FINAL

Munitions and Explosives of Concern (MEC) Desktop Study

BOEM Lease OCS-A 0486

Prepared For:
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Acronyms and Abbreviations

AMTB	Anti-Motor Torpedo Boat
AP	Armor Piercing
BOEM	Bureau of Ocean Energy Management
Deepwater Wind	Deepwater Wind New England, LLC
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DTS	Desktop Study
DMM	Discarded Military Munitions
EM	Engineering Manual
EOD	Explosive Ordnance Disposal
EP	Engineering Pamphlet
FC	Fire Control
FFAR	forward firing aircraft rocket
FUDS	Formerly Used Defense Sites
Fugro	Fugro Marine GeoServices, Inc
GIS	Geographic Information System
Hana	Hana Engineers and Consultants, LLC
HE	High Explosive
HRR	Historical Records Review
HVAR	high velocity aircraft rocket
MA	Massachusetts
MC	Munitions Constituents
MEC	Munitions and Explosives of Concern
MLLW	Mean lower low water
MMRP	Military Munitions Response Program
MPPEH	Material Presenting Potential Explosive Hazard
MSP	Munitions Survey Plan
NOAA	National Oceanic and Atmospheric Administration
NY	New York
OCS	Outer Continental Shelf
RA	Remedial Action
RI	Rhode Island
ROV	Remotely operated vehicle

SCAR	sub-caliber aircraft rocket
SFWF	South Fork Wind Farm
U.S.	United States
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDOI	United States Department of Interior
UXO	Unexploded Ordnance
VRH	VRHabilis, LLC
WEA	Wind Energy Area

1.0 **Introduction**

On behalf of Deepwater Wind New England, LLC (Deepwater Wind), Fugro Marine GeoServices, Inc (Fugro) with assistance from subconsultants Hana Engineers and Consultants, LLC (Hana) and VRHabilis, LLC (VRH), have prepared this Munitions and Explosives of Concern (MEC) Desktop Study (DTS) for the United States Department of Interior's (USDOI) Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Number Outer Continental Shelf (OCS)-A 0486. The lease is located within the Rhode-Island Massachusetts (RI-MA) Wind Energy Area (WEA).

In July 2017, BOEM published a report titled "Munitions and Explosives of Concern Survey Methodology and In-field Testing for Wind Energy Areas on the Atlantic Outer Continental Shelf" (BOEM, 2017). In the report BOEM states the areas of the seabed that will be disturbed during installation of renewable energy facilities should be cleared of MEC prior to construction to the extent necessary for human safety and environmental protection.

1.1. Study Area

In September 2013, the BOEM and Deepwater Wind executed two commercial leases on the outer continental shelf in federal waters off the coast of Rhode Island and Massachusetts within the area designated by BOEM as the RI-MA WEA. The South Fork Wind Farm (SFWF) is located in the southwest portion of the Lease Area (Lease Number OCS-A 0486) (**Figure 1**). The SFWF is a proposed offshore wind energy project interconnecting with the Long Island Power Authority transmission system in Long Island, New York (NY). The SFWF is planned to include up to 15 wind turbine generators and a collection system including an offshore substation and inter-array cables. Water depths in the SFWF range from approximately 100 - 125 feet (31 - 38 meters), referenced to mean lower low water (MLLW). The South Fork Export Cable (SFEC) will connect the SFWF to the mainland electric grid in Long Island.

There are two alternative routes for the SFEC. The northern route alternative extends westward through federal waters from the SFWF, passes south of Block Island and crosses into New York state waters northeast of Montauk Point, Long Island and is approximately 54 miles (87 kilometers) long. The southern route alternative will follow a similar route but will cross into New York state waters southeast of Montauk Point, Long Island and will be approximately 59 miles (95 kilometers) long (**Figure 1**). The range of water depths along the SFEC routes is approximately 49 - 171 feet (15 - 52 meters) (MLLW). The target inter-array and export cable burial depth within the seafloor is 4 - 6 ft (1.2 - 1.8 m).

The MEC DTS focuses on the 12,036-acre (49 square kilometers) SFWF Work Area, the 83,976-acre (340 square kilometers) North Lease Reconnaissance Survey Area, the SFEC alternative route corridors, and adjacent waters (**Figure 2**). This area will be referred to in this report as the MEC Study Area. This area in total encompasses

2,416,349 acres (9,778 square kilometers). For the purpose of this DTS, a 1-mile (1,609-meter) buffer was depicted around the SFEC routes and OCS-A 0486 Lease Area and a 5-mile (8,047-meter) buffer was depicted around the MEC Study Area, to ensure all military use areas with potential MEC risks were evaluated. The area of the SFWF Work Area, the North Lease Reconnaissance Survey Area, and the SFEC alternative route corridors is referred to as the Project Area.

1.2. Purpose and Scope

The purpose of the MEC DTS is to identify areas where military activities using munitions may have impacted the environment by identifying historical and current munitions sources and estimating the potential distribution of MEC that could present an explosive hazard in the Study Area. The DTS includes a Historical Records Review (HRR) and a MEC Risk Assessment. A summary of the key steps in the MEC DTS process is provided in Appendix G of the *Geophysical and Geotechnical Survey Plan* (Fugro, 2017).

The main objectives of the HRR include:

- Determining previous and current uses of the Study Area.
- Determining the types of munitions-related activities that occurred in the Study Area, if any.
- Determining the configuration, types, general locations, and approximate quantities of MEC potentially present at the Study Area.
- Identifying likely locations of military munitions-related activities (such as former ranges or target areas, demilitarization points, storage or transfer sites).
- Establishing the approximate dates that munitions-related activities occurred.

The main objectives of the MEC Risk Assessment include:

- Evaluating the potential locations of MEC based on the HRR findings and likely transport and migration pathways.
- Assessing the explosive hazards for the types and quantities of MEC potentially present.
- Determining probability of exposure to MEC during installation of the SFWF and SFEC.
- Determining the probability of detonation of MEC during the installation of the SFWF and SFEC.
- Assessing the potential impact or damage from a detonation.

The DTS includes the following sections:

- Section 1 – introduces the MEC Study Area, defines the purpose and scope of the MEC DTS, outlines the contents of the remainder of the report, and provides a general overview of the different types of MEC to be evaluated in the DTS.
- Section 2 – outlines the methodology of the research for the MEC DTS.

- Section 3 - outlines the historical and current military operations in the Study Area and provides a summary of ordnance hazards in the Study Area.
- Section 4 – provides a risk assessment based on potential ordnance hazards.
- Section 5 – provides recommendations; and
- Section 6 – provides references used in the MEC DTS.

1.3. Munitions Terminology

Munitions and explosives of concern include several sub-categories of potential hazards. The following provides an overview of the different types of MEC that will be evaluated in the study:

- Unexploded Ordnance (UXO) - Military munitions that have been primed, fused, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installation, properties, personnel, or material and remain unexploded either by malfunction, design, or any other cause (10 U.S.C. 101(e)(5)(A) through (C)), (Engineering Pamphlet [EP] 75-1-2), (Engineering Manual [EM] 385-1-95).
- Discarded Military Munitions (DMM) – Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental laws and regulations. (10 U.S.C. 2710(e)(2)) (EM 385-1-95).
- Material Presenting Potential Explosive Hazard (MPPEH) - Material owned or controlled by the Department of Defense that, prior to determination of its explosives safety status, potentially contains explosives or munitions (e.g., munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris) or potentially contains a high enough concentration of explosives that the material presents an explosive hazard (e.g., equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization, or disposal operations).
- Munitions Constituents (MC) - Any materials originating from UXO, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. (10 U.S.C. 2710(e)(3)). (EP 75-1-2) (EM 385-1-95).
- MEC – Includes UXO, DMM, MC, and MPPEH, present in high enough concentrations to pose an explosive hazard.

It should be noted that MPPEH is the primary concern of this DTS, as it represents the specific category of MEC that indicates a potential explosive hazard.

1.4. Limitations

The information provided in this DTS is based on data obtained from readily available public sources compiled by others. Historical information regarding past military activities can be of uncertain accuracy especially when it relates to training and disposal practices. The estimates of the quantities, locations and types of MEC described in reference documents should not be considered comprehensive but provide value as they represent documented findings. It is important to note that the items of interest in this DTS are hidden from plain view as they are underwater and in a dynamic environment further complicating the ability to accurately estimate location, quantity and density. The information contained herein should only be used with an understanding of the limitations of the study. Likewise, military ordnance is designed to release extreme amounts of energy as well as fragmentation creating devastating, catastrophic and lethal damage to people and equipment. Even a small signal charge cartridge from a practice bomb functioned in the proximity of personnel can have crippling and lethal affects. Therefore, MEC including UXO should never be considered safe for any encounter scenario. Military qualified Explosive Ordnance Disposal (EOD) Technicians should be a component of construction activity when risk assessment identifies a medium potential for encountering MEC or greater. Prudent construction plans must consider MEC avoidance as paramount to safety including the unlikely event that MEC becomes lodged in subsurface equipment that is later transported to the surface/deck creating a high hazard situation.

Filename: C:\Users\Christina Anderson\Documents\HANA\GIS\RI-MA Offshore Wind Farm\MXDs\DRAFT MEC DTS\Figure 1 Site Map.mxd

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Proposed Survey Areas

- OCS-A 0486 Lease Area
- SFWF Work Area
- North Lease Reconnaissance Survey Area
- South Fork Export Cable OCS (SFEC OCS)
- South Fork Export Cable NYS (SFEC NYS)
- 3 Nautical Mile State Limit

Northern Route Alternative

Southern Route Alternative

N

0 5 10 20 Miles

Site Map
Project No: 64529
Date: May 2018

MEC DESKTOP STUDY
BOEM LEASE OCS-A 0486

HANA ENGINEERS & CONSULTANTS, LLC

Figure: 1

Filename: C:\Users\Christina Anderson\Documents\HANA\GIS\RI-MA Offshore Wind Farm\MXDs\DRAFT MEC DTS\Figure 2 MEC Study Area.mxd

Legend

Proposed Survey Areas

- OCS-A 0486 Lease Area
- SFWF Work Area
- North Lease Reconnaissance Survey Area
- South Fork Export Cable OCS (SFEC OCS)
- South Fork Export Cable NYS (SFEC NYS)
- Project Area 1-Mile Buffer
- MEC Study Area 5-Mile Buffer
- MEC Study Area

Northern Route Alternative

Southern Route Alternative

0 5 10 20 Miles

MEC Study Area
Project No: 64529
Date: May 2018

MEC DESKTOP STUDY
BOEM LEASE OCS-A 0486

HANA ENGINEERS & CONSULTANTS, LLC

Figure: 2

2.0 **Methodology**

The MEC DTS considered both regional and, where the information is available, site specific historical factors with respect to the presence of and associated risk from MEC potentially located in the Study Area. Historical research focused on the following:

- Military history of the MEC Study Area
- Official and unofficial munitions dumping sites
- Military ranges and training areas
- Potential migration of submerged munitions in dumping/disposal areas
- Evidence of aerial or naval surface and subsurface warfare

A detailed review of the history of the site was completed by gathering historical and current information from publicly available sources including local and national archives, libraries and local authority offices. Principal sources include:

- United States Army Corps of Engineers (USACE), New England District
- USACE Formerly Used Defense Sites (FUDS) Inventory
- Historical and current aerial photography
- Previous MEC Response Actions
- Previous reports including but not limited to:
    - Archives Search Reports
    - Preliminary Assessments / Site Inspections
    - Remedial Investigations / Feasibility Studies
    - Engineering Evaluations/Cost Analysis
    - Ordnance and Explosives Engineering Removal Actions RAs
- Nautical Charts
- National Oceanic and Atmospheric Administration (NOAA) Office of Coast Survey Wrecks and Obstructions Database
- Personal Interviews

The extent of information presented within this study does not represent the full volume of research conducted or all documentation obtained as the intent of the DTS is to serve as a valid risk assessment and not a detailed historical record. Nevertheless, the data presented is appropriate for risk assessment purposes. Methodology for the Risk Assessment is discussed in **Section 4**. Reference documents can be found in **Appendix A**.

