OCS-A 0501

MASS USA

VINEYARD WIND

Draft Construction and Operations Plan

Volume I

Vineyard Wind Project

September 30, 2020

Submitted by
Vineyard Wind LLC
700 Pleasant Street, Suite 510
New Bedford, Massachusetts 02740

Submitted to
Bureau of Ocean Energy Management
45600 Woodland Road
Sterling, Virginia 20166

Prepared by
Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, Massachusetts 01754

Epsilon ASSOCIATES INC.

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Submitted to:

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In Association with:

Baird & Associates
Biodiversity Research Institute
C2Wind
Capitol Air Space Group
Clarendon Hill Consulting
Ecology and Environment
Foley Hoag
Geo SubSea LLC
Gray & Pape
JASCO Applied Sciences
Morgan, Lewis & Bockius LLP
Public Archaeology Laboratory, Inc.
RPS
Saratoga Associates
Swanson Environmental Associates
Wood Thilsted Partners Ltd
WSP

September 30, 2020

Appendix I-A

Draft Oil Spill Response Plan

DRAFT

OIL SPILL RESPONSE PLAN

for

VINEYARD WIND, LLC

New Bedford, Massachusetts

July 2018

(WTG oil quantities updated January 31, 2020)

A Response Plan Cover Sheet, presenting basic information regarding the Project is provided below:

Response Plan Cover Sheet

Owner/operator of facility:	**Vineyard Wind, LLC**		
Facility name:	**Vineyard Wind**		
Facility mailing address:	**700 Pleasant Street, Suite 510, New Bedford, MA 02740**		
Facility phone number:	**(508) 717-8964**	Latitude:	**N 41.171**
SIC code:	**4911**	Longitude:	**W -70.503**
Dun and Bradstreet number:			
Largest aboveground oil storage capacity (gals):	**76,994 (power transformer)**	Maximum oil storage capacity (gals):	**124,097 (per ESP)**
Number of aboveground oil storage tanks:	**(day tanks and diesel tank)**	Worst case oil discharge amount (gals):	**124,097**

Facility distance to navigable water. Mark the appropriate line:

0-1/4 mile: **X**		1/4-1/2 mile:		1/2-1 mile		> 1 mile:	

Applicability of Substantial Harm Criteria:				
Does the facility transfer oil over water to or from vessels and does the facility have a total oil storage capacity greater than or equal to 42,000 gallons?	**YES**	**X**	NO	
Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and, within any storage area, does the facility lack secondary containment that is sufficiently large to contain the capacity of the largest aboveground oil storage tank plus sufficient freeboard to allow for precipitation?	YES		**NO**	**X**
Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance such that a discharge from the facility could cause injury to fish and wildlife and sensitive environments?	**YES**		**NO**	**X**
Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance such that a discharge from the facility would shut down a public drinking water intake?	YES		**NO**	**X**
Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and has the facility experienced a reportable oil spill in an amount greater than or equal to 10,000 gallons within the last 5 years?	YES		**NO**	**X**

Management Certification

This plan has been developed for the Project to prevent and/or control the spills of oil. Vineyard Wind, LLC herein commits the necessary resources to fully prepare and implement this plan and has obtained through contract the necessary private personnel and equipment to respond, to the maximum extent practicable, to a worst-case discharge or substantial threat of such a discharge.

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and that based on my inquiry of those individuals responsible for obtaining information, I believe that the submitted information is true, accurate and complete.

Signature: ______________________ Title: ______________________

Name: ______________________ Date: ______________________

Plan Distribution

Plan Number	Plan Holder	Location
1	Qualified Individual	
2	Alternate Qualified Individual	
3	Alternate Qualified Individual	
4	Alternate Qualified Individual	
5	Operation Center	
6	BOEM Gulf of Mexico OCS and Atlantic Activities	1201 Elmwood Park Boulevard New Orleans, LA 70123-2394
7	EPA Region 1	EPA Region 1 Emergency Planning and Response Branch 5 Post Office Square Suite 100 (OSRR02-2) Boston, MA 02114-2023
8	USCG D1	USCG D1 408 Atlantic Avenue Boston, MA 02110

30 CFR 254.30(a): Biennial OSRP Review

Date	Name of Reviewer &Title	Signature

30 CFR 254.30(b): Revision Record

Revision Number	Revision Date	Pages and/or Sections Affected	Description of Revision

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List of Acronyms

ACP	Area Contingency Plan
AQI	Alternate Qualified Individual
Bbls	Barrels
BOEM	Bureau of Ocean Energy Management
BSSE	Bureau of Safety and Environmental Enforcement
COP	Construction and Operations Plan
CFR	Code of Federal Regulations
CTV	Crew Transport Vessels
EHS	Environmental, Health, and Safety
EMS	Emergency Management Services
EPA	Environmental Protection Agency
ERT	Emergency Response Team
ESI	Environmental Sensitivity Index
ESP	Electrical service platform
FOSC	Federal On-Scene Coordinator
ICO	Incident Command Organization
ICS	Incident Command System
JIC	Joint Information Center
kV	Kilovolt
LEPC	Local Emergency Planning Committee
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
MEMA	Massachusetts Emergency Management Agency
MOU	Memorandum of Understanding
MVY	Airport code for Martha's Vineyard Airport
MW	Megawatt
NCP	National Contingency Plan
NHESP	National Heritage and Endangered Species Program
NIIMS	National Interagency Incident Management System
NOAA	National Oceanic & Atmospheric Administration
NRC	National Response Center
NWR	NOAA Weather Radio
NWS	National Weather Service
OCS	Outer Continental Shelf
OHM	Oil and Hazardous Materials

O&M	Operation and Maintenance
OPA	Oil Pollution Act of 1990 (Public Law 101-380)
OSHA	Occupational Safety & Health Administration
OSPD	Oil Spill Preparedness Division
OSRO	Oil Spill Response Organization
OSRP	Oil Spill Response Plan
PPA	Power Purchase Agreements
PPE	Personal Protective Equipment
PREP	Preparedness for Response Exercise Program
QI	Qualified Individual
RCRA	Resource Conservation & Recovery Act
REPC	Regional Emergency Planning Committee
RFP	Request for Proposal
RI	Rhode Island
RQ	Reportable Quantity
RRT	Regional Response Team
SDS	Safety Data Sheet
SERC	State Emergency Response Commission
SERO	Southeast Regional Office of Massachusetts Department of Environmental Protection
SOV	Service Operations Vessel
SPCC	Spill Prevention Countermeasures and Control
TBD	To Be Determined
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
Vol	Volume
WCD	Worst Case Discharge
WTG	Wind Turbine Generators

1. Plan Introduction Elements

1.1 Purpose and Scope of Plan Coverage

This Oil Spill Response Plan (OSRP) has been prepared for Vineyard Wind, LLC for the development of "the Project". The Project is located in the Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0501, which is located approximately 14.4 miles south of Martha's Vineyard, a Massachusetts island located approximately 4 miles from mainland Massachusetts. The Project is an 800 MW project that consists of wind turbine generators (WTGs) and associated foundations, onshore work, inter-array and inter-link cables, export cables, and either one 800 MW electrical service platform (ESP) or two 400 MW ESPs. Oil sources in the WTGs include gear boxes, transformers, yaw gears, grease for yaw rings, and the pitch system, which total approximately 4,887 gallons per WTG. Oil sources in the ESPs include lubrication oil, diesel tanks, hydraulic oil for a platform crane, power transformers, reactors, and auxiliary/earthing transformers. Oil sources presented in this document are associated with the single largest ESP, which is the 800 MW ESP. The oil sources associated with one 800 MW ESP total approximately 124,097 gallons.

The Project is located in the Outer Continental Shelf (OCS), as defined by 30 CFR 254.6 and Section 2 of the Submerged Lands Act (43 U.S.C. 1301). Therefore, this plan has been written in accordance with the requirements of 30 CFR Part 254, Subpart B, Oil Spill Response Plans for Outer Continental Shelf Facilities. In accordance with 30 CFR 254, the OSRP demonstrates that Vineyard Wind can respond effectively in the unlikely event that oil is discharged from the Project. Please note that U.S. Environmental Protection Agency's (EPA) Spill Prevention, Control, and Countermeasure (SPCC) requirements in 40 CFR §112 is only required for offshore facilities if they are classified as "oil drilling, production, or workover facilities". Therefore, an SPCC Plan is not required for the Project. In addition, the Commonwealth of Massachusetts does not require planning and response submittals for review and approval with regards to offshore oil.

The purpose of this plan is to provide a written procedure for directing a plan of action in the event of a release or discharge of oil at the Project. The release or discharge may be the result of a spill, accident, natural disaster, or civilian threat. This OSRP adopts procedures to allow for a uniform plan of action that will assist in a systematic and orderly manner of response to the incident. This plan of action will minimize confusion and indecision, prevent extensive damage to the Project or injury to personnel, and minimize exposure to personnel within or outside of the Project. Routine training and exercises regarding the content of this plan will provide the confidence needed for employees to perform their assigned duties if such an event occurs. A designated Qualified Individual (QI) and Alternate Qualified Individuals (AQI) are considered Emergency Coordinators. Personnel, through the use of this plan, will utilize all resources necessary to bring any release under control. In order to prepare for such control, all personnel will be well trained and knowledgeable as to their various roles during a release.

The OSRP has been prepared considering the National Oil and Hazardous Substances Contingency Plan (40 CFR §300) commonly called the National Contingency Plan or NCP, and the Standard Federal Region I Response Team (RRT) Regional Oil and Hazardous Substances Pollution Contingency Plan, which is the ACP. The Regional Oil and Hazardous Substances Pollution Contingency Plan is available at: https://www.nrt.org/sites/38/files/2016%20Regional%20Contingency%20Plan%20Region%201.pdf.

The OSRP is consistent with these plans in that it provides a method/process for communication, coordination, containment, removal, and mitigation of pollution and other emergencies. The preparation of this plan utilized the detailed information and support on local environmental information provided in the RRT plan. The specific guidelines presented in this plan have been carefully thought out, prepared in accordance with safe practices, and are intended to prepare personnel to respond to oil spills and other environmental emergencies. This plan has the full approval of Management at a level of authority to commit the necessary resources to implement this plan.

Specifically, this plan:

- Identifies the Qualified Individuals (QI) or Person in Charge having full authority to implement this response plan;
- Requires immediate communication with the appropriate Federal, state and local officials, and entities/persons providing personnel and equipment;
- Identifies, and ensures by contract or other means, the availability of personnel and equipment necessary to remove a worst-case discharge (WCD) and mitigate or prevent a substantial threat of such a discharge; and
- Describes training, equipment testing, periodic unannounced drills, and response actions.

1.2 Regulatory Applicability

The National Contingency Plan and the Standard Federal Region I Response Team (RRT) Regional Oil and Hazardous Substances Pollution Contingency Plan have been reviewed and this plan was written to comply with the Federal Oil Pollution Act of 1990.

1.3 General Facility Information

The Project is located on property in the Outer Continental Shelf (OCS) leased from the BOEM's WEA, which has been identified as Vineyard Wind Lease Area OCS-A-501. The Lease Area is located approximately 14.4 miles south of the island of Martha's Vineyard, which is located approximately 4 miles off of the southeastern coast of mainland Massachusetts. The Project is depicted in Figure A1-1 through A1-4 (Annex 1). The mailing address of the Project is 700 Pleasant Street, Suite 510, New Bedford, Massachusetts.

The Project consists of wind turbine generators (WTGs) and associated foundations, onshore work, inter-array and inter-link cables, export cables, wind turbines, and electrical service platforms (ESPs). Oil sources in the WTGs include gear boxes, transformers, yaw gears, grease for yaw rings, and the pitch system and total approximately 4,887 gallons per WTG. Oil sources in the ESPs include lubrication oil, diesel tanks, hydraulic oil for a platform crane, power transformers, reactors, and auxiliary/earthing transformers. Oil sources associated with one 800 MW ESP total approximately 124,097 gallons.

Table 1-1 provides general information for the Project as it pertains to planning for potential spills. Annexes 1, 3, and 7 provide discussion of facility operations in greater detail regarding equipment description, drainage, secondary containment and emergency planning scenarios.

1.4 Plan Review and Revision

The July 2018 version of the OSRP is a draft working copy. Additional details will be provided for the OSRP as the size and buildout schedule of the Project are finalized.

