Mississippi to Louisiana, and is expected to continue, with possible increases. Sand surveys similar to those proposed here may occur by states, localities, or the Federal agencies such as the U.S. Army Corps of Engineers.
- *Marine Transportation*: Increases in activities, like shipping, are expected to occur.
- *Commercial and Recreational Fishing*: Despite seasonal and regional variation, activities are expected to continue at the same rate since no major changes are anticipated.
- *Military and Space Program*: Current levels of activity in military range complexes and at Federal space facilities are expected to continue at the same rate.
- *Dredged Material Disposal*: Sites used to dispose of material dredged during the maintenance of harbors or ports are expected to continue to be used at the current level.
- *New Cable Infrastructure*: Additional cables could be added to the OCS as the demand increases.

Climate change may result in environmental impacts over the next century, including altered migratory routes and timing for marine mammals and migratory birds; changes in shoreline configuration that could adversely affect sea turtle, shorebird, and seabird nesting beaches that could require increased levels of beach restoration activity and increased use of OCS sand resources; changes in estuaries and coastal habitats due to interactive effects of climate change, development, and pollution; and impacts on calcification in plankton, corals, shellfish, and other marine organisms due to ocean acidification.

Various activities and processes, both natural and anthropogenic, combine to form the sound profile within the ocean, generally referred to as ambient (background) ocean noise (Richardson et al. 1995; Hildebrand 2009). Noise-related impacts associated with the cumulative activities scenario are expected to range from negligible to moderate in the Study Area. Localized, short-term, minor noise impacts might

be realized in association with specific military activities (e.g., sonars), sand dredging, commercial trawling and dredging, air gun surveys, and shipping traffic; however, applicable mitigation measures (e.g., observation and clearance of safety zones) should minimize noise impacts from these acoustic sources to the extent possible. In this context, active acoustic noise sources and vessel and equipment noise from the proposed action would contribute to overall ambient noise levels within the Study Area, and the application of mitigation measures is expected to maintain acoustic exposure to negligible to minor levels for sensitive marine mammals and sea turtles.

In addition to climate change and noise, vessel traffic, discharges, and seafloor disturbance may also result in cumulative effects with the proposed action. Vessel traffic, including shipping, fishing, and dredging, concentrates around ports located on the Atlantic and GOM. While the proposed action would add to traffic, it would be a negligible incremental impact relative to all marine vessel traffic in a given area. Survey vessels generally operate at slower speeds than most other vessels, which would be expected to reduce impacts. Though small, an increase in vessels leads to an increase risk of collision and fuel spill. If a spill occurred in an area with a sensitive habitat or species (e.g., corals), however, there could be minor impacts depending on other physical and environmental factors. Though vessel discharges, trash, and debris may be released into offshore waters, regulations and mitigations are expected to minimize impacts to a negligible level. Seafloor habitat and resources (especially archaeological) may be impacted by disruptions like anchors, dredging, and storms. BOEM's proposed seafloor-disturbing activities would not occur in sensitive habitats or archaeological sites because typically geophysical surveys are conducted initially with geological samples then selected to avoid impacts to cultural resources. Moreover, BOEM would require strict clearance and avoidance requirements to ensure that sensitive bottom habitats and cultural resources are not otherwise affected. The incremental impact of the proposed action on seafloor resources in context of the cumulative activities scenario would be negligible.

4 Consultation and Coordination

BOEM notified potentially interested parties of the availability of this EA using a contact list that BOEM maintains for similar projects in the Atlantic and Gulf of Mexico regions. Coordination and correspondence for all environmental compliance is compiled in Appendix D.

The **Coastal Zone Management Act** (CZMA; 16 U.S.C. §§ 1451 *et seq*.) was enacted to protect the coastal environment from increasing demands associated with commercial, industrial, recreational, and residential uses, including Federal and State development. If an activity would have direct, indirect, or cumulative effects, the activity is subject to Federal consistency. Federal agency activities must be "consistent to the maximum extent practicable" with relevant enforceable policies of a State's federally approved coastal management programs (15 CFR part 930 subpart C). In accordance with these requirements, BOEM is preparing Consistency Determinations for 18 affected states describing potential impacts on their coastal zones from implementing the proposed action.

BOEM initiated an informal consultation with NMFS and the U.S. Fish and Wildlife Service pursuant to Section 7 of the **Endangered Species Act** (ESA) and implementing regulations (50 CFR part 402). BOEM determined that the proposed action is not likely to adversely affect or will have no effect on listed

species and their critical habitats. This EA and associated mitigation suite will be used to support informal Section 7 consultations in lieu of preparing a separate Biological Assessment.

BOEM determined that the proposed action may affect EFH, which is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" under Section 305 of the **Magnuson-Stevens Fishery Conservation and Management Act** (MSFCMA). BOEM has initiated consultation with NMFS regarding potential effects on EFH in accordance with 50 CFR part 600, using this EA, along with the EFH Assessment in Appendix C, to facilitate the consultation.

In accordance with the **National Historic Preservation Act** (NHPA; 16 U.S.C. § 470), Federal agencies are required to consider the effect of their undertakings on historic properties. BOEM, pursuant to 36 CFR § 800.4(g), prepared a Finding of No Historic Properties Affected document (Appendix E). The Finding explains the undertaking in more detail with regard to historic properties and provides BOEM's rationale for choosing the area of potential affect, the archaeological identification efforts that will be conducted prior to any bottom disturbance, and the mitigation measures that will be in place to ensure that historic properties are not affected during bottom-disturbing activities. Letters and a copy of the Finding will be sent to the Advisory Council on Historic Properties, State Historic Preservation Officers, and Federally or State-recognized Tribes, requesting comments and concurrence with the determination. To satisfy the public participation requirement of the Section 106 process (36 CFR § 800.2(d)(2)), BOEM will post the Finding to its website and a notice in the *Federal Register*.

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7 Appendices

A – DESCRIPTION OF EQUIPMENT

B –SURVEY REQUIREMENTS AND MITIGATION MEASURES

C – ESSENTIAL FISH HABITAT ASSESSMENT

The Department of the Interior Mission

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The Bureau of Ocean Energy Management Mission

The Bureau of Ocean Energy Management (BOEM) is responsible for managing development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.