3.0 Historical Records Review

This HRR focuses on the military history of the MEC Study Area including discussing the types of munitions-related activities known to occur in the Study Area as well as the configuration, types, and general location of MEC potentially present. The HRR also identifies areas of recorded UXO and dumping grounds. The hazards associated with the MEC potentially present are discussed in Section 4.

3.1. Military History Overview

Numerous former military use areas are located off the Atlantic Coast within the MEC Study Area. The area within the MEC Study Area was used for seacoast defense from the time of the United States independence up until World War II. In the late 1700s, these seacoast fortifications were relatively small and often only included one canon in the center of the fort. During the early 1800's forts were modified to include multi-tiered forts with covered casemates to allow for additional weapons as well as additional protection. Following the War of 1812, the forts were built to accommodate larger caliber artillery through the addition of batteries (gun emplacements). The three main coastal defenses in this area during this time and up until WWII were the Harbor Defense of Long Island Sound, the Harbor Defense of New Bedford, and the Harbor Defense of Narragansett Bay. The area was a key choke point for German U-boats attempting to conduct raids on submarine and Naval bases from Groton, CT to Maine. After the 1940s it was determined that these fixed fortifications were obsolete against aircraft and missiles and many were decommissioned.

In addition to land-based firing ranges, ordnance was airdropped, fired from ships and submarines, and jettisoned from ships. There are a large amount of shipwrecks in this relatively small geographic area, some of which contain munitions loads. For example, the *Port Hunter* was an ammunition ship which sunk in Nantucket Sound in November 1918. It is believed that the ship's cargo included 3 million rounds of ammunitions and phosphorus bombs (MA, 2017). Aircraft crashes with unknown bomb loads also occurred in the MEC Study Area.

In addition to former military use areas in the MEC Study Area there are also current military use areas. These military use areas are required by the United States (U.S.) Air Force, Navy, Marine Corps, and Special Operations Forces to conduct various testing and training missions (USDOI, 2007). The USACE has established surface danger zones and restricted areas in many areas adjacent to U.S. coastlines. A danger zone is the defined water area used for gunnery, bombing, rocket firing, or other especially hazardous military activities. The danger zones may be closed to the public on a fulltime or intermittent basis. A restricted area is a defined water area for the purpose of prohibiting or limiting public access. Restricted areas generally provide security for Government property and/or protection to the public from the risks of damage or injury arising from the Government's use of that area. There are also military training routes, military operating

areas, restricted airspace, and military and civilian radar systems along the Atlantic Coast (USDOI, 2007).

3.2. Military Training Areas

Historical military sites located within the MEC Study Area were primarily identified using the USACE FUDS Geographic Information System (GIS) Inventory (USACE, 2017). The inventory only includes properties in which the USACE is actively working or will take necessary cleanup actions to address Department of Defense (DoD) generated contamination. These are the sites of interest for the MEC DTS as they are ones in which potential MEC were used/stored. The sites are divided out by those within a 1-mile (1,609-meter) buffer of the Project Area, those within the MEC Study Area and those outside the MEC Study Area but within a 5-mile (8,047-meter) buffer. In many cases, the sites include their respective danger zone. The military sites and their respective danger zones within a 1-mile (1,609-meter) buffer of the Project Area were considered the highest priority in the DTS. The subsections below give additional detail on the munitions used at each of the military sites within a 1-mile (1,609-meter) buffer of the Project Area.

There are also several current military use areas located within the MEC Study Area. These include three U.S. Coast Guard (USCG) stations and the U.S. Navy's restricted torpedo area. The U.S. Navy's restricted torpedo area is a 2-Nautical Mile (NM) (3.704-kilometers) wide strip that begins within the northern limits of the Narragansett Bay Approach and extends south for more than 11.5 NM (21.30 kilometers). This area is closed to vessel traffic during periods of daylight and optimum weather conditions for torpedo range use by the Naval Undersea Warfare Center.

A brief description of the military sites is included in **Table 1** while **Table 2** details the potential munitions used or stored at the sites. The location of these sites with respect to the Project Area is shown on **Figure 3**.

3.2.1 Camp Hero

The former Camp Hero is located in Block Island Sound in Montauk Point, New York. From 1942 to 1947, Camp Hero served as a Coastal Defense Installation to defend the approaches to New York. The camp included three batteries (Batteries 112, 113, and 216). A total of 600 enlisted men and 37 officers were stationed at the camp. Batteries 112 and 113 consisted of two Navy MKIIM1 16-inch casemated guns. Battery 216 contained two M1903A2 6-inch shielded guns. Batteries 112 and 113 had a battle allowance of 200 16-inch 2,240-lb projectiles and war reserve allowance of 300 16-inch 2,240-lb projectiles. Batteries 215 had a battle allowance of 200 6-inch 90-lb high explosive (HE) rounds and 300 6-inch 105-lb armor piercing (AP) rounds and war reserve allowance of 300 6-inch 90-lb HE rounds and 400 6-inch 105-lb AP rounds. The camp's weaponry was periodically fired to practice over water, but was never fired as a result of an act of hostility.

From 1951 - 1957, Camp Hero was designated as a firing range and field exercise area for anti-aircraft artillery (AAA). Training included 90mm and 120mm guns, 3.5-inch rockets, and .40 caliber guns. The AA guns were by numerous AAA Battalions for training.

The off-shore ordnance area, as identified in the Camp Hero ASR, consists of approximately 756,491.75 acres (3,061 square kilometers) of Atlantic Ocean, which was used as a practice firing area for 90mm, 120mm, 6-inch and 16-inch projectiles, quad .50 caliber machine-guns, and 3.5-inch rockets. The firing fans for the 6-inch and 16-inch guns as well as the 90mm and 120mm guns are shown on **Figure 4**. These danger zones overlap the southern route alternative for the SFEC.

3.2.2 Cartwright Island Bombing Range

The former Cartwright Island Bombing Range is located just south of Gardiner's Island near the town of East Hampton, New York. The U.S. Navy used the island for bombing practice between 1940 and 1946. According to historical documents, 13-lb Mk 19 Mod 1 practice bombs; AN-Mk 5, AN-Mk 23, and AN-Mk 43 practice bombs; Mk4 or Mk 5 signals; 25 lbs or 100 lbs Mk I practice bombs; M1A1 spotting charges; and T29 smoke streamer bombs were used at the bombing range.

While in operation, the range included a total of 649 acres (2.63 square kilometers) of which approximately 591 acres (2.39 square kilometers) is tidal water. Currently, the range is almost completely submerged underwater even during low tide. The bombing range overlaps the northern route alternative for the SFEC. The danger zone for the bombing range is shown on **Figure 4**.

3.2.3 Fort H.G. Wright

The former Fort H.G. Wright is located on the southern and eastern portion of Fishers Island, situated in Long Island Sound, New York. The fort was used as a coastal defense fortification and training facility from 1900 through 1949. The fort included 12 gun emplacements, small arms ranges, various buildings used for military administration and housing, and a small airfield. The 12 gun emplacements include: AA Battery, Battery Butterfield, Battery Clinton, Dynamite Battery, Battery Hamilton, Battery Barlow, Battery Marcy, Battery 215, Battery Dutton, Battery Hoffman, Battery Hoppock, anti-motor torpedo boat (AMTB) 913, and the Small Arms Range.

The off-shore ordnance area consists of approximately 197,993 acres (801 square kilometers) of tidal waters in the Long Island Sound. It is known from historical records that this area was used for training and target practice by all guns at the fort. The firing fan for Battery 215 (188,859 acres) overlaps the northern route alternative for the SFEC. The firing fan for the Battery 215 is shown on **Figure 5**. Battery 215 consisted on two 6-inch gun (Mk 36) and was operational from 1943 to 1946. No information is known on the usage of this battery.

3.2.4 Fort Mansfield

The former Fort Mansfield is located on Napatree Point near Watch Hill in Westerly, Rhode Island. The fort served as part of the Harbor Defense System of Long Island Sound from 1898 to 1919. During this period, the fort contained three batteries (Wooster, Connell, and Crawford) which housed 5-inch and 8-inch guns. During World War II, a bombing target was constructed, and a portion of the fort was used as a practice bombing area. No information is known on the usage of the bombing range.

The off-shore ordnance area consists of 34,979.6 acres (142 square kilometers) in the Block Island Sound. The firing ran for the three batteries overlaps the northern route alternative for the SFEC. The firing fan for Fort Mansfield is shown on **Figure 4**. No information is known on the usage of this battery.

3.2.5 Fort Michie

The former Fort Michie is located on Great Gull Island in Long Island Sound, New York. The fort served as part of the Harbor Defense System of Long Island Sound from 1898 to 1949. Throughout its operation, the fort included seven batteries (Palmer, North, Benjamin, Maitland, Pasco, Davis, and 912). Batteries Palmer and North were constructed circa 1900. Battery Palmer consisted on two 12-inch breach loading rifles and Battery North consisted of two 10-inch breach loading rifles. Circa 1908, Batteries Benjamin, Maitland, and Pasco were constructed. Batteries Benjamin and Maitland consisted of two 6-inch guns each and Battery Pasco contained two 3-inch rapid firing guns. In 1923, Battery North was replaced with Battery Davis which was armed with one 16-inch gun. In 1943, Battery 912 was constructed and contained two 90mm AMTB guns.

The off-shore ordnance area of Fort Michie consists of approximately 92,163 acres (373 square kilometers) of tidal water. The firing fan for Battery Palmer overlaps the northern route alternative for the SFEC. The firing fan for Battery Palmer is shown on **Figure 4**. No information is known on the usage of this battery.