In accordance with 30 CFR §254.30, the OSRP must be reviewed at least every two years. Documentation of this review will be provided in the Review Table presented at the front of this OSRP. If the review does not result in modifications to the OSRP, the Chief of the Bureau of Safety and Environmental Enforcement (BSEE), and agency of the US Department of the Interior, should be notified that there are no changes. The BSEE Oil Spill Preparedness Division (Chief, OSPD) or designee must be notified in writing.

The OSRP must be modified and submitted to the Chief, OSPD for approval within 15 days when the following occurs:

- A change occurs which significantly reduces response capabilities;
- A significant change occurs in the worst-case discharge scenario or in the type of oil being handled, stored, or transported at the facility;
- There is a change in the name(s) or capabilities of the oil spill removal organizations cited in the OSRP;
- There is a significant change to the Area Contingency Plan(s) for the region; or
- The Chief, OSPD, requires that you resubmit your OSRP if it has become outdated, numerous revisions have made its use difficult, or if the OSRP has significant inadequacies.

Table 1-1 Facility Summary Information

Facility Owner	Vineyard Wind, LLC
Facility Name	Vineyard Wind
Facility Mailing Address	700 Pleasant Street Suite 510 New Bedford, MA 02740
Facility Qualified Individual	Person X
Facility Phone Number	(508) 717-8964 (New Bedford office)
E-mail Address	info@vineyardwind.com
Latitude	N 41.171
Longitude	W -70.503
SIC Code	4911
Wind Turbine Generators (WTGs)	• WTGs will range from 8 to ~14 MW. • Largest oil source in the WTGs is the gearbox/main bearings: 2,113 gallons • Total oil storage is 4,887 gallons • WTGs are equipped with secondary containment which is sized according with the largest container.
Electrical Service Platforms (ESPs): Emergency Generators	• Emergency Generators contain diesel day tanks and lubrication oil totaling 1,018 gallons • Largest oil source in the generator is the diesel day tank: 1,004 gallons.
ESP: Diesel Tank	• Diesel storage tank: 4,463 gallons
ESP: Transformers	• ESP will have power transformers and auxiliary/earthing transformers • Total oil storage is 79,226 gallons • Largest oil source is power transformers: 76,994 gallons
ESP: Reactors	• Reactors: 39,055 gallons
ESP: Other	• Hydraulic oil for platform crane: 174 gallons
Operation and Maintenance Center	• Vineyard Haven and/or New Bedford
Materials Stored / Oil Storage Start-Up Date	Petroleum Oil / Proposed 2022
Worst-Case Discharge Volume[1]	124,097 gallons
Maximum Most Probable Discharge Volume (USCG) [2]	12,410 gallons
Average Most Probable Discharge Volume (USCG) [2]	1,241 gallons
Oil Spill Response Organization (OSRO)	TBD

***Notes:**

1. Criteria established in 30 CFR 254.26 is for oil production platform facilities and pipeline facilities only. RPS has contacted BSEE for guidance regarding determining the worst-case discharge volume.

2. Definitions in 33 CFR 155.1020 are based percentage of cargo from a vessel during oil transfer operation

2. Core Plan Elements

2.1 Discovery and Initial Response

Detection of a spill or emergency is the first step in a response. There are several methods by which an emergency situation at the Project may be discovered including the following:

- Reported by company personnel;
- Abnormal operating conditions observed by operator; or
- Reported by private citizens or by public officials.

In every case it is important to collect accurate information and immediately notify the On-Duty Supervisor and any affected area personnel.

Initial response will take place as indicated in Table 2-1 Initial Response Actions Checklist. The Initial Notification Data Sheet Form (Annex 4**)** will be completed by the On-Duty Supervisor while discussing the incident when it is initially reported by the person detecting the spill/release. Information not immediately known may be added to the form as it becomes available.

The On-Duty Supervisor will notify the Qualified Individual (QI) or Alternate immediately upon receiving notification of an emergency event. The QI or his designee will make notifications as discussed in Section 2.2 to Federal, state and local agencies (Figure 2-1 and Table 2-3) immediately and shall assure that all required documentation is kept.

When making the initial notifications to the On-Duty Supervisor and affected personnel, one should attempt to provide the following information:

- Name of caller and callback number;
- Exact location and nature of the incident (e.g., fire, release);
- Time of incident;
- Name and quantity of material(s) involved, or to the extent known;
- The extent of personal injuries, damage and/or fire, if any;
- The possible hazards to human health, or the environment, outside the facility;
- Body of water or area affected;
- Quantity in water (size and color of slick or sheen) or amount released to the land or atmosphere;
- Present weather conditions–wind speed and direction, movement of slick or sheen, current/tide;
- Potential for fire; and
- Action being taken to control the release.

A log should be maintained which documents the history of the events and communications that occur during the response. See Annex 4 for form. It is important to remember that the log may become instrumental in legal proceedings, therefore:

- Record only facts, do not speculate.
- Do not criticize the efforts and/or methods of other people/operations.
- Do not speculate on the cause of the spill.
- If an error is made in an entry, do not erase; draw a line through it, add the correct entry above or below it and initial the change.

- Always evaluate safety throughout the response actions.

Table 2-1 Initial Response Checklist

Action	Comments
First Person on Scene	
Take personal protective measures (PPE) and/or distance.	
Identify and control source if possible (close valve, turn off pump, blind the flange). Eliminate ignition sources.	
Notify the On-Duty Supervisor.	
Notify the affected personnel of the incident.	
Warn personnel in the area and enforce safety and security measures.	
If possible, implement countermeasures to control the emergency. If personal health and safety is not assured, do not attempt to reenter the emergency site.	
Designate a staging area where the Emergency Response personnel and equipment can safely report to without becoming directly exposed to the emergency release (until QI arrives).	
On-Duty Supervisor	
Activate local alarms and evacuate non-essential personnel.	
Notify QI.	
Initiate defensive countermeasures and safety systems to control the emergency (booms, sorbent material, loose dirt, sandbags, or other available materials). Eliminate ignition sources.	
Initiate Emergency Response notification system.	
Dispatch response resources as needed.	
Monitor and or facilitate emergency communications until QI arrives.	
Keep the public a safe distance from the release.	
Qualified Individual (QI) or Designee	
Notify Federal, state and local agencies.	
Establish On-Scene Command and respond to the Command Post.	
Assess situation and classify incident.	
Perform air monitoring surveys prior to entering a release area.	
Determine extent and movement of the release.	
Identify sensitive areas and determine protection priorities.	
Request additional or specialized response resources.	
Establish Isolation Zones (Hot, Warm, Cold) and Direct On-Scene Response Operations.	
Coordinate initial regulatory notifications and external contacts.	
Keep the public a safe distance from the release.	

2.2 Notifications

2.2.1 Internal Notifications

The individual discovering the spill will call the On-Duty Supervisor immediately and report initial facts about the incident. The On-Duty Supervisor will record the facts (see forms in Annex 4) and immediately (within 15 minutes) notify the Qualified Individual (QI). Table 2-2 lists the QIs and their 24-hour contact information.

Table 2-2 Qualified Individuals

Name	Position	Cell	Email
Person A	Qualified Individual, Title	(XXX) XXX-XXXXX	XXX@XXX.com
Person B	Alternate Qualified Individual, Title	(XXX) XXX-XXXX	XXX@XXX.com
Person C	Alternate Qualified Individual, Title	(XXX) XXX-XXXX	XXX@XXX.com
Person D	Alternate Qualified Individual, Title	(XXX) XXX-XXXX	XXX@XXX.com
The Qualified Individual or designated alternate on duty will be available 24-hours per day and capable of arriving to the Project in a reasonable amount of time after contacting (typically within 1 hour).			

2.2.2 External Notifications

External notifications to agencies are required for:

- Spills of 10 gallons or greater on land; and
- Any size oil spill on water or on land with a threat to impact water (i.e., Atlantic Ocean, wetlands).

For initial determination of external notifications follow the steps in Figure 2-1. **Please note that the initial calls to USCG must be made within the first hour of discovering a reportable spill. Initial calls to MassDEP must be made within two hours of discovery of a release.** Follow-up calls to agencies can be provided as more information is obtained.

The QI or designee will make all initial and follow-up federal, state, and local agency notifications. Use forms provided in Annex 4 to document details of notifications and ensure accurate information is being passed along. For follow-up purposes, agency specific phone numbers are provided in Table 2-3 as well as the requirements for notifications, additional phone numbers are provided in Annex 2. It is recommended that a courtesy call be placed to the appropriate agency in order to establish proper lines of communication if warranted by the situation.

There are a number of other contacts that must be made if the incident is of a magnitude that requires them, and they may include:

- Massachusetts Department of Environmental Protection (MassDEP);
- Emergency Medical Personnel;
- Oil Spill Response Organizations (OSROs) available 24/7;
- OSHA (if death or 3 personnel injuries result in hospitalization); and

- Wildlife rehabilitation personnel if wildlife affected.

Contact information for these entities and others are included in Annex 2**.**

In the event that public notification of a spill is required, as deemed necessary by the Federal On-Scene Coordinator (FOSC), be prepared to discuss the following:

- The nature and extent of the economic losses that have occurred or are likely to occur;
- The persons who are likely to incur economic losses;
- The geographical area that is affected or is likely to be affected;
- The most effective method of reasonably notifying potential claimants of the designated source; and
- Any relevant information or recommendations.