3.2.6 Montauk Submarine Base and Torpedo Test Range

The former Montauk Submarine Base and Torpedo Test Range is located on the southern shore of Fort Pond Bay in Montauk, New York. From 1943 to 1946, the base served as a torpedo manufacturing facility and torpedo engine testing range. The main mission on the torpedo testing range was to test commercially manufactured torpedoes. The two torpedoes that were tested at Montauk were the air launched (Mk 13) and surface launched (Mk 15) steam operated torpedoes, with inert warheads. The air missions only lasted for 10 months, while the surface missions continued until March 1945. A total of 196 air launched torpedoes were dropped while the number of surface launched torpedoes is unknown. The torpedo warheads were filled with sand/air, so they would bob in the water for easy retrieval. Internal materials included: ethyl alcohol for fuel, Mark 6 series pyrotechnic device for the igniter, a 2800 psi air flask that released the air through a pressure differentiating device and a seven-pound sodium nitrate black powder

impulse charge to launch the torpedo from the tube. There were no high explosives in the torpedoes tested at Montauk.

According to historical documents, up to 41 inert torpedoes were not recovered as of March 1945. Some of these torpedoes have since been netted in Block Island Sound. The firing fan for the torpedo test range overlaps the northern route alternative for the SFEC. The firing fan for torpedo test range is shown on **Figure 4**.

3.3. Previous Investigations

Numerous previous investigations, including MEC removal actions, have been completed at several of the military sites identified in the MEC Study Area. However, these investigations were focused only on terrestrial and shallow near-shore environments and not the risk of the water impact areas including their respective danger zones. The removal of MEC from land, including those washed-up on beaches, could indicate a presence of MEC in water; however, the water impact areas have not been fully characterized. Several historical and recent MEC removal actions are discussed in Section 3.4 to give a better understanding of potential MEC risk.

According to Defense Environmental Restoration Program (DERP)-FUDS policy, tidal water extending beyond 100 yards (91 meters) beyond mean high tide are ineligible under DERP-FUDS. Therefore, these water range areas were not investigated in previous investigations completed at military sites identified in the MEC Study Area.

3.4. Known UXO and Dumping Grounds

In addition to military use areas, there are 20 identified areas with recorded UXO and dumping grounds within the MEC Study Area (**Figure 5**) (NOAA, 2017b). These sites and their distance to the Project Area are shown in **Table 3**. There are no UXO sites or dumping grounds within the proposed SFWF or 1-mile buffer area.

3.4.1 Historical MEC Findings

In addition to the identified areas in **Figure 5** and **Table 3**, there have been several historical MEC discoveries in the Atlantic Ocean related to military sites with danger zones which overlap the OCS-A 0486 Lease Area and the SFEC cable route alternatives. Details on these discoveries are presented below.

Camp Hero

- 1962 – Over 200 MEC items were discovered in the near shore area to include cannon balls, modern artillery projectiles, projectile fuzes, practice rockets, an intact hand grenade, 70 rounds of assorted ammunition, and several unidentified objects. The cannon balls were believed to have been associated with Revolutionary War and War of 1812 American and British ships that fired into the Montauk bluffs for target practice.
- 1996 / 1997 – A reportedly live 3.5-inch rocked was found by a fisherman just off-shore of Camp Hero. The location of the discovery is unknown.

- 2006 – Projectile fragments, functioned projectile fuzes, fuze debris, a 1942 .50 caliber casing, and a .50 caliber bullet were found during a site inspection.
- UXO has been discovered in at least three areas in the Atlantic Ocean south and southwest of the former Camp Hero shoreline. These areas may be associated with Camp Hero firing activities or an ordnance dumping ground area.

Cartwright Island Bombing Range

- 1940s – 1950s – Multiple practice bombs and smoke bombs found by commercial fisherman. The fisherman collected them and used them to weight their nets.

Fort H.G. Wright

- No reports of ordnance or explosives being recovered in this area; however, there is overwhelming evidence that the off-shore area was used as an impact area for all weapons fired from the fort. According to the ASR, it is highly likely that some amount of unexploded ordnance remains at the bottom of Fishers Island, Block Island, and Long Island Sounds.

Fort Mansfield

- No reports of ordnance or explosives being recovered in this area; however, there is overwhelming evidence that the off-shore area was used as an impact area for all weapons fired from the fort.

Fort Michie

- 1970s – 40mm shell found washed. It is believed to have washed ashore due to tidal action.

Montauk Submarine Base and Torpedo Test Range

- 1995 – A World War II 100-pound Mark I practice bomb with a two to four-pound black powder charge discovered in the Fort Pond Bay Area. The bomb was believed to have originated around Fort Tyler area and was brought into the harbor by the fisherman who netted it.

3.4.2 Recent MEC Findings and Remedial Actions

VRH has worked on and around Martha's Vineyard and Nantucket since 2008, providing dive teams for underwater UXO Remedial Actions (RA). Risk from exposure to MEC is mitigated by the fact that these RAs occur primarily on documented practice ranges, and that the team follows very strict regulations established by the USACE and the Department of Defense Explosives Safety Board (DDESB).

Underwater UXO Clearance contractors in the Study Area have responded to a MK 55 series mine (explosive weight 600lbs), several 100 lb bombs and over a thousand other types of ordnance from MK23 practice bombs, rockets, 5" projectiles, flares, and small caliber high explosive (HE) cannon rounds. MEC items have been found high ashore, on

the surface of the ocean bottom and to depths of fourteen feet under the sea bed. In addition to British Smoke Float, Float No.1 MkII, the following lists the types of ordnance discovered during four of the projects VRHabilis has completed in the region.

Nantucket

- 5-inch high velocity aircraft rockets (HVARs)
- 3.5-inch forward firing aircraft rockets (FFARs)
- 2.25-inch sub-caliber aircraft rockets (SCARs)
- Miscellaneous rocket components

Martha's Vineyard - Tisbury Great Pond

- 0.30 and 0.50 caliber ammunition
- Miniature practice bombs; AN-MK 5, 15, 21, 23 and 43
- 2.25-inch SCARs
- 5-inch HVARs

Martha's Vineyard - South Beach

- 0.30 and 0.50 caliber ammunition
- MK1 rockets
- 2.25-inch SCARs
- 3.5-inch FFARs
- 5-inch HVARs

3.5. MEC Migration

It is important to remember that some of the ordnance items discussed in Section 3 may have been buried deep in the sediment since being discharged and have been immobile for quite some time. However, storms and high seas cause this area to be highly dynamic. The multiple estuaries leading into the Project Area exacerbate some of the most hazardous navigational waters in New England. Wave action, tidal circulation, and storm waves interact with sediments on the surface of the outer continental shelf, inducing sediment reworking and/or transport which may cause MEC items to be transported from their original locations. MEC items on or near the seafloor are susceptible to continued migration in the strong currents and heavy wave action that frequent the area.

Without the assistance of geophysical data, determining the spatial distribution of MEC items in the Study Area is not possible. This is due to the presence of multiple MEC sources of variable nature, as well as the potential migration of MEC from any of these sources. However, the following can be reasonably stated with regards to the potential distribution of MEC:

- There are numerous potential munitions sources in the Study Area that could result in MEC items being present within the SFEC route alternatives from the SFWF Work Area to Long Island, NY.

- The northern route alternative appears to have a higher density of potential MEC items from on-shore ranges than the southern route alternative, based on the presence of numerous overlapping danger zones (i.e., range fans) in Block Island Sound (see **Figure 3**).
- The OCS-A 0486 Lease Area, including the SFWF Work Area and the North Lease Reconnaissance Survey Area does not appear to have been impacted by known military sites or their respective danger zones.
- The SFWF Work Area, OCS-A 0486 Lease Area, and SFEC routes have the potential to be impacted by MEC from non-range sources, such as undocumented dumping grounds, wrecks and migrated ordnance (see **Figure 5)**.

Table 1: Military Sites within MEC Study Area

Site Name	FUDS Site ID	FUDS Site Number	Years of Military Operation	Acreage[2]	Location	Distance from Project Area (NM/Km)		Uses
						Site	Danger Zone	
Within 1-Mile Buffer of Export Cable, South Fork Wind Farm, and North Lease Area								
Camp Hero	CP Hero	C02NY0024	1942 – 1947 / 1951 - 1957	469	Block Island Sound, Montauk Point, Suffolk County, NY	4.0 / 7.41	0	Harbor Defense of Long Island Sound; Training base for Anti-Aircraft Artillery (AAA)
Cartwright Island Bombing Range[1]	Cartwright Is Bomb Target	C02NY09651	1940 – 1946	23	Cartwright Island, near the town of East Hampton, NY	1.04 / 1.93	0	Practice bombing range
Fort H.G. Wright[1]	Fort H.G. Wright	C02NY061001	1900 – 1949	412	Eastern and Southern edges of Fishers Island, Southold, Suffolk County, NY	8.4 / 15.56	0	Headquarters of Harbor Defense System of Long Island Sound
Fort Mansfield[1]	Fort Mansfield	D01RI048001	1898 – 1919 / WWII (exact dates unknown)	112	Napatee Point near Watch Hill, Westerly, Washington County, RI	10.3 / 19.08	0	Harbor Defense of Long Island Sound; Practice bombing range
Fort Michie[1]	Fort Michie	C02NY061203	1898 – 1949	17	North of Long Island, Suffolk County, NY	8.5 / 15.74	0	Harbor Defense of Long Island Sound
Montauk Submarine Base and Torpedo Test Range[1]	Montauk Naval Sub Base	C02NY0766	1943 – 1946	45	Southern Shore of Fort Pond Bay in Montauk, Suffolk County, NY	3.0 / 5.56	0	Torpedo manufacturing facility and torpedo engine testing range
Within MEC Study Area								
Anti-Motor Torpedo Boat (AMTB) Battery 933	AMTB Site	D01MA0544	1943 – 1946	34.7	Nashawena Island, Gosnold, MA	13.8 / 25.56	7.8 / 14.45	Harbor Defense of New Bedford
Barneys Point AMTB Battery	Barneys Joy Battery	D01MA0507	1943 – 1948	50.5	Dartmouth, MA	15.2 / 28.15	9.1 / 16.85	Harbor Defense of New Bedford
Camp Candoit	CP Candoit	D01MA0502	1942 – 1945	202	North Bay near Point Isabella, Cotuit, MA	35.2 / 65.19	N/A	Personnel training for amphibious operations

Site Name	FUDS Site ID	FUDS Site Number	Years of Military Operation	Acreage[2]	Location	Distance from Project Area (NM/Km)		Uses
Cape Poge Little Neck Bomb Target Site	Cape Poge Little Neck Bomb Target Site	D01MA0595	1944 – 1945	141	Edgartown, Dukes County, MA	22.8 / 42.23	N/A	Bombing Target
Cuttyhunk Island Fire Control (FC) Station	Cuttyhunk Isl FC Sta	D01MA0193	1940 – 1946	20.6	Cuttyhunk Island, Duke County, MA	11.9 / 22.04	N/A	Harbor Defense of New Bedford
Fort Nathaniel Greene Military Reservation	Fort Nathaniel Greene	D01RI0333	1939 – 1947	272	Point Judith, Narragansett, RI	15.3 / 28.34	14.3 / 26.48	Harbor Defenses of Narragansett Bay
Fort Ralph	Ft Ralph – Naushan Isl	D01MA0568	1770s – 1814	2	Naushon Island, Gosnold, MA	18.9 / 35.0	N/A	Harbor refuge during Revolutionary War and War of 1812
Fort Taber, Fort Rodman	Fort Rodman	D01MA0513	1861 – 1973	174.42	New Bedford, Bristol County, MA	21.2 / 39.26	13.1 / 24.26	Fort Taber (Union Fort); Fort Rodman (Harbor Defense of New Bedford)
Fort Terry	Plum Island Animal Research Center	C02NY0010	1897 – 1948	843	Plum Island, Long Island Sound, Town of Southhold, NY	9.7 / 17.96	N/A	Harbor Defense of Long Island Sound; WWI and WWII training camp
Fort Tyler	N/A	N/A	1898 – 1915; WWII (exact dates unknown)	N/A	Gardiners Point Island, Block Island Sound, NY	4.3 / 7.96	N/A	Harbor Defense of Long Island Sound; US Navy Target Practice
Great Neck	Great Neck	D01MA0450	1945 – 1949	229	Mashpee, MA	28.8 / 53.34	N/A	Practice Bombing Target; Dive Bombing
Gull Island Bombing Range	Gull Island Bomb Area	D01MA0569	1941 – 1960s	N/A	Gull Island, Gosnold, MA	13.2 / 24.45	11.4	Practice Bombing Water Target; Dive and High-Altitude Bombing
Martha's Vineyard Air Warning Station #6	Martha V/Yard AWS Sta6	D01MA0239	1941 – 1945; 1956 – 1970	259	Martha's Vineyard, Chilmark, Duke County, MA	13.9 / 25.74	N/A	Army Air Warning Service Station and Anti-Artillery Site; Gap Filler Radar Station
Mishaum Point FC Station and Mishaum Point Electronics Research Annex	Misc Pt Ele Rock Ax	D01MA0371	1943 – 1947	26.84	Southern tip of Mishaum Point, Dartmouth, MA	16.1 / 29.82	N/A	Harbor Defense of New Bedford

Site Name	FUDS Site ID	FUDS Site Number	Years of Military Operation	Acreage[2]	Location	Distance from Project Area (NM/Km)		Uses
Moving Target Machine Gun Range	Moving Tar Mach Gun Rg	D01MA0486	1943 – 1948	264	Edgartown, Dukes County, MA	19.0 / 35.19	16.2 / 30.0	Aerial machine gun and rocket firing practice
Nashawena Island Bombing Target	N/A	N/A	WWII	N/A	Nashawena Island, Gosnold, MA	13.8 / 25.56	N/A	Masthead Bombing
Naval Auxiliary Air Station	Martha's Vineyard Arpt	D01MA0488	1944 – 1946	683	Edgartown and West Tisbury, MA	18.2 / 33.71	N/A	Airport
Nomans Land Range	N/A	N/A	1943 – 1996	N/A	Chilmark, MA	7.4 / 13.7	4.0 / 7.41	Rocket and Dive Bombing Practice
Sector SE New England	N/A	N/A	2006 – Present	N/A	Woods Hole, Barstable County, MA	23.8 / 44.08	N/A	US Coast Guard Base
Station Point Judith	N/A	N/A	1875 – Present	N/A	Narragansett, RI	15.2 / 28.15	N/A	US Coast Guard Base
Tisbury Great Pond	Tisbury Great Pond	D01MA0453	1943 – 1947	496	West Tisbury and Chilmark, MA	15.5 / 28.71	13.8 / 25.56	Practice Dive Bombing and Strafing Range
U.S. Navy Bombing Practice Area Weepecket Islands	Bomb Area Weepecket Is	D01MA0567	1941 – 1960s	N/A	Weepecket Islands, Gosnold, MA	21.0 / 38.89	19.2 / 35.56	Bombing Practice Area; Dive Bombing
Washburn Island	Washburn Isl	D01MA0015	1942 – 1943	350	Falmouth, MA	28.7 / 53.15	N/A	Assault landing training for small boats
West Island	NA	NA	WWII	N/A	Fairhaven, MA	11.0 / 20.37	N/A	Bombing Target
Within 5-Mile Buffer of MEC Study Area								
Anti-Aircraft Training Center, Price's Neck	ANTI-AIRCRFT TRNG CNTR	D01RI0004	1939 – 1945	25.6	Newport, RI	13.8 / 25.56	N/A	Naval Anti-Aircraft Gunnery Training Center
Brenton Point FC Station	BRENTON POINT FC STA	D01RI0324	1941 – 1946	17.9	Newport, RI	14.3 / 26.48	N/A	Army Fire Control Station and Coastal Defense
Butler's Point AMTB Battery	BUTLERS POINT BATTERY	D01MA0506	1943 – 1946	8.34	Butler Point, Plymouth County, MA	29.5 / 54.63	N/A	Harbor Defense of New Bedford

Site Name	FUDS Site ID	FUDS Site Number	Years of Military Operation	Acreage[2]	Location	Distance from Project Area (NM/Km)		Uses
Camp Edwards / Joint Base Cape Cod	CAMP EDWARDS	D01MA0009	1938 – Present	14,700	Barnstable County, MA	32.5 / 60.19	N/A	Combat Training, Hospital; Included Otis Air National Guard Base, Camp Edwards, and Coast Guard Air Station Cape Cod
Fort Adams Military Reservation	FT ADAMS	D01RI0043	1799 – 1965	136.43	Newport, RI	15.0 / 27.78	N/A	1799 - 1950: Army Coastal and Land Defense; 1950 - 1965: Navy Storage and Housing
Fort Burnside; Naval Radio Station (NAVRADSTA) Jamestown	BEAVERTAIL PT.NAV COMM	D01RI0321	1942 – 1975	185.22	Jamestown, RI	15.9 / 29.45	N/A	1942 - 1951: Army (Fort Burnside) 1951 - 1975: Harbor Entrance Control Post, Naval Communication Station
Fort Varnum	FORT VARNUM	D01RI0335	1941 – 1948; 1958 – present	34	Boston Neck, Narragansett, RI	16.8 / 31.11	N/A	1941 - 1948: Harbor Defense of Narragansett Bay 1958 - present: RI National Guard Regional Training Institute (Camp Varnum)
Fort Walcott, US Naval Torpedo Station	GOAT ISLAND NAVAL BASE	D01RI0506	1799 – 1869; 1869 – 1959	30	Newport, RI	15.4 / 28.52	N/A	1799 - 1827: Defend Narragansett Bay; 1869 - 1951: US Naval Torpedo Station; 1951 - 1959: Power Plant
Fort Wetherill	FORT WETHERILL NUSC	D01RI0337	1900 – 1946	62	Conanicut Island, Jamestown, RI	15.8 / 29.26	N/A	Harbor Defense of Narragansett Bay
Hull Cove FC Station	HULL COVE FIRE CON STA	D01RI0341	1942 – 1963	2.84	Beaver-tail Road at Hull Cove, Jamestown, RI	16.1 / 29.82	N/A	1942 - 1953: Cable Crossing; 1953 - 1963: Harbor Defense of Narragansett Bay
Naval Auxiliary Land Field	NAVAL AUX LANDING FIELD	D01RI0008	1943 – 1950	631.3	Charlestown, RI	18.7 / 34.63	N/A	Training, Naval Auxiliary Landing Field for Quonset Point NAS
North Hill FC Station	N HILL FIRE CON STA	C02NY0661	1940 – 1948	23.82	Fishers Island, Suffolk County, NY	9.2 / 17.04	N/A	Fire Control Station for the Harbor Defense of Long Island

Site Name	FUDS Site ID	FUDS Site Number	Years of Military Operation	Acreage[2]	Location	Distance from Project Area (NM/Km)		Uses
Prospect Hill FC Station	PROSPECT HILL FCS	D01RI0350	1916 – 1963	18.43	Battery Lane, Jamestown, RI	16.8 / 31.11	N/A	Harbor Defense of Narragansett Bay
Sachuest Point	SACHUEST PT-NPORT NCM	D01RI0041	1942 – 1973	184.1	Middleton, Newport County, RI	12.7 / 23.52	10.9	1942 - 1950: Army Fire Control Station for Coastal Defense of Narragansett Bay; 1942 - 1964: Navy Training Station; 1964 - 1973: Naval Communication Station (NAVRADSTA Sachuest Point, part of NAVCOMMSTA Newport)
Sakonnet Point Military Reservation, Fort Church	FORT CHURCH	D01RI0331	1939 – 1947	204	Little Compton, RI	11.8 / 21.85	N/A	Gun Battery for US Army, Harbor Defense of Narragansett Bay
Station Point Castle Hill	N/A	N/A	1941 – Present	N/A	Newport, RI	15.0 / 27.78	N/A	US Coast Guard Base

Note:
[1] Not located within 1-mile buffer for SFEC route alternative south of Long Island, NY.
[2] Acreage as provided in FUDS GIS Inventory; does not include danger zone.