Figure 2-1 External Notification Flowchart

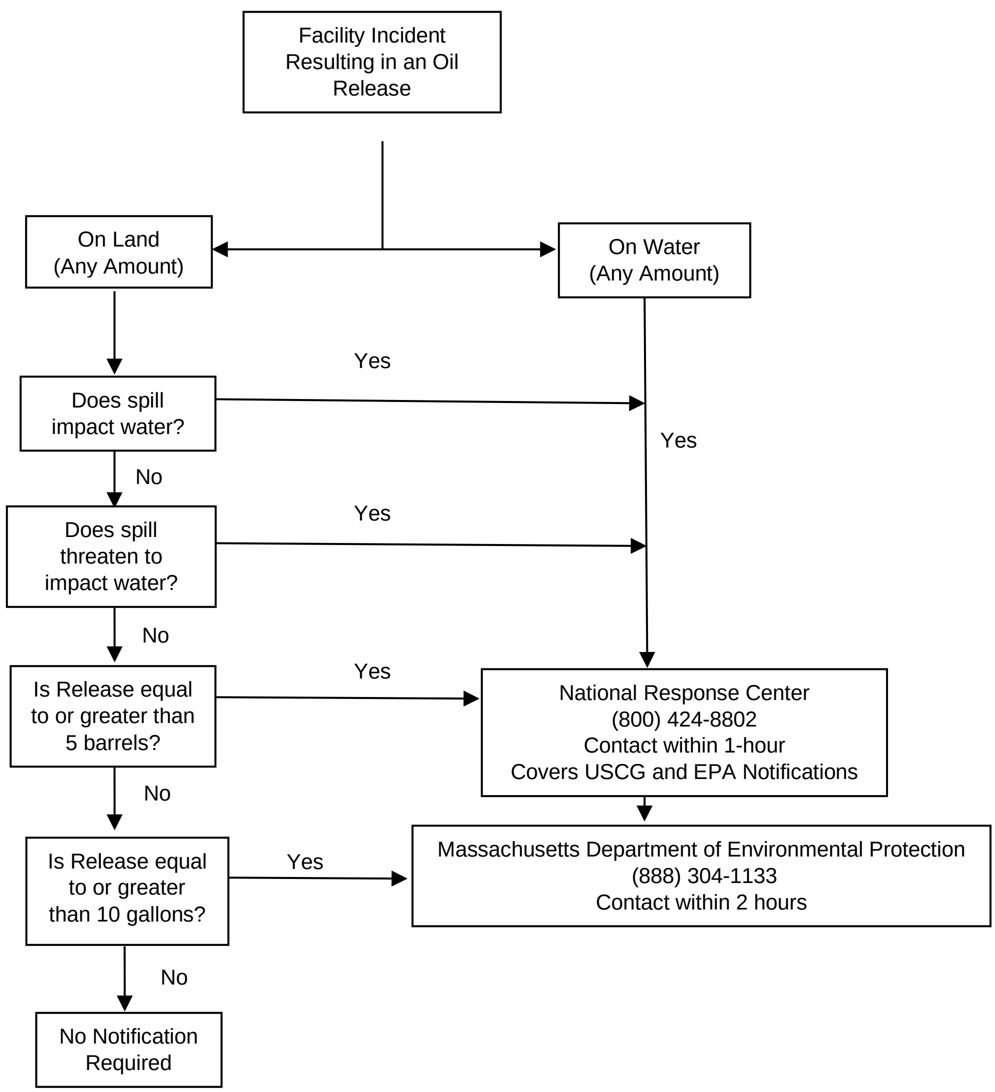

Table 2-3 Initial Agency Notifications

Agency	Phone	Requirements for Notifications
Federal Agencies		
National Response Center (NRC)	(800) 424-8802 (serves to notify EPA and USCG)	Immediate notification (less than one hour) is required for all discharges of oil sufficient to produce a sheen on navigable waters of the United States.
EPA Region 1	(888) 372-7341 or (617) 918-1251	The EPA must be notified through the NRC for all oil discharges into inland navigable waters of the U.S. sufficient to create a sheen. A written report is not required. If the facility has discharged more than 1,000 gallons of oil in a single discharge or more than 42,000 gallons of oil in each of two discharges occurring within any twelve month period, the following must be submitted to EPA within 60 days: name of facility; name of reporting party; location of facility; maximum storage or handling of the facility and normal daily throughput; corrective action and countermeasures that have been taken, including a description of equipment repairs and replacements; adequate description of the facility, including maps, flow diagrams, and topographical maps; the cause of such discharge as including a failure analysis of the system or subsystem in which the failure occurred, additional preventive measures that have been taken or contemplated to minimize the possibility of recurrence and such other information as the EPA may reasonably require pertinent to the Plan or discharge.
USCG	(617) 223-4812 or (617) 406-9011	The USCG must be notified via the NRC for all oil discharges into coastal navigable waters of the U.S. sufficient to create a sheen. A written report is not required.
OSHA	(617) 565-9860	OSHA must be notified by telephone if an accident occurred which caused a death, or three personnel injuries which required hospitalization.
Bureau of Safety and Environmental Enforcement (BSEE)	(504) 736-2595 or (504) 400-7836	Documentation of the biennial review must be submitted to the BSEE Oil Spill Preparedness Division (Chief, OSPD) or designee in writing. If the OSRP must be modified, it must be submitted to the Chief, OSPD for approval within 15 days.
State Agencies		
Massachusetts Department of Environmental Protection (MassDEP)	(888) 304-1133	Immediate notification (less than two hours) is required for all discharges of oil to water and any spill equal to or greater than 10 gallons on land. In addition, the local fire department should be notified, if applicable.
Local Authorities		
Barnstable County REPC	(508) 375-6908	Contact for any release, fire, or explosion which could threaten human health, or the environment for Nantucket island.
Dukes County REPC	(508) 696-4240	Contact for any release, fire, or explosion which could threaten human health, or the environment for Martha's Vineyard.
Contact information for additional agencies or services that may become involved in an incident is provided in Annex 2.		

2.3 Establishment of a Response Management System

The Qualified Individual (QI) at the facility will initially be the incident commander during any spill. As the incident escalates, more personnel will be called in to form the Incident Command System (ICS). The National Interagency Incident Management System (NIIMS) will be used by the facility, in concert with OSROs and federal, state, and local agencies. An outline of the ICS can be found in Annex 3.

The designated QI or AQI for the Project is English-speaking, located in the United States, available on a 24-hour basis, familiar with implementation of this response plan, and trained in their responsibilities under the plan. The QI or designated AQI has full written authority to implement this response plan, including:

(1) Activating and engaging in contracting with identified oil spill removal organization(s);
(2) Acting as a liaison with the pre-designated Federal On-Scene Coordinator; and
(3) Obligating, either directly or through prearranged contracts, funds required to carry out all necessary or directed response activities.

2.3.1 Preliminary Assessment

After initial response has been taken to stop further spillage and notifications made to the required agencies further spill containment, recovery and disposal operations can begin. It is important to first identify the magnitude of the problem and resources threatened. The QI or designee will:

1. Classify the type and size of spill (see Figure 2-2).
2. Determine chemical and physical properties of spilled material for potential hazards (see Annex 10, Safety Data Sheets - SDS).
3. Obtain on-scene weather forecast such as wind speed, wind direction and tide schedules (12, 24, 48 and 72-hour).
4. Track oil movement or projected movement. Consider need for over flights.
5. Continuously assess human health and environmental concerns.
6. Determine extent of contamination and resources threatened (i.e., waterways, wildlife areas, economic areas).
7. Start chronological log of the incident.

Incident classifications, or levels, are used to quickly categorize the appropriate level of response, notifications, and resources which may be necessary to mitigate the emergency. The incident will be categorized based upon the nature of the incident, degree of containment and isolation, materials involved or size of the release, and any other additional information provided by the person reporting the release. Incident levels may be upgraded or downgraded from the initial determination if the call-in classification was inaccurate or the situation changes. The Incident Classification levels are presented in Figure 2-2.

Based on the preliminary assessment, additional clean-up personnel and equipment will be dispatched to the site and deployed to control and contain the spill.

Figure 2-2 Guidelines for Determining Incident Classification

Level 1 – Minimal danger to life and property and the environment. Project personnel are capable of responding to the incident. The problem is limited to the immediate work area or release site and spills are generally less than 55 gallons.

Level 2 – Serious situation or moderate danger to life, property, and the environment. The problem is currently limited to the Project Area, but does have the potential for either involving additional exposures or migrating offsite. The incident could involve a large spill of oil, a fire, and loss of electrical power.

Level 3 – Crisis situation or extreme danger to life, property, and the environment. The problem cannot be brought under control, goes beyond the Project Area, and/or can impact public health and safety, and the environment, or a large geographic area for an indefinite period of time. Such incidents include a vessel fire or release of oil in a volume that can impact surrounding areas.

2.3.2 Establishment of Objectives and Priorities

Emergency conditions will be managed in a controlled manner, and oil release response operations will be conducted with the following objectives:

1. Continuously assess personnel safety.
2. Secure or isolate the source.
3. Contain the release.
4. Protect sensitive areas.
5. Coordinate response actions and customize response organization to situation.
6. Think ahead and anticipate needs.
7. Recover product.
8. Document incident.

During a major oil spill, resource, time, and various response constraints may limit the amount of areas that can be immediately protected. Every attempt should be made to prevent impacts to areas surrounding a spill site.

The Project is located in the OCS. The island of Martha's Vineyard, which is the closest land mass, is located approximately 14.4 miles north of the Project. Martha's Vineyard is comprised of six towns and a sovereign tribal nation. The towns of Chilmark, West Tisbury, and Edgartown are located on the southern portion of the island. Resources of special economic or environmental importance located on the southern portion of Martha's Vineyard include:

- Public drinking water well and distribution systems;
- Primary schools located in Chilmark, West Tisbury, and Edgartown;
- Squibnocket Beach, Lucy Vincent Beach, Long Point Beach, Katama Beach, and East Beach;

- Sovereign tribal nation of the Wampanoag Tribe of Gay Head (Aquinnah); and
- Marinas of Edgartown, West Tisbury, and Chilmark.

Environmental Sensitivity Index (ESI) maps, available from NOAA, provide a summary of coastal resources that are at risk if an oil spill occurs in the area. Maps with coverage of Martha's Vineyard would be contained in: Massachusetts and Rhode Island: Volume 3 Buzzards Bay. The maps are available in pdf format at: https://response.restoration.noaa.gov/maps-and-spatial-data/download-esi-maps-and-gis-data.html.

2.3.3 Implementation of Tactical Plan

The Construction and Operations Plan (COP) for the Project is to be submitted to BOEM WEA by the end of 2017. Initial award selection(s) for long term PPA(s) are expected in the spring of 2018. Construction is scheduled to commence in 2020. Vineyard Wind will establish contractual agreements with an oil spill response organization (OSRO).

The general procedures for implementation of a tactical plan are:

- Maximize protection of response personnel.
- Deploy containment resources and if appropriate divert spill to a suitable collection point that is accessible and has the least impact to surrounding areas.
- Boom off sensitive areas.
- Maximize on-water containment and recovery operations.
- Handle wastes to minimize secondary environmental impacts.

Vineyard Wind will establish contractual agreements with an OSRO to contain a spill on the waterway or land, and clean up the area after a spill. The Response Team will use containment equipment available at the site to surround or divert the spill until the contractor arrives on scene. Vineyard Wind personnel and equipment will assist in any way possible to expedite the cleanup operations.

2.3.4 Containment and Recovery Methods

The objective of the initial phase of the containment procedure prevents the spread of the spill, especially on water, and confines it to as small an area as possible. The containment goals are to prevent liquid or vapors from reaching a possible ignition source (i.e., boat engines, electrical equipment) and any environmentally sensitive area (i.e., water, wetland, wildlife management area). The primary methods to be used in containing a release would be absorbents, if on the rig, or containment booms, if it reaches water. It may be necessary to use many different methods in one release.

Containment and recovery refer to techniques that can be employed to contain and recover onshore and aquatic petroleum spills. Responses on water should therefore emphasize stopping the spill, containing the oil near its source, and protecting sensitive areas before they are impacted.

Sorbents can be used to remove minor on-water spills on the WTGs and ESPs. For larger spills, or spills reaching water, booming is used to protect sensitive areas and to position oil so it can be removed with skimmers or vacuum trucks. Due to entrainment, booming is not effective when the water moves faster than one knot, or waves exceed 1.5 feet in height. Angling a boom will minimize entrainment. Using multiple parallel booms will also improve recovery in adverse conditions. A summary of booming techniques for both aquatic and onshore scenarios is provided in Table 2-4.

Table 2-4 Containment and Diversion Booming Techniques

Type of Boom	Use of Boom
Containment/Diversion Berming	Berms are constructed ahead of advancing surface spills to contain spill or divert spill to a containment area. May cause disturbance of soils and some increased soil penetration.
Containment Booming	Boom is deployed around free oil. Boom may be anchored or left to move with the oil.
Diversion Booming	Boom is deployed at an angle to the approaching oil. Oil is diverted to a less sensitive area. Diverted oil may cause heavy oil contamination to the shoreline downwind and down current. Anchor points may cause minor disturbances to the environment.

2.4 Response Strategies for Containment and Recovery

The WTGs and ESPs will be located in the OCS. Offshore cable systems will move power from the offshore substations to landfall on the south-central shore of Cape Cod (i.e., Landfall Site). Vineyard Wind has been engaged in route selection work for the necessary sea cable Landfall Site, the landside transmission cabling, the onshore substation and utility interconnection point. At this juncture, the Project will use a landfall site in the Town of Barnstable; a single Landfall Site will be used for all cables for the 800 MW project. If oil storage on the landside of the Project exceeds 1,320 gallons in capacity in aggregate for containers or oil-filled equipment with a capacity of 55 gallons or greater, an SPCC Plan or an Integrated Contingency Plan (ICP) will be developed to address spill response procedures. While onshore releases are not the primary focus of this plan, they are still addressed for completeness.

2.4.1 Atlantic Ocean

The Project is located in the OCS. Water depths in the area of the Project range from 115 feet to 161 feet. However, oils stored in the WTGs and ESPs have a specific gravity less than 1.0 and would float on the surface of the water. Feasible protection methods include skimming, booming, and improvised barriers.

2.4.2 Banks

The nearest land mass to the WTGs and ESPs is Martha’s Vineyard, which is located approximately 14.4 miles north of the Project. Therefore, it is not anticipated that a release of oil would impact the terrain alongside the bed of a river, creek, or stream. However, the following response discussion is made available for planning of such an event.

Vegetated Banks

Oil may penetrate the area and coat plants and ground surfaces. Oil can persist for months. Minimize cutting plants. A no-action alternative may be appropriate to minimize environmental impacts. Cleanup is usually unnecessary for light coatings, but heavier accumulations may require sediment surface removal to allow new growth. Low-pressure spraying and neutralization solutions may aid removal.

Sand Beaches

Heavy accumulations of wastes can cover an entire beach surface and subsurface. Oil can penetrate the sand from 6 to 24 inches deep. Organisms living along the beach may be smothered or dangerously contaminated. Fine sand beaches are generally easier to clean. Clean by removing oil above the swash zone after all oil has come ashore. Minimize sand removal to prevent erosion. Soil treatment may be possible as well.