Table 2: Potential Munitions Used/Stored at Military Sites within MEC Study Area

Site Name	Munitions
Within 1-Mile Buffer of SFEC Southern Route Alternative	
CP Hero	16-inch casemated guns (Navy MKIIM1); 6-inch shielded guns (M1903A2); 90mm and 120mm projectiles; quad .50 caliber machine-guns; 3.5-inch rockets; and .30 cal, .38 cal, .45 cal, 5.56mm small caliber ammunition
Within 1-Mile Buffer of SFEC Northern Route Alternative	
Cartwright Is Bomb Target	13-lb Mk 19, Mod 1, Practice bomb; AN-Mk 5, AN-Mk 23, AN-Mk 43, Practice bomb; Mk4 or Mk5 signal; Mk I Practice bomb, 25 lbs or 100 lbs; M1A1 Spotting charge; Smoke streamer, T29
Fort H.G. Wright	12-inch mortars (1890M1); 37mm, M54, HE w/tracer; 5-inch; 155mm Mk I shrapnel; MK I shell; Mk III shell, Mk III AI shell; M101 and M101B1 shell H.E.; M102 and M101B1 shell H.E.; 12-inch disappearing guns, Model 1898 projectile D.P.; Mk XVI projectile A.P.C.; MK XXVIII projectile D.P.; M1911 AI projectile D.P.; M1912A projectile D.P.; M1913 projectile D.P.; 10-inch disappearing guns, model 1896; MK III projectile A.P.C.; MK IV shell HE; 1911 projectile A.P.C; 6-inch disappearing guns, model 1987M1; M1911 shell A.P.C.; M1911 Shot A.P.C.; MK II AI shell H.E.; 6-inch guns, model 1903; 3-inch seacoast guns, model 1902 - M1915 HE; M42AI He; TP MK VII or MK VIIAI, blank; 15-inch dynamite guns; 6-inch HC, Mk 36/6-inch guns; 90mm, HE, M71 and HE-T, M171A1/90-mm guns; 3-inch shrapnel, Mk I/3-inch guns Model 1918; general small arms
Fort Mansfield	8-inch, AL, Mk 21; 5-inch, A.A. Common, Mk 28 Mod 9; M38A2, Practice Bomb, 100lbs
Fort Michie	3-inch HE, M1915; 6-inch, AP (shell), M1911; 6-inch, Mk 35; 16-inch, AP, Mk 5; 12-inch, AP, M1912; 12-inch, AP, Mk15; 90mm, AP, M77; 37mm, general; 40mm, general; 0.50 caliber
Montauk Submarine Base and Torpedo Test Range	Small caliber ammunition (.30, .45 caliber), .50 caliber machine gun; Air launched MK 13 and surface or barged launched MK 15 steam operated torpedoes (fitted with inert warheads)

Site Name	Munitions
Within 1-Mile Buffer of SFWF Work Area	
None	
Within 1-Mile Buffer of North Lease Area	
None	
Within MEC Study Area	
AMTB Battery 933	90mm guns; 37mm M1 guns
Barneys Point AMTB Battery	90mm fixed M1 guns
Camp Candoit	No munitions used at this site.
Cape Poge Little Neck Bomb Target Site	100-pound practice bombs, AN-MK15-series; Miniature practice bombs, AN-MKS Mod 1, AN-MK23, AN-MK43; Signal practice bombs, AN-MK4 Mods 3 & 4; Signal practice bombs, AN-MK6 Mod O; and, Flare, aircraft, parachute, M26 & AN-M26
Cuttyhunk Island FC Station	90mm fixed M1 guns
Fort Nathaniel Greene Military Reservation	16-inch (M1); 6-inch guns (M1903); 155mm guns
Fort Ralph	12-lb guns
Fort Taber, Fort Rodman	8-inch breechloading rifle (M1888); 3-inch breechloading rifles (M1898); 155mm Panama mount field pieces (M1918); 5-inch breechloading rifles (M1900); 12-inch long range breechloading rifles (M1895)
Fort Terry	12-inch coast defense mortar M1890; 10-inch gun M1888; 6-inch gun M1897; 6-inch gun M1903; 5-inch gun M1900; 3-inch gun M1903; 6-inch gun M1; 90 mm gun; 155 mm gun M1918
Fort Tyler	Naval Bombing Range WWII--no known records
Great Neck	MK23, 100 GP bombs, 100lb phosphorous bombs, MK 55 series moored mines
Gull Island Bombing Range	MK23
Martha's Vineyard Air Warning Station #6	No munitions used at this site.
Mishaum Point FC Station and Mishaum Point Electronics Research Annex	155mm GPF guns (M1918MI rapid fire guns); 37mm guns; 6-inch guns (T2 - M1; Watervliet)
Moving Target Machine Gun Range	0.30 and 0.50 caliber ammunition, 2.25 to 5 in. sub-caliber aircraft rockets, 5 in. rocket warheads, 1 to 3.5 in. rocket warheads, 3 to 3.25 in. rockets with warheads, and 3 to 3.25 in. rockets with 5 in. warheads.
Nashawena Island Bombing Target	MK23
Naval Auxiliary Air Station	No munitions used at this site.
Nomans Land Range	100/200lb GP bombs, 30mm high explosive shells, 5inch anti-surface Naval artillery shells
Sector SE New England	No munitions used at this site.
Station Point Judith	No munitions used at this site.

Site Name	Munitions
Tisbury Great Pond	0.30 and 0.50 caliber ammunition; miniature; (3-5 pounds) practice bomb series including AN-Mark (MK)5 Mod1, MK23, and MK43; and large (100-500 pound) practice bomb series including MK5, MK15, and MK21; Spotting charge (MK4 and MK7)
U.S. Navy Bombing Practice Area Weepecket Islands	Naval Bombing Range WWII--no known records
Washburn Island	No munitions used at this site.
West Island	Naval Bombing Range WWII--no known records
Within 5-Mile Buffer of MEC Study Area	
Anti-Aircraft Training Center, Price's Neck	20mm, 40mm, 3-inch AA guns
Brenton Point FC Station	155mm
Butler's Point AMTB Battery	155mm; 90mm
Camp Edwards / Joint Base Cape Cod	Small caliber, Artillery and Mortar, Explosives
Fort Adams Military Reservation	12-inch (M1890); 10-inch (M1888); 6-inch; 4.72-inch; 3-inch (M1903); 155mm; 90mm
Fort Burnside; Naval Radio Station (NAVRADSTA) Jamestown	3-inch; 6-inch
Fort Varnum	3-inch; 6-inch; 90mm
Fort Walcott, US Naval Torpedo Station	No munitions used at this site.
Fort Wetherill	12-inch; 10-inch; 6-inch; 3-inch; 90mm
Hull Cove FC Station	No munitions used at this site.
North Hill FC Station	3-inch gun M1903
Naval Auxiliary Land Field	.30 and .50 cal; fixed 20mm cannons; MK15 Mk2 100lb practice bombs (devoid of energetic material); 20mm cannons, 5-inch rockets, torpedoes, 325lb depth charges, HE bombs (100 - 2000 lbs), 2.25-inch SCAR, 100lb MK15 water/sand filled practice bombs
Prospect Hill FC Station	No munitions used at this site.
Sachuest Point	Small caliber ammunition
Sakonnet Point Military Reservation, Fort Church	16-inch, 8-inch, 6-inch guns; 155mm

Table 3: Documented UXO and Disposal Sites within MEC Study Area

Type	Easting[1]	Northing[1]	Distance to Project Area		Date Discovered
			NM	Kilometers	
Unexploded Ordnance	1067911.124	14965402.527	0.1	1.85	June 1971
Unexploded Depth Charge	1033440.289	14985406.883	1.1	2.04	October 1947
Unexploded Ordnance	1126811.528	14929860.841	1.2	2.22	June 2005
Unexploded Ordnance	897997.913	14889027.577	1.3	2.41	N/A
Unexploded Ordnance	947477.254	14899457.046	1.6	2.96	June 2005
Unexploded Depth Charge	1072819.946	15001780.530	1.6	2.96	N/A
Unexploded Bombs	1006392.682	14942711.045	2	3.7	December 1958
Unexploded Torpedo	981676.211	14896546.496	4	7.4	June 2005
Unexploded Ordnance	800979.597	14867441.001	4.4	8.15	January 1989
Unexploded Depth Charges	1001582.078	14983336.935	4.8	8.89	December 1952
Residual Mines	774338.018	14958074.392	7.2	13.3	N/A
Unexploded Depth Charge	975815.234	14985665.781	7.5	13.89	May 1945
Unexploded Torpedo	900180.825	14843428.968	8.7	16.11	November 1965
Disposal Site	1009809.564	15042087.995	9.4	17.41	N/A
Unexploded Bomb	1097691.308	14863537.209	9.5	17.59	August 1968
Dumping Ground	790639.219	15004634.201	9.8	18.15	2005
Unexploded Depth Charge	1053337.379	14858873.828	10.3	19.08	November 1960
Unexploded Depth Charge	999345.797	15041471.079	11.1	20.56	N/A
Dumping Ground	1121173.332	14806047.730	13.9	25.74	N/A
Unexploded Ordnance	1178166.027	15075018.729	22	40.74	N/A

Note:

[1] Coordinate System: WGS_1984_UTM_Zone_19N

N/A – not available

Filename: C:\Users\Christina Anderson\Documents\HANA\GIS\RI-MA Offshore Wind Farm\MXDs\DRAFT MEC DTS\Figure 3 Former and Current Military Use Areas_r1.mxd

Legend

- Military Use Area
- Danger Zone
- Project Area 1-Mile Buffer

Proposed Survey Areas

- OCS-A 0486 Lease Area
- SFWF Work Area
- South Fork Export Cable OCS (SFEC OCS)
- South Fork Export Cable NYS (SFEC NYS)
- MEC Study Area
- MEC Study Area 5-Mile
- 3 Nautical Mile State Limit

Fort Walcott, US Naval Torpedo Station
Mishaum Point FC Station and Mishaum Point Electronics Research Annex
Fort Taber, Fort Rodman
Butler's Point AMTB Battery
Camp Edwards / Joint Base Cape Cod
Camp Candoit
Fort Adams
Barneys Point AMTB Battery
Fort Wetherill
Bombing Practice Area Weepecket Islands
Washburn Island
Great Neck
Prospect Hill FC Station
Sakonnet Point, Fort Church
Station Point Castle Hill
Hull Cove FC Station
Sector SE New England
Fort Ralph
Fort Burnside; NAVRADSTA Jamestown
Sachuest Point
AMTB Battery 933
Naval Auxiliary Land Field
West Island
Naval Auxiliary Air Station
Fort Varnum
Nashawena Island Bombing Target
Brenton Point FC Station
Cape Poge Little Neck Bomb Target Site
Anti-Aircraft Training Center, Price's Neck
Fort Mansfield
Fort Nathaniel Greene
Moving Target Machine Gun Range
North Hill FC Station
Cuttyhunk Island FC Station
Gull Island Bombing Range
Station Point Juidith
Fort H.G. Wright
Tisbury Great Pond
Torpedo Testing Area
Fort Terry
Nomans Land
Fort Michie
Martha's Vineyard Air Warning Station #6
Fort Tyler
Camp Hero
Cartwright Island Bombing Range
Montauk Submarine Base and Torpedo Test Range

0 5 10 20 Miles

Current and Former Military Use Areas
Project No: 64529
Date: May 2018

MEC DESKTOP STUDY
BOEM LEASE OCS-A 0486

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Figure: 3

Filename: C:\Users\Christina Anderson\Documents\HANA\GIS\RI-MA Offshore Wind Farm\MXDs\DRAFT MEC DTS\Figure 4 Military Use Areas Within Project Area.mxd

Legend

Proposed Survey Areas

- OCS-A 0486 Lease Area
- SFWF Work Area
- Project Area 1-Mile Buffer
- MEC Study Area
- MEC Study Area 5-Mile Buffer
- South Fork Export Cable OCS (SFEC OCS)
- South Fork Export Cable NYS (SFEC NYS)

Danger Zone

- Camp Hero, Battery 112
- Camp Hero, Battery 113
- Camp Hero, 90mm & 120mm
- Camp Hero, Battery 216
- Cartwright Island Bombing Range
- Fort H.G. Wright, Battery 215
- Fort Mansfield, All Batteries
- Fort Michie, Battery Palmer
- Montauk Naval Sub Base, Torpedo Test Range