Muddy Beaches

Mud habitats are characterized by a substrate composed predominantly of silt and clay sediments, although they may be mixed with varying amounts of sand or gravel. The sediments are mostly water saturated and have low bearing strength. In general, mud shorelines have a low gradient. These fine-grained habitats often are associated with wetlands. Mud habitats are highly sensitive to oil spills and subsequent response activities. Shoreline sediments are likely to be rich in organic matter and support an abundance of fauna. Muddy habitats are important feeding grounds for birds and rearing areas for fish. Oil will not penetrate muddy sediments because of their low permeability and high-water content, except through decaying root and stem holes, or animal burrows. There can be high concentrations and pools of oil on the surface. Natural removal rates can be very slow, chronically exposing sensitive resources to the oil. The low bearing capacity of these shorelines means that response actions can easily leave long-lasting imprints, cause significant erosion, and mix the oil deeper into the sediments. When subsurface sediments are contaminated, oil will weather slowly and may persist for years. Response methods may be hampered by limited access, wide areas of shallow water, fringing vegetation and soft substrate. Natural recovery is typically the best response action for light crude. Vacuum trucks may be used to remove pooled oil on the surface if accessible. Avoid digging trenches to collect oil because that can introduce oil deeper into the sediment.

Riprap Structures

Oil contamination may penetrate deeply between the rocks. If left, oil can asphaltize and fauna and flora may be killed. If possible remove all contaminated debris. Use sorbents to remove oil in crevices. Best response may be to remove and replace heavily contaminated riprap to prevent chronic sheening and release.

Walls/Pier/Barriers and Docks

Mussels, shellfish, and algae are often found attached to these structures, which may be constructed of concrete, stone, wood, or metal. Contamination may percolate between joints and coat surfaces. Heavy accumulations will damage or kill the biota. High-pressure spraying may remove oil and prepare the substrate for recolonization of fauna/flora. Consider concentration of oil and continual release concentration to make a determination as to whether an action is required to remove contamination from these structures.

2.4.3 Wetlands

MassDEP's Priority Resource Map does not identify any wetland areas along the southern shoreline of Martha's Vineyard. Wetlands are located in the vicinity of Allen Point, Cobbs Point, Swan Neck Point, King Point, and Butler Neck. It is anticipated that a release of oil would impact the shoreline prior to impacting the wetlands areas. However, the following response discussion is made available for planning of such an event.

Wetlands are characterized by water, unique soils, and vegetation adapted to wet conditions. Wetlands include a range of habitats such as marshes, bogs, and swamps. The surfaces of wetlands usually have a low gradient, and vegetated areas are typically at, or under, the water level. Wetlands are highly sensitive to oil spills. The biological diversity in these habitats is significant and they provide critical habitat for many types of animals and plants. Oil spills affect both the habitat and the organisms that directly and indirectly rely on the habitat. Wetlands support populations of fish, amphibians, reptiles, birds, and mammals, with many species reliant upon wetlands for their reproduction and early life stages when they are most sensitive to oil. Migratory water birds depend heavily on wetlands as summer breeding locations, migration stopovers, and winter habitats.

For small to moderate spills and lighter oils, natural recovery avoids damage often associated with cleanup activities. However, the threat of direct oiling of animals using the wetland often drives efforts to remove the oil. Sorbents may be used, but overuse generates excess waste materials. Flooding can be used selectively to remove localized heavy oiling, but it can be difficult to direct water and oil flow towards recovery devices. Pooled oil can be removed by vacuum truck, if accessible, and trampling of vegetation can be avoided. The removal of heavily oiled vegetation may reduce the contamination of wildlife. Time of year is an important consideration for any clean-up method used in a wetland area.

2.4.4 Onshore Spills

The WTGs and ESPs are located in the OCS. It is unlikely that a release of oil from the WTGs or ESPs would result in an onshore spill. However, the following response discussion is made available for planning of such an event.

Onshore spills typically result from pipeline or equipment (i.e., pumps, valves) leaks. Secondary containment systems will be provided at operating areas more prone to spillage. The WTGs and ESPs are equipped with a secondary containment structure that will be sized according to the largest container. The ESP containment will drain to a sump tank. Spills occurring outside these areas should be contained at or near the source to minimize the size of the cleanup area and quality of soil affected.

Containment is most effected when conducted near the source of the spill, where the oil has not spread over a large area, and contained oil is of sufficient thickness to allow effective recovery and/or cleanup. The feasibility of effectively implementing containment and recovery techniques is generally dependent upon the size of the spill, available logistical resources, implementation time, and environmental conditions or nature of the terrain in the spill area.

For onshore spills, trenches, earthen berms, or other dams are the most effective response to contain oil migration on the ground surface. Recovery of free oil is best achieved by using pumps, vacuum trucks, and/or sorbents. Forming collection ponds for containing free product may be considered when attempting to recover free oil. Absorbents such as hay, straw, dry dirt or sand, and other commercial products may be considered as alternative methods of containment.

2.4.5 Small Lakes

Edgartown Great Pond and Tisbury Great Pond are located along the southern portion of Martha’s Vineyard and have navigational channels connecting the pond to the Atlantic Ocean. It is anticipated that a release of oil from the WTGs and ESPs could be contained prior to reaching the navigational channels for the ponds. However, should this occur, the following response discussion is made available for planning of such an event.

Lakes and ponds are standing bodies of water of variable size and water depth. Water levels can fluctuate over time. The bottom sediments close to shore can be soft and muddy, and the surrounding land can include wetlands and marshes. Floating vegetation can be common. Lakes provide valuable habitat for migrating and nesting birds and mammals, and support important fisheries. Wind will control the distribution of oil slicks, holding the oil against a shore, or spreading it along the shore and into catchment areas. Wind shifts can completely change the location of oil slicks, contaminating previously clean areas. Thus, early protection of sensitive areas is important. Oil impacts on floating vegetation depend to a large degree on dose, with possible elimination of plants at high doses. The best possible response method is to deploy booms to prevent oil from entering the lakes. If oil does enter any lakes, containing the oil to a small area with booms is the next best response.

2.4.6 Offshore Environments

The Project is located approximately 14.4 miles south of the southern shore of Martha's Vineyard. Therefore, it is anticipated that a release of oil from the WTGs and ESPs could be contained prior to reaching the coastline. However, should this occur, the following response information is included in this plan to assist in planning of such an incident.

The initial response to mitigate/contain a spill in a coastal environment is to review the ACP response plans for locating applicable sensitive areas. Oil that is deposited on an open water surface is generally distributed by wind direction and velocity. In addition, wave action causes emulsification of the oil, decreasing the recoverable amount, and increasing the area of contamination. These elements will be used as an advantage for containment/cleanup response. Deploy the containment boom in a V-shape, allowing the wind/wave action to move the oil, trapping, and funneling the oil towards recovery equipment near shore. Plan the recovery sites near roads, if possible, to allow tanker trucks and vacuum trucks to pick up the recovered material and transport it to disposal, recovery, or temporary storage. Clean up any accumulated amounts of contaminated shoreline debris. Store the debris on impervious material and cover it in the same manner.

2.5 Waste Disposal and Oil Recovery

Oil spill cleanup from recovery operations will involve the further handling of recovered oil and oiled materials. These will be directed to a state-approved reclamation/disposal site. Normally, the waste generated from a recovery operation will be classified as a non-RCRA state regulated waste. Waste Code MA01 is appropriate for used or unused waste oil that is not otherwise RCRA hazardous waste. Waste Code MA97 is appropriate for Class A regulated recyclable material (including, but not limited to, specification used oil fuel) that is shipped using a hazardous waste manifest. Waste Code MA98 is appropriate for off-specification used oil fuel that is shipped using a hazardous waste manifest. In rare instances, where it is suspected that extraneous substances have been introduced into a spill, it is appropriate to test the recovered oil for hazardous waste characteristics (ignitability, reactivity, corrosivity, and toxicity).

The different types of wastes generated during response operations require different disposal methods. Waste will be separated by material type for temporary storage prior to transport to an approved recovery or treatment/storage/disposal facility.

Skimmer tanks allow for gravity separation of the oil from the water. The separated water is transferred through a hose and discharged forward of the recovery pump. This method is called "decanting". This process is vital to the efficient mechanical recovery of spilled oil because it allows maximum use of limited storage capacity, thereby increasing recovery operations. Approval must be obtained from federal and state agencies prior to decanting.

Recovered oil may be transferred to portable tanks. It is important to ensure temporary storage devices are of sufficient size to allow continued operations.

Oily debris collected requires specific handling. Contaminated materials will be placed in leak proof, sealable containers, such as drums or roll-off boxes, and transported to appropriate facilities for processing, recycling, or disposal.

Clean sand and shoreline materials can be separated from oiled materials and returned to the shoreline. Not only is this cost effective from an operations perspective, it also provides an efficient means of returning clean, excavated material back to the shoreline as a restorative measure.

2.6 Potential Failure Scenarios

Specific mitigation actions and responses to be taken (exact pumps to shut down, valves to close, etc.) depend on the way the transfer is performed and the nature of the situation; however, certain failure scenarios share common characteristics for mitigation. Mitigation procedures will be performed with consideration for health and safety as the top priority.

The Project is being developed and permitted using an “Envelope” concept. The Envelope concept allows Vineyard Wind to properly define and bracket Project characteristics for purposes of environmental review and permitting, while maintaining a reasonable degree of flexibility with respect to selection and purchase of key Project components. Potential failure scenarios will be developed as key Project components are selected. General mitigation procedures are included in Annex 3.

2.7 Procedures for Mobilization of Resources

A major consideration during a spill is the organization and direction of the transportation of manpower, equipment, and materials used in response operations. The QI will work with local authorities (state police) to establish land routes which will expedite the movement of personnel, equipment, materials, and supplies to the Staging Area, and waste products from the Staging Area. The facility will utilize status boards to coordinate all equipment, personnel, and materials mobilized to the spill site. Equipment will first be mobilized from the OSRO warehouse to the Staging Area. A Staging Area Manager will be designated to direct which equipment will be delivered to which Division/Task Force.

Once the first increment of the Project is installed, tested, and commissioned, the Project will enter a 20 to 30 year operating phase. In support of Project operations and the necessary maintenance activities, Vineyard Wind will have management and administrative team offices, a control room, and an Operation and Maintenance Facility (O&M facility). These functions will be co-located, if feasible. Details regarding spill response materials, services, equipment, and response vessels has not been finalized at this time. Vineyard Wind will retain a third-party OSRO that is licensed as hazardous waste transporters, and can provide emergency response services and cleanups of oil and/or hazardous material (OHM) spills. MassDEP emergency response contractors located in close proximity to the Project include Frank Corporation (New Bedford), Global Remediation Services, Inc. (Sandwich), Clean Harbors, Incorporated (Braintree), and Cyn Oil Corporation (Stoughton). Response times for mobilization of OSRO resources will be dependent on the location of the OSRO.

2.8 Sustained Actions

The WTGs and ESPs are equipped with secondary containment, which would reduce the potential for the need for a sustained action. Most incidents are able to be handled by a few individuals without implementing an extensive response management system. However, an incident could occur where clean-up is not possible within seven days, transition from the initial emergency stage. A sustained action stage may be required where more prolonged mitigation and recovery actions may be warranted.

Response operations will need to be managed 24-hours a day, seven days a week, until the operation is complete. The facility’s Incident Command Organization (ICO) team members are available to be cascaded in to support response operations. Once the initial emergency stage of the spill situation has transformed to the sustained action stage, the response management structure will develop more prolonged mitigation and recovery action strategies.

2.9 Termination and Follow-Up Actions

Cleanup will be conducted as thoroughly as possible, but will be terminated when, in the opinion of the FOSC and the QI;

- There is no detectable oil in the water;
- Further removal actions would cause more environmental harm than the remaining oil;
- Cleanup measures would be excessive in view of their insignificant contribution to minimizing a threat to the public health, welfare, or the environment; and
- Actions required to repair unavoidable damage resulting from removal activities have been completed.

Once the determination has been made that the response can be terminated, certain regulations may become effective once the "emergency" is declared over. Orderly demobilization of response resources will need to occur. Follow-up actions such as accident investigation, response critique, plan review, and written follow-up reports are needed.

The QI will develop a plan of demobilization and assist to ensure that an orderly, safe, and cost-effective demobilization of personnel and equipment is accomplished.

General demobilization considerations for all personnel are the following:

- Complete all work assignments;
- Brief subordinates regarding demobilization;
- Complete and file required forms and reports;
- Follow check out procedures provided by the QI;
- Evaluate performance of subordinates prior to release;
- Return communications equipment or other non-expendable supplies; and
- Report to assigned departure points on time, or slightly ahead of schedule.

The QI will convene a meeting to summarize the incident, and a complete report will be developed within 180 days. This report will record the incident as it developed and will identify, in detail, the actions taken, resources committed, and any problems encountered. The QI will include a recommendation outlining any suggested changes of policies or procedures.

Annex 1 – Facility Diagrams

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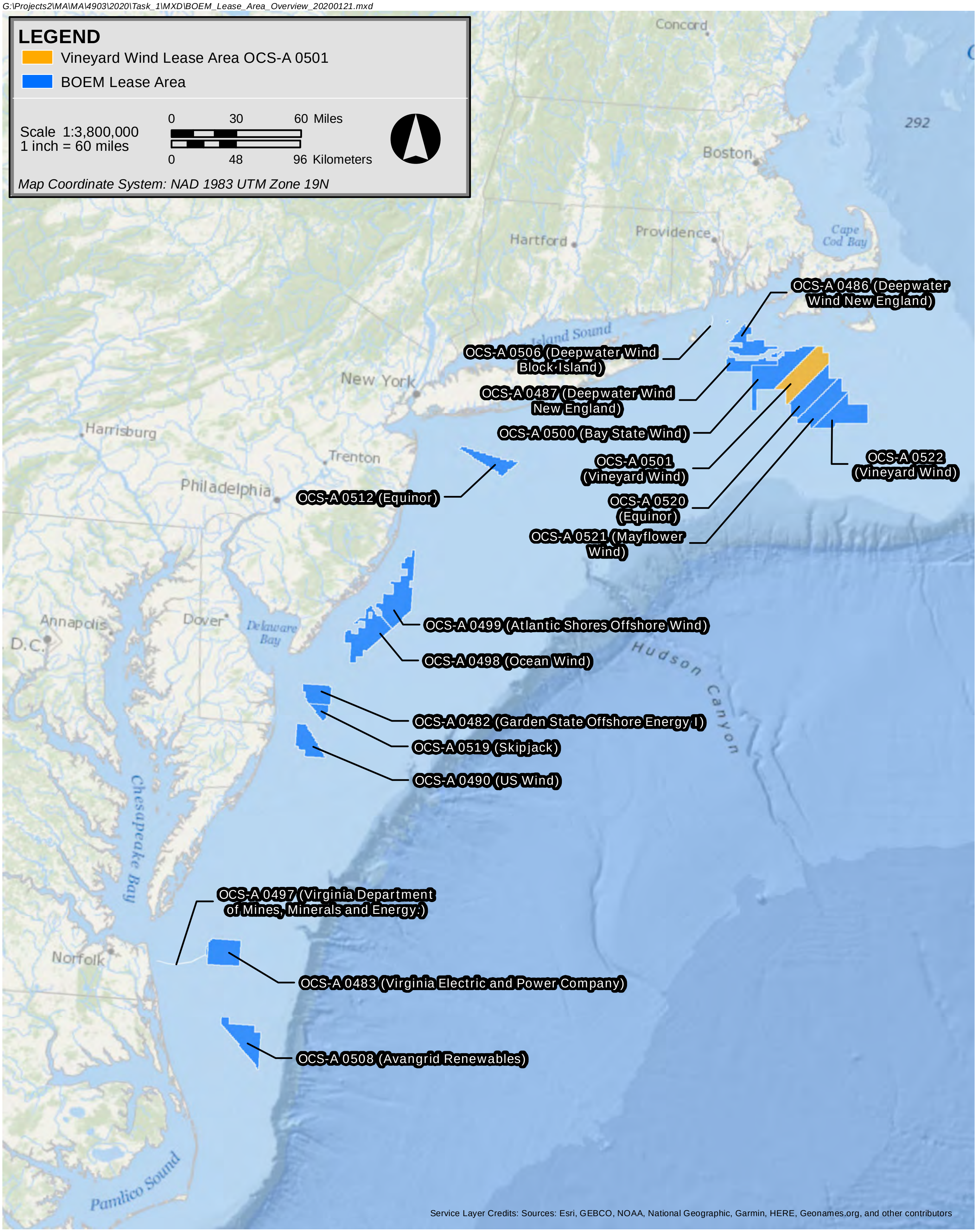

Vineyard Wind Project

VINEYARD WIND

Figure A1-1

Overview, BOEM Offshore Wind Lease Areas - Atlantic Coast

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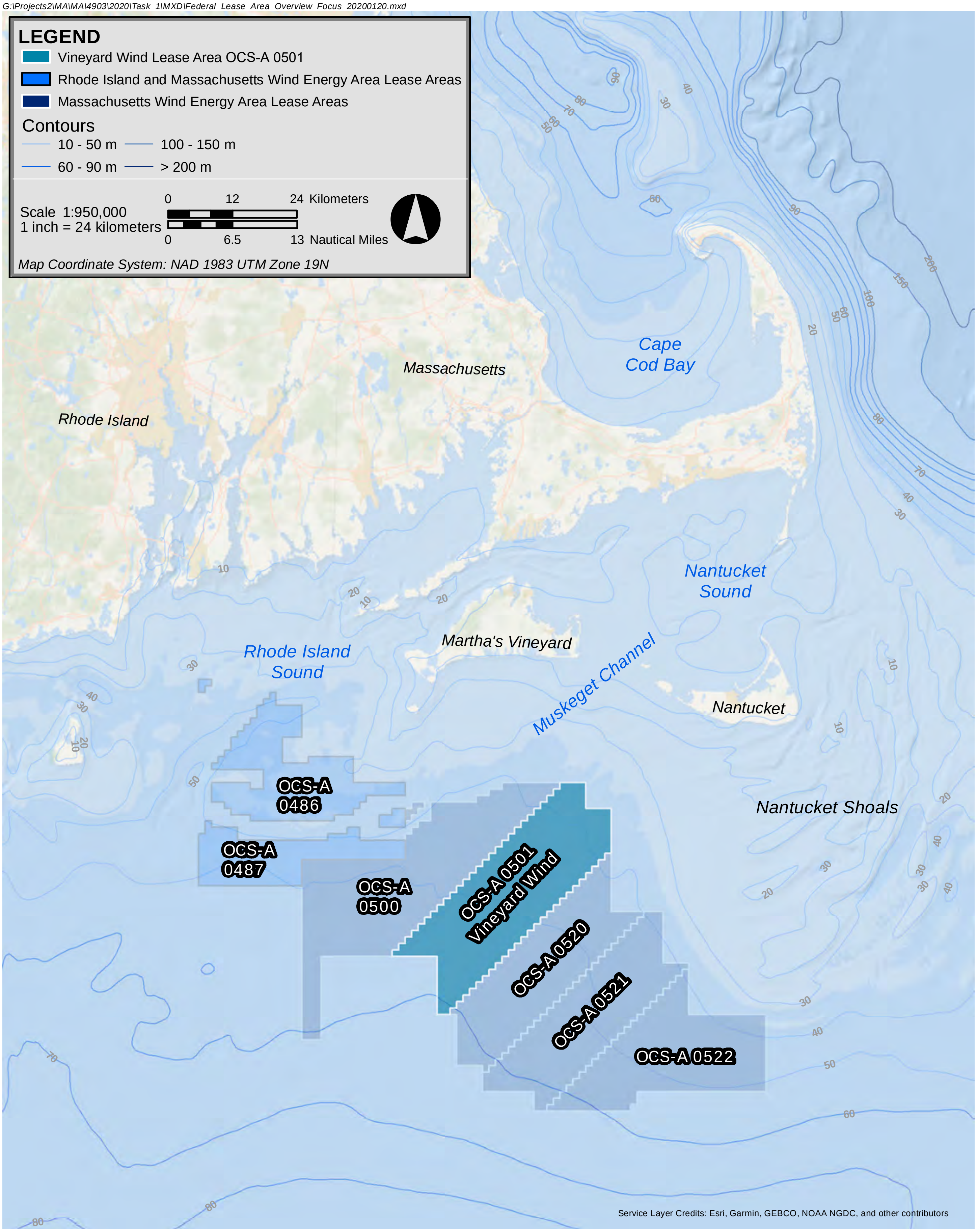
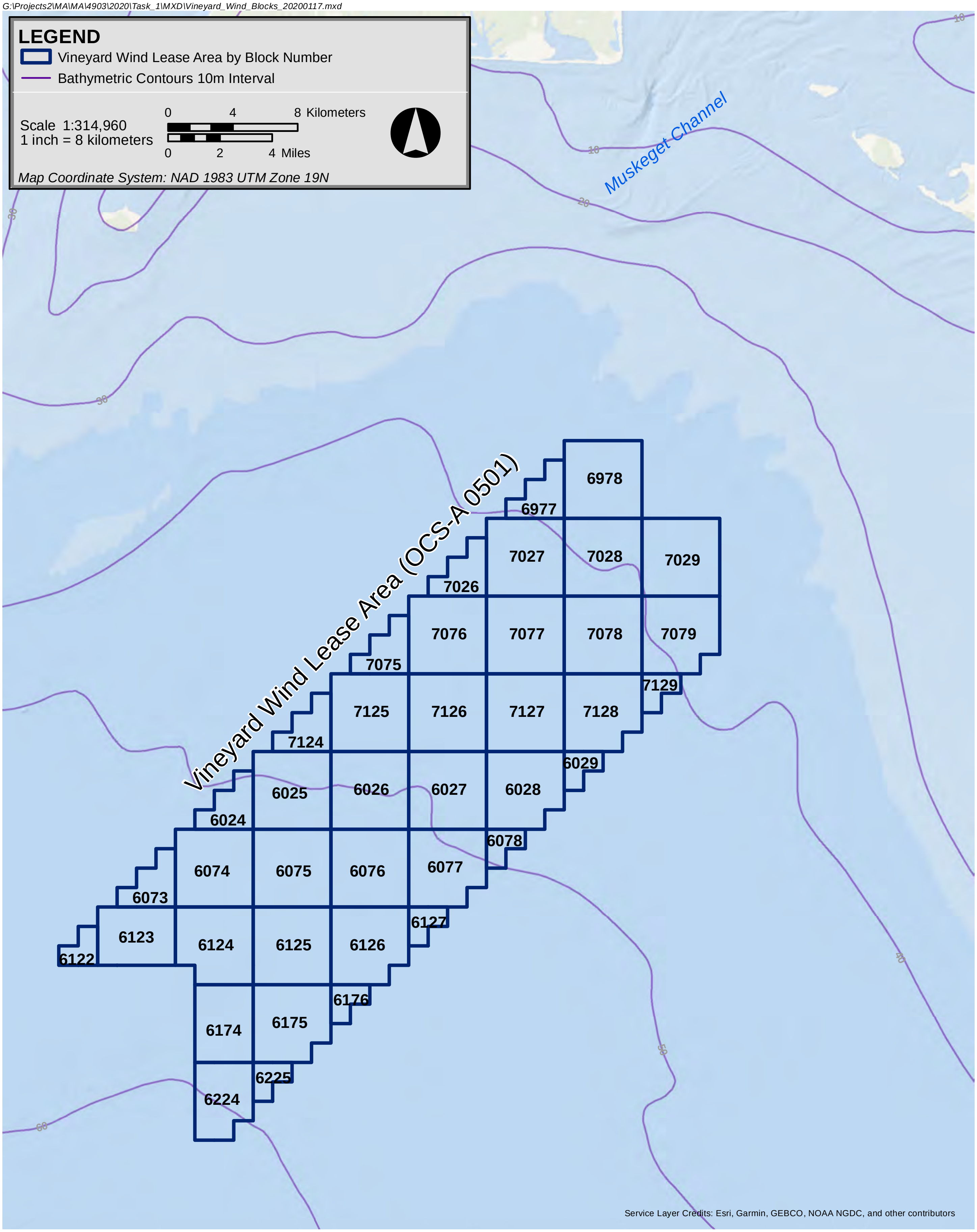