Fort Mansfield
All Batteries

Fort H.G. Wright
Battery 215

Fort Michie
Battery Palmer

Camp Hero
Battery 216

Camp Hero
Battery 113

Camp Hero
90mm & 120 mm

Montauk Naval Sub Base
Torpedo Test Range

Cartwright Island
Bombing Range

Camp Hero
Battery 112

0 5 10 20
Miles

Military Use Areas Within Project Area
Project No: 64529
Date: May 2018

MEC DESKTOP STUDY
BOEM LEASE OCS-A 0486

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Figure: 4

Filename: C:\Users\Christina Anderson\Documents\HANA\GIS\RI-MA Offshore Wind Farm\MXDs\DRAFT MEC DTS\Figure 5 UXO and Disposal Sites.mxd

Legend

- UXO and Dumping Grounds (NOAA)

Proposed Survey Areas

- OCS-A 0486 Lease Area
- SFWF Work Area
- North Lease Reconnaissance Survey Area
- South Fork Export Cable OCS (SFEC OCS)
- South Fork Export Cable NYS (SFEC NYS)
- Project Area 1-Mile
- MEC Study Area
- MEC Study Area 5-Mile

Unexploded Depth Charge
Disposal Site
Unexploded Depth Charge
Unexploded Depth Charges
Unexploded Depth Charge
Unexploded Depth Charge
Unexploded Ordnance
Unexploded Bombs
Unexploded Ordnance
Unexploded Ordnance
Unexploded Torpedo
Unexploded Ordnance
Unexploded Ordnance
Unexploded Depth Charge
Unexploded Bomb
Unexploded Torpedo
Dumping Grounds
Dumping Grounds
Residual Mines
Unexploded Ordnance

0 5 10 20 Miles

Unexploded Ordnance and Disposal Sites
Project No: 64529
Date: May 2018

MEC DESKTOP STUDY
BOEM LEASE OCS-A 0486

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Figure: 5

4.0 **MEC Risk Assessment**

4.1. Background

The DoD has been investigating the presence of MEC on land and in shallow nearshore environments, through the Military Munitions Response Program (MMRP) under DERP. Formal procedures for risk assessment have been established, and numerous MEC Removal Actions have been completed by the DoD. However, the DoD has not yet instituted a formal program to proactively investigate and remediate MEC in underwater environments that extend beyond the nearshore (i.e., outside areas where humans may be readily exposed). There are several reasons for this, including:

- Minimal potential for exposure in deeper (> 120 feet [36.5 meters]) underwater environments
- Complexity and cost of technology needed to systematically investigate and remediate MEC in these environments
- Lack of a funding priority (related to the factors above)

Therefore, response to underwater munitions generally occurs when exposure is anticipated or after an item is discovered. Controls are often instituted in areas suspected of containing underwater MEC. These controls may include restrictions on recreational or commercial use, public awareness, signage, or physical barriers. The 3 R's (Recognize, Retreat, Report) are commonly used when training workers and the public on MEC response procedures. When MEC items are discovered unexpectedly, such as by fisherman, an EOD unit will typically be contacted to assess and safely dispose of the item. When intrusive underwater activities, such as dredging or cable burial, are planned in an area suspected of containing MEC, a site-specific evaluation and/or special procedures may be warranted, as is the case with the SFWF and SFEC.

There is currently no formal guidance in the United States to aid offshore developers in collecting desktop data concerning the possible presence of MEC, where they can expect to encounter MEC or the technologies available to detect these hazards. It has been recommended that offshore wind developers consider an integrated approach for integrating risk assessment information into the process of evaluating their site (BOEM, 2017). An essential part of the risk assessment is the development of a framework for assessing sites that may vary greatly in terms of complexity, physical and chemical characteristics and in the risk that they may pose to human health and the environment. The MEC risk assessment approach used in this DTS has followed a similar approach used in Munitions and Explosives of Concern Survey Methodology and In-field Testing for Wind Energy Areas on the Atlantic Outer Continental Shelf, which was prepared for BOEM (BOEM, 2017). This approach was generally based on methodology developed in Europe, as described in the Assessment and Management of Unexploded Ordnance (UXO) Risk in the Marine Environment, prepared by Construction Industry Research and Information Association (CIRIA, 2015).

4.2. Evaluation of MEC Hazards

The methodology used for evaluating hazards from MEC generally consists of a combination of the following factors:

- *Accessibility* – an assessment of the likelihood of potential exposure of equipment, humans, or animals to MEC.
- *Sensitivity* – an assessment of the probability of a MEC item detonating in the presence of equipment, human or animals.
- *Severity* – an assessment of the consequences to equipment, humans or animals from detonation of MEC.

4.2.1 Accessibility to MEC

Accessibility includes both the probability of a MEC item being present and the likelihood of a receptor coming into contact with the item. The probability of a MEC item being present is associated with distribution and migration, as discussed in Section 3. In the absence of supporting geophysical data, it is rarely possible to know precisely how many items of MEC are potentially present within the site boundary (if any) but a qualitative determination can be made based on the results of the HRR, past experience and knowledge of the types of project activities to be completed.

As discussed in Section 3, there are numerous potential sources of MEC in the Study Area, including former military training areas and ranges, coastal defense batteries, shipwrecks, plane wrecks, dump sites and other sources such as moored mines and depth charges. The types of MEC potentially present in the Study Area varies greatly, ranging from small caliber ammunition, to large caliber HE projectiles, bombs, and torpedoes.

A MEC hazard assessment was completed to identify the potential sources of danger related to the MEC. The MEC hazard assessment consists of the collection of information to establish the types of activities that occurred or are currently occurring in the Project Area and the anticipated types, locations, and distribution of MEC involved. This information is included in Section 3. Based on this information, a probability grade is assigned concerning the likelihood of an encounter with MEC present in the renewable energy development area.

For the purpose of the MEC risk assessment, various exposure units were identified along the 1-mile buffer of the Project Area. These exposure units are presented in **Table 4** and **Figure 6.** The exposure units were broken up based on their location to the nearby military sites and their respective danger zones.

Table 4: Exposure Areas Within the 1-Mile Buffer of the Project Area

Exposure Unit Name	SFEC
NYS – SR1 (Beach Lane)	Southern Route
NYS – SR2 (Napeague Lane)	Southern Route
NYS – SR3 (Hither Hills)	Southern Route
OCS – SR4	Southern Route
OCS – SR5	Southern Route
OCS – SR6	Southern Route
OCS – SR7	Southern Route
OCS – SR8	Southern Route
OCS – SR9	Southern Route
OCS – SR10	Southern Route
OCS – SR11	Southern Route
NYS – NR1	Northern Route
OCS – NR2	Northern Route
OCS – NR3	Northern Route
OCS – NR4	Northern Route
OCS – NR5	Northern Route
OCS – NR6	Northern Route
SFWF Work Area	---
OCS-A 0486 Lease Area	---

The research presented in Section 3 determined that MEC is potentially present, therefore, the probability of encountering MEC was evaluated and assigned a probability grade. The probability of the likelihood of an encounter with MEC in each of these exposure areas is shown on **Table 5**. A probability grade between 1 (unlikely) and 5 (probable) was assigned based on the history of the area and likely distribution of MEC.

The next step in the MEC hazard assessment is to evaluate the events leading to the possible MEC deposition in the Study Area (e.g., disposal, combat, training), explosive train status (e.g., incomplete, fuzed and fired), sensitivity of the munitions (e.g., sensitive fuzing, armor piercing), and sensitivity of the filling (e.g., insensitive explosive, shock sensitive explosive). Based upon this information, the MEC is assigned a sensitivity factor of 1 (insensitive) to 5 (high) (**Table 6**). The probability grades and sensitivity grades are then used to complete the MEC risk assessment.

4.2.2 Sensitivity

As described in Section 3, a broad range of various types of MEC are potentially present in the Study Area from small arms to large HE projectiles and bombs. Ordnance may be designed with a variety of triggering devices, but most are designed to detonate from the

energy imparted by contact with a surface. The impact of years of deterioration in salt water on the potential for detonation is difficult to determine without actual inspection of the item. In the absence of physical inspection of an MEC item, it is impossible to accurately assess an items sensitivity. MEC has the potential to detonate even in the absence of a triggering device.

MEC items that are potentially present within the SFWF Work Area and export cable routes may be encountered by heavy equipment during anchoring, pile driving or plowing activities associated with construction. Human receptors potentially exposed to or impacted by MEC include crews on boats during SFWF construction and cable installation activities, as well as divers supporting construction and maintenance activities. The likelihood of exposure is based on the specific future construction activities. However, the probability of exposure is likely greater than zero with any intrusive cable installation method (e.g., plow).

The main mechanisms that have the potential to cause unintended detonation of an item of MEC are:

- Crushing of the casing, imparting energy to the detonator leading to its detonation (the main filling is unlikely to be initiated independently).
- A blow with sufficient energy by heavy equipment, such as anchors or plows, or, perhaps, a rock against a sensitive fuze pocket or exposed detonator.
- Sympathetic detonation caused by another item of UXO sufficiently close by or by a shock wave with sufficient energy imparted by an activity such as percussive piling.
- Vibration, blow or friction sufficient to initiate sensitive metallic salts, leading to detonation of the main filling.

Based on data published by BOEM, the likelihood of a MEC detonation is based on the sensitivity of the item and the energy imparted to the item during the planned renewable energy development activities. A relative energy factor between 1 (very low) and 5 (very high) was assigned to each activity and is shown on **Table 7**.

4.2.3 Severity

Based on a combination of factors including the probability of an encounter with a MEC type (**Table 5**), sensitivity of the MEC (**Table 6)**, and the energy transmitted (**Table 7**), a probability of detonation grade is assigned (BOEM, 2017)

A severity grade is assigned based on the type of receptor and the likely impact to that receptor from a MEC incident (**Table 8**). The severity of the effects from a detonation is based on a number of factors. The primary factor is the net explosive weight of the MEC (**Table 9**). However, these effects may be mitigated by the water column and burial in sediments. Other factors include distance from the receptor (e.g., individual, vessel, equipment) and the robustness of the receptor (e.g., double-steel-hull vessel, marine mammal).

In underwater environments, the distance and velocity of fragmentation during an explosion is greatly reduced by the surrounding water. However, underwater explosions can be extremely hazardous due to the blast effect. The blast effect is the creation of pressure waves due to the incompressible nature of water. The magnitude of the blast effect is related to the depth of the explosion and explosive weight of the item. The deeper the blast and the higher the explosive weight, the farther the pressure wave will propagate. The blast effect can result in death to humans and marine mammals at great distances up to several hundred yards away. The blast effect can also cause significant damage to equipment and vessels. The damage can range from minimal to catastrophic, based on the type of explosive and depth of water. The blast effect has been well studied and formulas and guidance exist for determining safe distances for mammals and vessels. There are numerous exposure scenarios possible during the field work for this project. All encounters with MEC should be avoided as they can result in lethal affects.

Using the information discussed above, a risk matrix, shown in **Table 10**, was developed which uses the probability of a MEC detonation from a specific renewable energy development activity and the severity of the consequences should that occur, to determine the relative risk (BOEM, 2017). The results of the MEC risk assessment are shown on **Table 11** for each exposure unit. Based on this table, the developer must decide as to whether the risk is tolerable or if mitigation measures are necessary.

Table 5. Likelihood of MEC Encounter at Project Area

Exposure Unit Name	NYS – SR1 (Beach Lane)	NYS – SR2 (Napeague Lane)	NYS – SR3 (Hither Hills)	OCS – SR4	OCS – SR5	OCS – SR6	OCS – SR7	OCS – SR8	OCS – SR9	NYS – NR1	OCS – NR2	OCS – NR3	OCS – NR4	OCS – NR5	OCS – All	SFWF Work Area	OCS-A 0486 Lease Area
16-inch Projectile	3	3	3	4	3	4	4	4	4	1	1	3	3	3	1	1	1
12-inch Projectile	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1
8-inch Projectile	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1
6-inch Projectile	1	1	1	1	1	1	4	3	1	3	3	3	3	1	1	1	1
90mm Projectile	1	1	3	1	3	3	4	1	1	3	3	3	1	1	1	1	1
120mm Projectile	1	1	3	1	3	3	4	1	1	3	3	3	1	1	1	1	1
Practice Bombs	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1
Torpedoes (inert)	1	1	1	1	1	1	1	1	1	3	1	1	1	1	3	1	1
Torpedoes (live)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	1	1
Depth Charges	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
Potential Unknown UXO	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3

Key		
1	Unlikely	Possible encounters but improbable
2	Possible	Infrequent encounters
3	Likely	Sporadic or intermittent encounters
4	Very Likely	Several or numerous encounters
5	Probable	Regular or almost inevitable encounters

Note: Based on the historic military training records and past uses of the proposed Project Areas, there exists at least a slight risk of encountering MEC in all areas including those categorized as 1 - Unlikely. The reader should consult section 1.4 to further understand the uncertainties associated with forecasting the chance of an encounter during the project.

Table 6. MEC Sensitivity Factor

Exposure Unit Name	Sensitivity Factor
16-inch Projectile[1]	2
12-inch Projectile[1]	2
8-inch Projectile[1]	2
6-inch Projectile[1]	2
90mm Projectile[1]	2
120mm Projectile[1]	2
Practice Bombs	1
Torpedoes (inert)	1
Torpedoes (live)	3
Depth Charges	3
Potential Unknown UXO	4

Key		
1	Insensitive	Armor piercing munitions Pyrotechnics
2	Low	Munitions with incomplete explosive trains such as sea-disposed military munitions
3	Moderate	UXO Fuzed sensitive disposed military munitions
4	High	Fuzed sensitive munitions such as a sea mine with chemical horns Sensitive fillings such as picric acid filled munitions

Note:
[1]This score only represents items that may have been disposed of with explosive filler and without a fuze. It is possible that fuzed items and “duds” (UXO) may be present changing the score to 3 for the item.

Table 7. Likelihood of MEC Detonation at Project Area

Exposure Unit Name	Development Activity Energy Factor
NYS – SR1 (Beach Lane)	4
NYS – SR2 (Napeague Lane)	4
NYS – SR3 (Hither Hills)	4
OCS – SR4	4
OCS – SR5	4
OCS – SR6	4
OCS – SR7	4
OCS – SR8	4
OCS – SR9	4
NYS – NR1	4
OCS – NR2	4
OCS – NR3	4
OCS – NR4	4
OCS – NR5	4
OCS – All	4
SFWF Work Area	5
OCS-A 0486 Lease Area	2

Key		
1	Very Low	Non-intrusive, non-contact geophysical survey
2	Low	Geotechnical survey
3	Moderate	PLGR operation Placement of jack up barge logs Anchor deployment Cable jetting Concrete mattress placement
4	High	Cable ploughing Cable trenching Scour protection Armoring with rock
5	Very High	Driving of monopiles

Table 8. Severity of MEC Detonation Effects Factor

Severity Factor	Description	Definition	Summary
1	Negligible	Personnel – Occurrence (e.g., startling sound) causing minor disruption of activity Equipment/Infrastructure – Damage that does not affect usability (e.g., cosmetic) or is similar to normal wear and tear that is readily repaired by onsite personnel (e.g., replace shear pin) Natural Resources – Temporary minor disturbance (e.g., sound causing feeding birds to take flight) or other de minimus impacts (e.g., disturbance of sediments impacting a small area) Cultural Resources – De minimus impacts to a cultural resource (e.g., similar to typical aging processes)	No injury or loss, with de minimus damage or impact to activities
2	Minor	Personnel – One or more injuries requiring no more than onsite first aid (e.g., cut, bruise), outpatient medical care and may result in restricted work or transfer to another job (29 CFR 1907.4(b)(4)) Equipment/Infrastructure – Relatively minor damage that may affect usability and requires repair Natural Resources – Temporary disturbance (e.g., sound causing minor injury to marine mammals, fish or birds) or other minor impacts with no significant long-term impacts (e.g., loss of a small number of individuals of a common species) Cultural Resources - Minor impacts to a cultural resource (e.g., similar to typical aging processes)	Minimal injury, loss, or damage; little or no impact to activities
3	Moderate	Personnel – Lost time accident (29 CFR 1904.7(b)(3)) to one or two individuals Equipment/Infrastructure – Significant damage limited to a small area Natural Resources – Significant temporary disturbance/impact to marine animals (e.g., injure a small number of protected marine animals, injure or kill a modest number of common fish or birds) Cultural Resources – Significant impacts but no greater than might be expected from a large natural event (e.g., storm)	Minor injury, illness, loss, or damage; degraded ability to complete activities
4	Severe	Personnel – Injuries to three or more individuals requiring hospitalization or resulting in one or more permanent partial disabilities Equipment/Infrastructure – Significant damage to a major item that hinders operations and requires a shore-based repair Natural Resources – Significant disturbance/impact to marine animals (e.g., kill a protected marine animal, injure or kill a significant number of common fish or birds) Cultural Resources – Impacts greater than might be expected from a large natural event (e.g., storm)	Severe injury, illness, loss, or damage; significantly degraded ability to complete activities
5	Catastrophic	Personnel – Injuries to one or more individuals resulting in permanent total disabilities or one or more fatalities Equipment/Infrastructure – Significant damage to a major item requiring major rebuilding or repair, threatens the seaworthiness of a vessel or causes damage to nearby infrastructure (e.g., ruptures a pipeline) Natural Resources – Kill more than one protected marine animal, or kill or injure a large number of common fish or birds Cultural Resources – Loss of the resource (e.g., demolition of shipwreck)	Death, unacceptable loss or damage, mission failure, or ability to complete activities eliminated

Source: BOEM, 2017

Table 9. Relation of Net Explosive Weight to Severity of Effects from Underwater Detonation on Vessels, on Board Personnel, and Equipment

Severity Grade	Descriptor	Net Explosive Weight		Examples
		lb	kg	
1	Negligible	< 11	< 5	Anti-aircraft artillery projectiles
2	Minor	> 11 to 33	> 5 to 15	Artillery projectiles
3	Moderate	> 33 to 110	> 15 to 50	Hedgehog
4	Severe	> 110 to 550	> 50 to 250	Depth charges, torpedoes, bombs
5	Catastrophic	> 550	> 250	Sea mine, torpedoes

Note: This table is to be used for a detonation on the seafloor when no personnel are in the water (e.g., no divers). The same net explosive weight may have differing severity grades depending on the situation (e.g., detonation in the water near divers, recovery of MEC and subsequent detonation on deck).

Source: BOEM, 2017

Table 10. Risk Assessment Matrix

Probability of Detonation Grade (Table 10)						
	81 to 100	**Low**	**Medium**	**High**	**Very High**	**Very High**
	61 to 80	**Low**	**Medium**	**High**	**Very High**	**Very High**
	41 to 60	**Low**	**Medium**	**Medium**	**High**	**Very High**
	21 to 40	**Low**	**Low**	**Medium**	**High**	**High**
	1 to 20	**Low**	**Low**	**Medium**	**Medium**	**High**
		Negligible	Minor	Moderate	Severe	Catastrophic
		1	2	3	4	5
		Severity of Detonation Effects Factor (Table 9)				

Source: BOEM, 2017

Table 11. MEC Risk Assessment Results for Project Area

Activity	Exposure Unit	MEC	Probability of Encounter (Table 5)	Sensitivity Factor (Table 6)	Activity Energy Factor (Table 7)	Probability of Detonation Grade (Pe*S*A)	Net Explosive Weight (lbs)	Severity of MEC Detonation Effects Factor (Table 9)	Risk[2]
Geophysical Survey	All	Artillery Projectiles	4	2	1	8	(≤120 mm) < 11	1	Low
			4	2	1	8	(6-in to 12-in) > 11 to 33	2	Low
			4	2	1	8	(16-in) > 33 to 110	3	Medium
		Practice Bombs	3	1	1	3	(Inert) < 11	1	Low
		Torpedoes	3	1	1	3	(Inert) < 11	1	Low
			3	3	1	9	>550	5	High
		Depth Charges	2	3	1	6	> 110 to 550	4	Medium
		Potential Unknown UXO[1]	3	4	1	12	>550	5	High
Geotechnical Survey	All	Artillery Projectiles	4	2	2	16	(≤120 mm) < 11	1	Low
			4	2	2	16	(6-in to 12-in) > 11 to 33	2	Low
			4	2	2	16	(16-in) > 33 to 110	3	Medium
		Practice Bombs	3	1	2	6	(Inert) < 11	1	Low
		Torpedoes	3	1	2	6	(Inert) < 11	1	Low
			3	3	2	18	>550	5	High
		Depth Charges	2	3	2	12	> 110 to 550	4	Medium
		Potential Unknown UXO[1]	3	4	2	24	>550	5	High
PLGR Operations	NYS – SR1, NYS – SR2, NYS – SR3, OCS – SR4, OCS – SR5, OCS – SR6, OCS – SR7, OCS – SR8, OCS – SR9, NYS – NR1, OCS – NR2, OCS – NR3, OCS – NR4, OCS – NR5, OCS – All	Artillery Projectiles	4	2	3	24	(≤120 mm) < 11	1	Low
			4	2	3	24	(6-in to 12-in) > 11 to 33	2	Low
			4	2	3	24	(16-in) > 33 to 110	3	Medium
		Practice Bombs	3	1	3	9	(Inert) < 11	1	Low
		Torpedoes	3	1	3	9	(Inert) < 11	1	Low
			3	3	3	27	>550	5	High
		Depth Charges	1	3	3	9	> 110 to 550	4	Medium
		Potential Unknown UXO[1]	1	4	3	12	>550	5	High