Vineyard Wind Project

VINEYARD WIND

Figure A1-2

RI and MA Lease Areas Overview

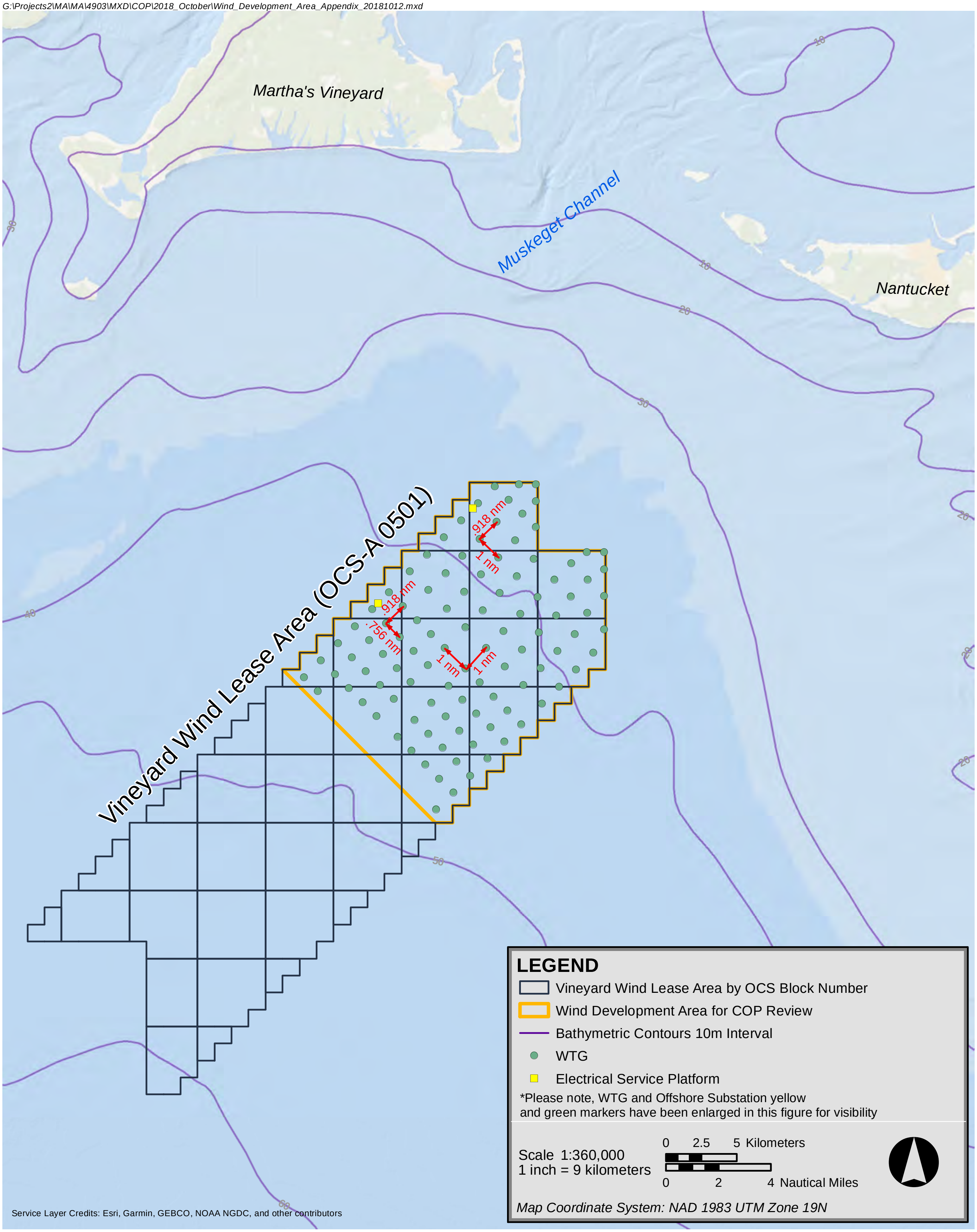


Vineyard Wind Project

VINEYARD WIND

Figure A1-3

Vineyard Wind Lease Area with BOEM Block Designation



Vineyard Wind Project

VINEYARD WIND

Figure A1-4

Wind Development Area and Site Layout

Annex 2 – Notification Contact List

Table A2-1 Internal Notification List

The Project has not yet been approved. Construction of the Project is scheduled to commence in 2020. Details regarding QI personnel have not been finalized at this time.

Name	Title	Phone Number
Person A	Qualified Individual, Title	(XXX) XXX-XXXX
Person B	Alternate QI, Title	(XXX) XXX-XXXX
Person C	Alternate QI, Title	(XXX) XXX-XXXX
Person D	Alternate QI, Title	(XXX) XXX-XXXX
Person E	Manager EHS	(XXX) XXX-XXXX
Person F	Director of Communications	(XXX) XXX-XXXX
Person G	Chief Financial Officer	(XXX) XXX-XXXX
Person H	Director of Administration	(XXX) XXX-XXXX

Table A2-2 External Notification and Call Lists

Agency	Location	Telephone
Initial Required Notifications		
National Response Center	c/o USCG (CG-3RPF-2) 2100 2nd Street Southwest Room 2111-B Washington, D.C. 20593-0001	800-424-8802 (24 hr) 202-267-2675 (24 hr) 202-267-1322 (fax)
Massachusetts State Emergency Response Commission (SERC)	MEMA 400 Worcester Road Framingham, MA 01702	508-820-2010
U.S. Coast Guard (any discharge on navigable water)	408 Atlantic Avenue Boston, MA 02110	617-223-4812 or 617-406-9011
Massachusetts Department of Environmental Protection (10 gallons or more)	1 Winter Street Boston, MA 02108	888-304-1133
EPA Region 1 (>5 barrels on land or any amount on water)	5 Post Office Square Boston, MA 02109	888-372-7341 or 617-918-1251
Bureau of Safety and Environmental Enforcement (BSSE)	1201 Elmwood Park Boulevard New Orleans, LA 70123-2394	504-736-2595 or 504-400-7836
Dukes County REPC (Threat to Martha's Vineyard)	32 Water Street Tisbury, MA 02568	508-696-4240
Wampanoag Tribe of Gay Head (Threat to tribal lands on MV)	20 Black Brook Road Aquinnah, MA 02535	508-645-9265
Barnstable County REPC (Threat to Nantucket)	3195 Main Street Barnstable, MA 02630	508-375-6908
OSHA (fatality or 3 or more employees sent to hospital)	200 Constitution Avenue Washington, D.C. 20210	800-321-6742
USCG Classified Oil Spill Response Organizations (OSRO)		
Vineyard Wind has not selected a OSRO at this time. MassDEP maintains a list of licensed hazardous waste transporters who provide Emergency Response Services in MassDEP's Southeast Region. The list is available here: http://www.mass.gov/eea/docs/dep/cleanup/serohwtr.pdf		
Weather		
National Oceanic & Atmospheric Administration National Weather Service National Weather Service	445 Myles Standish Boulevard Taunton, MA 02870	508-822-0634 (forecasts) 508-828.2672 (general info) http://www.weather.gov/box/
NOAA Weather Radio (NWR) Hyannis, MA	Camp Edwards Hyannis, MA	Call sign: KEX73 VHF: 162.550
NOAA National Data Buoy Center	http://www.ndbc.noaa.gov/maps/Northeast.shtml	
MVY: Martha's Vineyard Airport	http://mvyairport.com/	
Aviation Resources		
Vineyard Wind has not selected aviation resources at this time. A list of Massachusetts charter operators is available at: http://www.aircharterguide.com/US_Operators/MA/Massachusetts		
Marine Resources		
Steamship Authority	1 Cowdry Road Woods Hole, MA 02543	508-548-5011

Agency	Location	Telephone
Regulatory Agencies for Wildlife		
U.S. Fish and Wildlife Service North East Regional Office	300 Westgate Center Drive Hadley, MA 01035	413-253-8200
U.S. Fish and Wildlife Service New England Field Office	70 Commercial Street Suite 300 Concord, NH 03301	603-223-2541
Massachusetts Environmental Police (fish kills)	251 Causeway Street Boston, MA 02114	800-632-8075
MassWildlife	1 Rabbit Hill Road Westborough, MA 01581	508-389-6300
MA Department of Fish and Game	251 Causeway Street Boston, MA 02114	617-626-1500
Other Wildlife Resources		
Mass Audubon	208 South Great Road Lincoln, MA 01773	781-259-9500 or 800-823-8266
Felix Neck Wildlife Sanctuary	100 Felix Neck Drive Edgartown, MA 02539	508-627-4850
International Fund for Animal Welfare	290 Summer Street Yarmouth Port, MA 02675	508-743-9548
New England Aquarium	1 Central Warf Boston, MA 02110	617-973-5247
NOAA Greater Atlantic Fisheries Office	55 Great Republic Drive Gloucester, MA 01930	866-755-6622
National Audubon Society	New York, NY	212-979-3196
Licensed Wildlife Rehabilitation Providers		
The Commonwealth of Massachusetts maintains a list of licensed wildlife rehabilitators at: https://www.mass.gov/service-details/wildlife-rehabilitators-southeast-district		
Medical Facilities		
Martha's Vineyard Hospital	1 Hospital Road Oak Bluffs, MA 02557	508-693-0410
Vineyard Medical Care (Walk-in Clinic)	364 State Road Vineyard Haven, MA 02568	508-693-4400
Ambulances		
Tri-Town Ambulance	West Tisbury, MA	508-693-4922
Oak Bluffs Ambulance Department	Oak Bluffs, MA	508-693-5380
Tisbury Ambulance	Vineyard Haven, MA	508-696-4112
Boston MedFlight (Air lift)	Bedford, MA	781-863-2213
Coast Guard Air Station Cape Cod (Medevac)	Buzzards Bay, MA	508-968-6673
Fire Aid (911)		
Edgartown Fire Department	Edgartown, MA	508-627-5167
Oak Bluffs Fire Department	Oak Bluffs, MA	508-693-0077
West Tisbury Fire Department	West Tisbury, MA	508-693-2749
Chilmark Fire Department	Chilmark, MA	508-645-2207
Vineyard Haven Fire Department	Vineyard Haven, MA	508-696-6726

Police Aid (911)		
Massachusetts State Police	Oak Bluffs, MA	508-693-0545
Dukes County Sherriff	Edgartown, MA	508-627-5328
Massachusetts Environmental Police	Boston, MA	800-632-8075
Massachusetts Department of Public Safety	Boston, MA	617-727-3200
US Marshals Services	Boston, MA	617-748-2500
Federal Bureau of Investigation	Chelsea, MA	857-386-2000
Local Government and Agencies		
Wampanoag Tribe of Gay Head (Aquinnah)	Aquinnah, MA	508-645-9265
Dukes County Health Department	Vineyard Haven, MA	508-696-3844
Martha's Vineyard Chamber of Commerce	Vineyard Haven, MA	508-693-0085
Edgartown Town Hall	Edgartown, MA	508-627-6100
Oak Bluffs Town Hall	Oak Bluffs, MA	508-693-3554
Town of Tisbury	Vineyard Haven, MA	508-696-4200
West Tisbury Town Hall	West Tisbury, MA	508-696-4700
Chilmark Town Hall	Chilmark, MA	508-645-2100
Aquinnah Town Selectman	Aquinnah, MA	508-645-2310
Other Industrial Facilities in Local Area		
Not Applicable		

Annex 3 – Response Management System

Figure A3-1 Initial Response Flowchart

Annex 4 – Incident and Other Documentation Forms

The Qualified Individual (QI) will coordinate the documentation during the incident, and for post-incident review, in conjunction with federal, state, and local officials, as well as with others familiar with the incident. Forms to assist in documentation and presentation of consistent notification information are presented at the end of this Annex for use during an incident. These include:

- Initial Notification;
- Agency Call Back for Information;
- Chronological Log of Incident; and
- Incident Report.

As an alternative, or in addition to, the National Incident Management Systems (NIMS) Incident Command Forms noted below may also be used. These can be accessed on-line at: http://www.fema.gov/emergency/nims/JobAids.shtm

Table A4-1 ICS Forms National Incident Management System (NIMS) Alternative

ICS Form No.	Description
IAP	Cover Sheet Incident Action Plan
201	Incident Briefing
202	Incident Objectives
203	Organization Assignment List
204	Assignment List
204a	Assignment List Attachment
205	Incident Radio Communications Plan
206	Medical Plan CG
207	Organizational Chart
208	Site Safety Plan
209	Status Summary (SITREP/Opsum)
210	Status Change
211	Check-In List
213	General Message
213-RR	Resource Request
214	Unit Log
215	Operational Planning Worksheet
216	Radio Requirements Worksheet
217	Radio Frequency Assignment Worksheet
218	Support Vehicle Inventory
219	Resource Status Card (T-Cards)
220	Air Operations Summary
221	Demobilization Checkout
224	Crew Performance Rating
225	Personnel Performance Rating
226	Individual Personnel Rating
230	Daily Meeting Schedule
232	Resources at Risk Summary
232a	ACP Site Index

233	Open Action Tracker
234	Work Analysis Matrix
235	Facility Needs Assessment

The post-incident investigation will begin after the source of the incident has been corrected, eliminated, or repaired, and the facility has been declared safe by the QI. The QI will take the following steps during a post-accident investigation:

- Obtain all data, information, and reports pertaining to the incident.
- Interview in person, or by telephone, each person knowledgeable of the incident.
- Review the response of operations personnel to see if procedures and training were adequate or if changes are warranted.
- Evaluate other potentially dangerous situations which could have occurred, and if the response of personnel and safety systems would have accommodated those situations had they occurred.
- Prepare recommendations as appropriate for changes to:
    - Design of facility;
    - Operating procedures;
    - Training;
    - Communications; and
    - Emergency response plans and procedures.
- The QI will prepare and issue a written report to all supervisors with any changes deemed appropriate.

The QI will prepare a Post-Incident report. This annex will contain an accounting of incidents that occur including proof that the Project met its legal notification requirements for any given incident (i.e., signed record of initial notifications and certified copies of written follow-up reports submitted after a response).

Examples of routine equipment and maintenance checklists/ logs are also provided. These include:

- Response Equipment Inspection Log;
- Secondary Containment Checklist and Inspection Form;
- Tank Inspection Form; and
- Maintenance Log.

Form A4-10 Initial Notification Data Sheet

Date:	Time:
INCIDENT DESCRIPTION	
Reporters Name:	Position:
Reporters Phone Number:	Address:
Company:	
Latitude:	Longitude:
Date of Incident:	Time of Incident:
Spill/Incident Location:	Source and/or Cause of spill/incident:
Material spilled and total volume:	Vessel Name and Number (if applicable):
Is the material spilled in water?	Is the source secured?
Weather conditions:	Precipitation?
Incident Description:	
Name of Incident Commander:	Where is the Incident Command Post (directions)?
RESPONSE ACTIONS	
Actions taken to correct, control or mitigate incident:	
Number of injuries:	Number of deaths:
Were there evacuations?	Number of evacuated:
Areas affected:	Damage estimate:
Any other information about impacted medium:	
CALLER NOTIFICATIONS	
National Response Center (NRC): 800-424-8802	Texas State Emergency Response Commission: 800-832-8224
NRC Incident Assigned Number:	Other Agencies Notified: □ USCG □ EPA □ OSHA □ USFWS □ MassDEP
Other Information Not Recorded Elsewhere:	

Note: Do Not Delay Notifications Pending Collection of All Information. Notify within 1 hour of discovery.

Form A4-11 Agency Call Back Information

Incident Number: ____________

Document all information that agencies request.

Date:	**Time:**
Agency:	**Person Contacted:**
Reason for Call Back:	
Document all dialogue with agency below:	

Form A4-12 Chronological Log of Events

Incident No.___________

Document all events chronologically.

Date/Time	Record of Event

Form A4-13 Incident Report

Incident No. ___________

Reviewed by:	**Final Date:**
□ Attach Initial Notification Form for basic data, update as incident progresses.	
Incident Duration (dates and time):	Type and Location of Incident:
Categorical Level of Incident and what portions of response team were assembled? Identify all leader positions and names.	Does the incident create a potential compliance issue? If yes, describe.
Material released:	Final released volume:
Were there any abnormal operating conditions immediately before the emergency? If yes, describe.	Were there any equipment problems or changes immediately before the emergency? If yes, describe.
Description of media impacted:	Was all media cleaned up to satisfaction of regulatory agencies?
Type and volume of waste generated: (attach waste tracking log if applicable)	How and where was waste disposed or recovered?
Were all spilled materials recovered? If not, describe what was not recovered and why.	

Provide description of clean-up methods utilized:	
Describe decontamination procedures and include pieces of equipment decontaminated.	
Has stock of emergency equipment been replenished to pre-incident conditions?	Date demobilization was completed.
Describe what worked and did not work during incident:	
Recommendations for improvement:	

Form A4-14 Response Equipment Inspection Log

Incident No. ___________

Inspector	Date	Equipment	Comments

The Project is being developed and permitted using an "Envelope" concept. The Envelope concept allows Vineyard Wind to properly define and bracket Project characteristics for purposes of environmental review and permitting while maintaining a reasonable degree of flexibility with respect to selection and purchase of key Project components. Specific details will be identified in the final version of the OSRP.

Form A4-15 Secondary Containment Checklist and Inspection Form

Incident No. ___________

Area(s) Inspected:	**Date/Time:**	**Inspected By:**
Inspection Item	**Acceptable (Y/N)**	**Comments/Corrective Action**
Level of precipitation in containment		
Presence of spilled or leaked material		
Operational status of drainage valves		
Debris		
Location/status of pipes, inlets, drainage		
Cracks		
Discoloration		
Corrosion		
Valve conditions		

The Project is being developed and permitted using an "Envelope" concept. The Envelope concept allows Vineyard Wind to properly define and bracket Project characteristics for purposes of environmental review and permitting while maintaining a reasonable degree of flexibility with respect to selection and purchase of key Project components. Specific details will be identified in the final version of the OSRP.

Form A4-16 Monthly Checklist and Inspection Form

Incident No. ___________

Tank(s) Inspected:	Date/Time:	Inspected By:
Inspection Item	**Acceptable (Y/N)**	**Comments/Corrective Action**
Emergency Generator (Day Tank and Lubrication Oils)		
Diesel Tank		
Platform Crane		
Power Transformers		
Reactors		
Auxiliary/Earthing Transformers		
Wind Turbine Generators		

Inspect for the following:

- **Support structure is in good condition (no corrosion or damage)**
- **External shell structure is in good condition (no corrosion or damage)**
- **Drip pans are in place (if applicable)**
- **Foundation is in good condition (stable and level)**
- **Liquid level gauge is in place and in good working condition (if applicable)**

Remarks:

Form A4-17 Response Equipment Maintenance Log

This may be maintained on computer log or paper but kept on-site. Include description of maintenance activities performed (i.e., repaired boat motor, gate valves lubricated, booms cleaned, etc.).

Date	Equipment	Maintenance Performed

Annex 5 – Training Exercises/Drills and Logs

Facility response training, drills/exercises, personnel response training, and spill prevention meetings in this section comply with the requirements of 30 CFR 254.41. Per 30 CFR 254.41(d), training certificates and training attendance records must be maintained in a designated location for at least two years. Vineyard Wind will maintain documentation of training in the New Bedford, Massachusetts office. Training records must be made available to any authorized BSEE representative upon request. The Emergency Response Critique forms used to document inspections, drills and training are included in Appendix A5-1.

A5.1 Drills and Exercises

Per 30 CFR 254.42(a), the entire OSRP must be exercised at least once every three years. However, to satisfy this requirement, separate exercises may be conducted over a 3-year period. Exercises must simulate conditions in the area of operations, including seasonal weather variations, to the extent practicable. In addition, exercises must cover a range of scenarios, such spills of a short duration and limited volume, large continuous spills, and the worst-case scenario discharge.

A schedule of exercises will be determined by management in accordance with 30 CFR §254.42(b). The Chief, OSPD may require a change in the frequency of required exercises. Actual training exercises will be coordinated with the OSRO. Response training programs will comply with the Preparedness for Response Exercise Program (PREP) and the USCG/EPA training guidelines for oil spill response. Table A5-1 includes a list of regular personnel training exercises. Appendix A5-1 presents Drill/Exercise Documentation Forms associated with the training exercises.

The Chief, OSPD and BOEM must be notified at least 30 days prior to the following exercises: annual spill management team tabletop exercise; annual deployment exercise of response equipment identified in the OSRP that is staged at onshore locations; and semi-annual deployment exercise of any response equipment which the BSEE Regional Supervisor requires an owner or operator to maintain at the facility or on dedicated vessels. The annual Incident Command Organization (ICO) tabletop exercise will include the actual notification to the NRC, BSEE Regional Supervisor, BOEM, and the OSRO, to determine availability and response times. Each call that is made will begin with the statement “This is a drill”.

As detailed in this annex, several types of drills are conducted as part of the drill program as follows:

- Notification drills to test communications procedures are conducted monthly.
- Qualified Individual (QI) notification drills are conducted at least quarterly to verify that the QI can be reached in an emergency situation to perform required duties.
- The Spill Management Team participates in a table-top drill annually and is included in other drills as often as possible.
- Unannounced annual notification drills are performed. These drills are conducted with BOEM and OSRO participation. These annual drills will simulate a response action and conveyance of key information between the QI, BOEM, and the OSPD.
- Every effort is made to cooperate in local drills requested by regulatory agencies and neighbors.
- Spill removal organizations under contract are drilled at least annually.

The annual notification drill will be an opportunity for the QI, BOEM, and OSPD to simulate an incident command post setting that is capable of supporting response efforts (e.g., deployment of personnel and equipment, tracking containment efforts, taking samples, shoreline cleanup, etc.) for a variety of spill scenarios. Prior to the drill, the size and scope of the drill will be defined and will be structured of various levels of complexity to test events ranging from implementation of specific components of the OSRP to full implementation of the plan.

Facility spill response drills are comprehensive and designed to improve response actions at the level of the first responder. A tabletop planning session is held prior to the drill, with a limited number of supervisory personnel informed of the drill.

Drills are conducted to enable personnel who will act as initial responders during an actual spill to become familiar with response equipment. During spill drills, the techniques of pulling and placing boom such as for diversion, deflection, and containment are practiced. Drills are also conducted to allow personnel to become familiar with climatic conditions, such as the interactions of wind, tide, and wave actions and their effect on oil movement. In spill drills, consideration is given to sensitive areas which may be affected and need protection.

As part of the drill process, a critique is held following the drill. All personnel who participate in the drill, including observers, also participate in the critique. The purpose of this is to review the drill for procedures which worked well and procedures which did not work well. Each individual has an opportunity to provide for input. Recommendations are submitted to management.

Annually, at least one of the exercises listed in Table A5-1 must be unannounced. Unannounced means the personnel participating in the exercise must not be advised in advance, of the exact date, time, and scenario of the exercise. The staff from the Project will also participate in unannounced exercises as directed by the lead federal agency. The objectives of the unannounced exercises will be to test notifications and equipment deployment for response to the average most probable discharge. After participating in an unannounced exercise directed by the lead federal agency, Project personnel will not be required to participate in another unannounced exercise for at least 3 years from the date of the exercise.

Project personnel will also participate in Area exercises as directed by the applicable On-Scene Coordinator. The Area exercises will involve equipment deployment to respond to the spill scenario developed by the Exercise Design Team, of which Project will be a member. After participating in an Area exercise, Vineyard Wind will not be required to participate in another Area exercise for at least six years.

All drills and exercises will be documented on the Exercise Drill Logs and maintained by the Training Department. An example training log form is presented in Appendix A5-2. Records of these activities will be maintained for a period of three years, as per 30 CFR 254.42(e).

A5.2 Planned Training

Planned training sessions are held for staff and operations personnel on an annual basis to gain an understanding of the OSRP process. The intent of these sessions is to keep personnel informed of their obligation to respond to all emergencies, prevent pollution incidents, and to improve spill control and response techniques. These briefings highlight and describe known spill events or failures, malfunctioning components, and recently developed precautionary measures to prevent spills.

All field personnel will be indoctrinated in the proper procedures for the reporting of spills. Included in this training are procedures for contacting the Qualified Individual (QI) on a 24-hour basis. They will also review procedures on how and where to place facility containment/recovery materials depending on where the spill occurs and various seasonal conditions. Personnel will be informed that detergents or other surfactants are prohibited from being used on an oil spill in the water, and that dispersants may only be used with the approval of the Regional Response Team.