Activity	Exposure Unit	MEC	Probability of Encounter (Table 5)	Sensitivity Factor (Table 6)	Activity Energy Factor (Table 7)	Probability of Detonation Grade (Pe*S*A)	Net Explosive Weight (lbs)	Severity of MEC Detonation Effects Factor (Table 9)	Risk[2]
Cable Installation (Jetting or Concrete Mattress)	NYS – SR1, NYS – SR2, NYS – SR3, OCS – SR4, OCS – SR5, OCS – SR6, OCS – SR7, OCS – SR8, OCS – SR9, NYS – NR1, OCS – NR2, OCS – NR3, OCS – NR4, OCS – NR5, OCS – All	Artillery Projectiles	4	2	3	24	(≤120 mm) < 11	1	Low
			4	2	3	24	(6-in to 12-in) > 11 to 33	2	Low
			4	2	3	24	(16-in) > 33 to 110	3	Medium
		Practice Bombs	3	1	3	9	(Inert) < 11	1	Low
		Torpedoes	3	1	3	9	(Inert) < 11	1	Low
			3	3	3	27	>550	5	High
		Depth Charges	1	3	3	9	> 110 to 550	4	Medium
		Potential Unknown UXO[1]	1	4	3	12	>550	5	High
Cable Installation (Trenching or Ploughing)	NYS – SR1, NYS – SR2, NYS – SR3, OCS – SR4, OCS – SR5, OCS – SR6, OCS – SR7, OCS – SR8, OCS – SR9, NYS – NR1, OCS – NR2, OCS – NR3, OCS – NR4, OCS – NR5, OCS – All	Artillery Projectiles	4	2	4	32	(≤120 mm) < 11	1	Low
			4	2	4	32	(6-in to 12-in) > 11 to 33	2	Low
			4	2	4	32	(16-in) > 33 to 110	3	Medium
		Practice Bombs	3	1	4	12	(Inert) < 11	1	Low
		Torpedoes	3	1	4	12	(Inert) < 11	1	Low
			3	3	4	36	>550	5	High
		Depth Charges	1	3	4	12	> 110 to 550	4	Medium
		Potential Unknown UXO[1]	1	4	4	16	>550	5	High

Activity	Exposure Unit	MEC	Probability of Encounter (Table 5)	Sensitivity Factor (Table 6)	Activity Energy Factor (Table 7)	Probability of Detonation Grade (Pe*S*A)	Net Explosive Weight (lbs)	Severity of MEC Detonation Effects Factor (Table 9)	Risk[2]
Cable Installation (Armoring with Rock)	NYS – SR1, NYS – SR2, NYS – SR3, OCS – SR4, OCS – SR5, OCS – SR6, OCS – SR7, OCS – SR8, OCS – SR9, NYS – NR1, OCS – NR2, OCS – NR3, OCS – NR4, OCS – NR5, OCS – All	Artillery Projectiles	4	2	4	32	(≤120 mm) < 11	1	Low
			4	2	4	32	(6-in to 12-in) > 11 to 33	2	Low
			4	2	4	32	(16-in) > 33 to 110	3	Medium
		Practice Bombs	3	1	4	12	(Inert) < 11	1	Low
		Torpedoes	3	1	4	12	(Inert) < 11	1	Low
			3	3	4	36	>550	5	High
		Depth Charges	1	3	4	12	> 110 to 550	4	Medium
		Potential Unknown UXO[1]	1	4	4	16	>550	5	High
Installation of Scour Protection Systems	SFWF Work Area	Artillery Projectiles	1	2	4	8	(≤120 mm) < 11	1	Low
			1	2	4	8	(6-in to 12-in) > 11 to 33	2	Low
			1	2	4	8	(16-in) > 33 to 110	3	Medium
		Practice Bombs	1	1	4	4	(Inert) < 11	1	Low
		Torpedoes	1	1	4	4	(Inert) < 11	1	Low
			1	3	4	12	>550	5	High
		Depth Charges	2	3	4	24	> 110 to 550	4	High
		Potential Unknown UXO[1]	2	4	4	32	>550	5	High
Installation of Monopiles or Foundations	SFWF Work Area	Artillery Projectiles	1	2	5	10	(≤120 mm) < 11	1	Low
			1	2	5	10	(6-in to 12-in) > 11 to 33	2	Low
			1	2	5	10	(16-in) > 33 to 110	3	Medium
		Practice Bombs	1	1	5	5	(Inert) < 11	1	Low
		Torpedoes	1	1	5	5	(Inert) < 11	1	Low
			1	3	5	15	>550	5	High
		Depth Charges	2	3	5	30	> 110 to 550	4	High
		Potential Unknown UXO[1]	2	4	5	40	>550	5	High

Note:
[1] Includes sea mines
[2] Source: BOEM, 2017

Filename: C:\Users\Christina Anderson\Documents\HANA\GIS\RI-MA Offshore Wind Farm\MXDs\DRAFT MEC DTS\Figure 6 Exposure Units.mxd

Legend

Proposed Survey Areas

- OCS-A 0486 Lease Area
- SFWF Work Area
- MEC Study Area
- MEC Study Area 5-Mile Buffer
- South Fork Export Cable OCS (SFEC OCS)
- South Fork Export Cable NYS (SFEC NYS)
- Danger Zones
- Exposure Units
- UXO and Dumping Grounds (NOAA)

N

Unexploded Depth Charge
Dumping Ground
Unexploded Ordnance
Unexploded Depth Charge
Unexploded Depth Charge
Unexploded Depth Charges
Unexploded Depth Charge
Unexploded Ordnance
OCS-A 0486 Lease Block
Unexploded Bombs
Unexploded Ordnance
Unexploded Ordnance
Unexploded Torpedo
SFWF
OCS - All
OCS - SR9
OCS - SR8
OCS - SR7
OCS - SR6
OCS - SR5
OCS - SR4
Unexploded Ordnance
Unexploded Torpedo
Unexploded Depth Charge
Unexploded Bomb
Dumping Ground
Danger Zone
OCS - NR2
OCS - NR3
OCS - NR4
OCS - NR5
NYS - NR1
NYS – SR2 (Napeague Lane)
NYS – SR3 (Hither Hills)
NYS - SR1 (Beach Lane)
Dumping Ground

Buzzards Bay
Vineyard Sound
Nantucket Sound
Rhode Island Sound
Block Island Sound
Middle Shoal Rock

0 5 10 20 Miles

Exposure Units
Project No: 64529
Date: May 2018

MEC DESKTOP STUDY
BOEM LEASE OCS-A 0486

HANA ENGINEERS & CONSULTANTS, LLC

Figure: 6

5.0 Conclusions and Recommendations

The MEC Study Area includes the SFWF Work Area, the North Lease Reconnaissance Survey Area, the two SFEC alternative route corridors, and the adjacent waters. In total, this area encompasses 2,416,349 acres (9,779 square kilometers). Numerous historical and current military use areas are located off the Atlantic Coast within the MEC Study Area. While none of the military sites are located within the OCS-A 0486 Lease Area, several sites, including their respective danger zones, are located within the SFEC route alternatives. These historical military sites were used for coastal defense during WWII and included multiple large gun batteries (up to 16-inch guns), a practice bombing range, and a torpedo testing area. These operations had the potential to release large munitions into the nearby waters, including the SFEC routes. In addition, there are numerous other military sites located within the MEC Study Area where firing and other activities could have deposited MEC into these waters. Over time these projectiles could have been transported across the sea floor into the Project Area. There is significant uncertainty regarding the overall distribution of MEC within the study are, including types, quantities and location.

As shown on **Table 11**, there is a risk posed by the potential presence of MEC. There is clearly some potential for MEC items to be present within the SFEC routes. The probability of a MEC item detonating is also uncertain, but it must be conservatively assumed that any explosive item could detonate through impact with installation equipment. The consequences of a detonation range from minor to catastrophic, depending on the depth and net explosive weight of the item. Large caliber HE projectiles including 90mm, 120mm, 6-inch, 8-inch, 12-inch, and 16-inch projectiles are known to have been fired in the area. In addition, unexploded depth charges, torpedoes, and unidentified UXO, which have severe to catastrophic detonation consequences, have been documented within the MEC Study Area. Based on these considerations, additional measures are recommended to further assess and mitigate the hazard from potential MEC. The MEC Risk Assessment methodology dictates that the overall risk is more influenced by the severity of the potential consequence than the probability of encounter.

Based on the results of this DTS, recommendations for additional characterization of the cable routes and SFWF are provided below:

1) Development of a Munitions Survey Plan (MSP) as part of an overall risk management plan for the construction of the SFWF area and SFEC routes.
   a) Consider performing a geophysical survey in select areas. Perform a geophysical survey in select areas, including the use of side scan sonar, electromagnetic (EM) and magnetometer/gradiometer surveys to identify targets and their distribution within the area. There is no readily available documentation of systematic removal of MEC in the Study Area so MEC encounters should be expected. A geophysical survey is a prudent method to minimize these encounters. The geophysical survey should be designed to detect all MEC shown in **Table 11** as having a medium to

high overall risk at a minimum. This includes 16-inch projectiles, torpedoes, depth charges and potential unknown UXO in the SFEC route (exposure units OCS-SR4, OCS-SR6, OCS-SR7, OCS-SR8, and OCS-SR9) and the SFWF Work Area.

b) If warrented based on geophysical survey results, consider performing video inspection of select targets. Video inspection by Remotely Operated Vehicles (ROVs) can be useful in determining if a target is MEC related and in assessing the condition of the item.
c) Based on the results of the geophysical survey and video inspection, consider diving with trained UXO divers to inspect a prioritized list of potential MEC targets. UXO trained divers can be useful in classifying MEC items, evaluating their condition and determining appropriate response actions.

Regardless of the results of any geophysical survey or inspection, some potential for explosive hazard will remain, as it relates to intrusive activities associated with the SFWF and SFEC installation. Therefore, the following is recommended with regards to further mitigating risk from MEC during SFWF and SFEC installation.

1) Routing of the cable corridor to avoid MEC hazards, where feasible. Geophysical survey data can be used to reposition and “steer” construction activities away from potential MEC items.
2) Consideration of construction and cable installation procedures that can reduce the explosive hazard posed by MEC such as mapping and removal.
3) Development of a munitions response plan, in the event MEC items are encountered during construction. This may include having UXO Technicians available to respond and safely address the hazard through controlled detonation or removal. It is possible for MEC to become lodged in subsurface equipment that is later transported to the surface/deck creating a high hazard situation. Deck hands should be trained in basic MEC recognition but this in no way should be substituted for full time, on board UXO Technician support.

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APPENDIX A

REFERENCE DOCUMENTS

(provided electronically)