Records of all training activities are maintained for at least five years following completion of training. The facility will maintain records for each individual as long as these individuals are assigned duties in this plan. Individuals will sign documentation when participating in training classes or exercises as provided in Appendix A5-2.

Credit for any of the above drills and exercises may be taken by Vineyard Wind if an actual incident occurs and records of the incident are maintained to show evidence of complying with any of the above drill or exercise requirements.

Table A5-1 Response Training Exercises

Exercise	Purpose/Scope	Objectives	Frequency	Participants
QI Notification Exercise	Ensure the QI can be contacted in a spill response emergency in order to carry out required duties.	• Contact QI by telephone, radio, fax, pager, or email. • Confirmation received from QI of notification.	Monthly	Qualified Individuals
Incident Command Organization Team (table top) *	Ensure the Incident Command Organization's emergency management team is familiar with the procedures.	• ICO Team is familiar with emergency response procedures. • Employs proper procedures during a simulated emergency response.	Annually	ICO Management Team, OSPD, BOEM
On-Site Equipment Deployment Exercise	Verify that required response equipment is operable and personnel are capable of deploying the equipment.	• Verify that designated equipment is available. • Deploy at least minimum required equipment during exercise. • Verify that personnel tasked with deployment have received required training.	Annually	Project Response Team, OSPD, BOEM, OSRO
OSRO Equipment Deployment Exercise	Same as above, but performed by OSRO	• Same as above	Annually	OSRO
Discharge Prevention Briefings	Conduct Discharge Prevention Briefings	• Personnel have adequate understanding of the OSRP. • Describe known discharges or failures. • Discuss any recently developed precautionary measures.	Annually (optional)	Oil-handling Personnel
Simulated Spill Drill**	Test the resources and response capabilities of the OSRO.	• Demonstrate OSRO's ability to deploy resources to include: o On water containment and recovery o Sensitive habitat protection • Storage	Every three years	Oil-handling Personnel

* *In a 3-year period, at least one of these exercises must include a worst-case discharge scenario.*

** *In a 3-year period, all components of the response plan must be exercised.*

Annually at least one of the first three exercises listed must be unannounced to participants.

A5.2 Training Documentation and Record Maintenance

Spill response personnel training records will be maintained at the Vineyard Wind office in New Bedford, example training record is provided in Appendix A5-2. Records will be maintained at this location for five years and will include:

- Documentation of yearly training associated with the OSRP as provided to ICO and facility personnel;
- Records of personnel training in accordance with OSHA at 29 CFR §1910.120 regulations; and
- Records of training provided for response contractor personnel will be maintained at the respective contractor's office and will be verified by facility personnel on-site.
- Logs of volunteer workers (if applicable) and activities performed.

Table A5-2 Spill Response Drill Form Notification Exercise

VINEYARD WIND LLC
SPILL RESPONSE DRILL/EXERCISE DOCUMENTATION FORM

NOTIFICATION EXERCISE

1. Date performed: ____
2. Exercise or actual response: ____________________________________
3. Facility initiating exercise:_______________________________________
4. Name of person notified:____

   Is this person identified in your response plan as qualified individual or designee?____
5. Time initiated:____

   Time in which qualified individual or designee responded:___________________
6. Method used to contact:

   ____Telephone

   ____Pager

   ____Radio

   ____Other______________________________
7. Description of notification procedure:

   ____
   ____
   ____
8. Evaluation of Drill:

   ____
   ____
   ____
9. Changes to be implemented (if any):

   ____
   ____
   ____

Certifying Signature____

Table A5-3 Spill Response Drill Form Team Tabletop Exercise

VINEYARD WIND LLC
SPILL RESPONSE DRILL/EXERCISE DOCUMENTATION FORM

SPILL MANAGEMENT TEAM TABLETOP EXERCISE

1. Date performed:____
2. Exercise or actual response:____
   If an exercise, announced or unannounced:______________________________
3. Location of tabletop:____
4. Time started:____
   Time completed:____
5. Response plan scenario used (check one):
   ____Average most probable discharge ____Worst case discharge
   ____Maximum most probable discharge ____Size of (simulated) spill-bbls/gals
6. Describe how the following objectives were exercised:

a) Spill management team's knowledge of oil-spill response plan:

____
____
____

b) Proper notifications:

____
____
____

c) Communications system:

____
____
____

d) Spill management team's ability to access contracted oil spill removal organizations:

____
____
____

e) Spill management team's ability to coordinate spill response with On-Scene Coordinator, State and applicable agencies:

____
____
____

f) Spill management team's ability to access sensitive site and resource information in the Area Contingency Plan:

____
____
____

SPILL MANAGEMENT TEAM TABLETOP EXERCISE (Continued)

7. Evaluation of Exercise:

____

____

____

____

____

____

8. Changes to be implemented (if any):

____

____

____

____

____

____

Certifying Signature:____

Table A5-4 Spill Response Drill Form Equipment Deployment Exercise

VINEYARD WIND LLC
SPILL RESPONSE DRILL/EXERCISE DOCUMENTATION FORM

EQUIPMENT DEPLOYMENT EXERCISE

1. Date performed:____

2. Exercise or actual response:____

   If an exercise, announced or unannounced:__________________________________

3. Deployment location(s):

   ____
   ____
   ____

4. Time started:____

   _______Time OSRO called (if applicable)

   _______Time on-scene

   _______Time boom deployed

   _______Time recovery equipment arrives on-scene

   _______Time completed

5. Equipment deployed was:

   _______Facility-owned

   _______OSRO-owned; if so, which OSRO:___________________________________

   _______Both

6. List type and amount of all equipment (e.g., boom and skimmers) deployed and number of support personnel employed:

   ____
   ____
   ____
   ____
   ____

7. Describe goals of the equipment deployment and list any Area Contingency Plan strategies tested. Attach a sketch of equipment deployments and booming strategies:

   ____
   ____
   ____
   ____
   ____

8. For deployment of facility-owned equipment, was the amount of equipment deployed at least the amount necessary to respond to your facility's average most probable spill?

   ____
   ____
   ____

EQUIPMENT DEPLOYMENT EXERCISE (Continued)

9. Was the equipment deployed in its intended operating environment?

____
____
____

10. For deployment of OSRO-owned equipment, was a representative sample (at least 1000 feet of each boom type and at least one of each skimmer type) deployed?

____
____
____

11. Was the equipment deployed in its intended operating environment?

____
____
____

12. Are all facility personnel that are responsible for response operations involved in a comprehensive training program, and all pollution response equipment involved in a comprehensive maintenance program?

____
____
____

13. Date of last equipment inspection:____
14. Was the equipment deployed by personnel responsible for its deployment in the event of an actual spill?____
15. Was all deployed equipment operational? If not, why not?

____
____
____

16. Evaluation of Exercise:

____
____
____

17. Changes to be implemented (if any):

____
____
____
____
____
____

Certifying Signature:____

Table A5-5 Vineyard Wind Training Log

VINEYARD WIND LLC
TRAINING LOG

EMPLOYEE TRAINING

Employee Name	Date	Hours of Training	Training Topic

Annex 6 – Regulatory Compliance and Cross-Reference Matrix

Table A6-1 Oil Spill Response Plans for Outer Continental Shelf Facilities

Oil Spill Response Plans for Outer Continental Shelf Facilities 30 CFR254, Subpart B		Plan Reference
254.21(b)(1)	Table of Contents	Table of Contents
254.21(b)(2)	Emergency response action plan	Annex 3
254.21(b)(3)(i)	Equipment response inventory	Annex 9
254.21(b)(3)(ii)	Contractual agreements	Annex 8
254.21(b)(3)(iii)	Worst case discharge scenario	Annex 7
254.21(b)(3)(iv)	Dispersant use plan	Annex 7: Response
254.21(b)(3)(vi)	In situ burning plan	Annex 7: Response
254.21(b)(3)(vi)	Training and drills	Annex 5
254.22(a)	Facility location and type	OSRP Section 1.3
254.22(b)	Table of Contents	Table of Contents
254.22(c)	Record of changes	OSRP Page iv
254.22(d)	Cross reference table	Annex 6
254.23(a)	Designation of QI	OSRP: Section 2.2, Table 2-2, Section 2.3
254.23(b)	Designation of spill management team	TBD[1]
254.23(c)	Spill response operating team	TBD[1]
254.23(d)	Spill response operation center	TBD[1]
254.23(e)	Oil stored, handled, or transported	Annex 7
254.23(f)	Procedures for early detection of a spill	OSRP Section 2.1
254.23(g)(1)	Spill notification procedures	OSRP Section 2.2 Annex 4
254.23(g)(2)	Methods to detect/predict spill movement	Annex 7
254.23(g)(3)	Methods to prioritize areas of importance	OSRP Section 2.5, Annex 7
254.23(g)(4)	Methods to protect areas of importance	OSRP Section 2.6
254.23(g)(5)	Containment and recovery equipment deployment	Table 2-4
254.23(g)(6)	Storage of recovered oil	OSRP Section 2.6.3
254.23(g)(7)	Procedures to remove oil and oil debris from shallow waters	OSRP Section 2.6.2
254.23(g)(8)	Procedure to store, transfer, and dispose of recovered oil and oil-contaminated materials	OSRP Section 2.6.3
254.23(g)(9)	Methods to implement dispersant use plan and in situ burning plan	Annex 7: Response
254.24(a)	Inventory of spill response resources	Annex 9

Oil Spill Response Plans for Outer Continental Shelf Facilities 30 CFR254, Subpart B		Plan Reference
254.24(b)	Procedures for inspecting and maintaining spill response equipment	Annex 9
254.25	Contractual agreements	Annex 8
254.26(a)	Volume of worst case discharge	Annex 7
254.26(b)	Trajectory analysis	Annex 7
254.26(c)	List of special economic and environmentally important resources	Table 2-4
254.26(d)(1)	Response equipment	Annex 9
254.26(d)(2)	Personnel, materials, and support vessels	TBD[1]
254.26(d)(3)	Oil storage, transfer, and disposal equipment	Annex 9
254.26(d)(4)	Estimation of time to mobilize	TBD[1]
254.26(e)	Suitability of response	TBD[1]
254.27	Dispersant use plan	Annex 7: Response
254.28	In situ burning plan	Annex 7: Response
254.29(a)	Training	Annex 5
254.29(b)	Drills	Annex 5
254.30	Revision of OSRP	OSPR Page iv

Note: The Construction and Operations Plan (COP) for the Project is to be submitted to BOEM WEA by the end of 2017. Initial award selection(s) for long term PPA(s) are expected in the spring of 2018. Construction is scheduled to commence in 2020.

Annex 7 – Planning Calculations for Discharge Volumes and Response Equipment

Per 30 CFR 254.26, the volume of the worst-case discharge scenario must be determined using the criteria in 30 CFR 254.47. The criteria in 30 CFR 254.47 applies to oil production platform facilities and pipeline facilities. The Project does not fall into either one of these categories. Per BOEM WEA, each region is responsible for Worst Case Discharge Determination (WCD) verifications and decision documentation for plans in their regional jurisdiction. The Atlantic Region does not have guidance available for wind farms. For calculating the worst-case scenario, information on what fluids will be present and associated quantities was provided.

A7.1 Facility Information

Vineyard Wind is developing an 800 MW offshore wind project for the northern half of BOEM WEA Lease Area OCS-A-0501 (the Project). The Project is being developed and permitted using an “Envelope” concept. The Envelope concept allows Vineyard Wind to properly define and bracket Project characteristics for purposes of environmental review and permitting while maintaining a reasonable degree of flexibility with respect to selection and purchase of key Project components (the wind turbine generators, the foundations, the offshore cable system, the offshore substations, etc.). This flexible approach is particularly important in this situation because the RFP process is designed to reward the most economic projects.

The Project will include Wind Turbine Generators (WTGs) ranging from 8 to ~14 MW. Up to 106 turbine locations are being permitted to allow for spare positions (in the event of environmental or engineering challenges). Although the Project is including 106 WTG positions in the Project Envelope, only up to 100 positions will be occupied by a WTG. The offshore substations or electrical service platforms (ESPs) will include step-up transformers (66 kV to 220 kV) and other electrical gear. The Project will include either one 800 MW ESP or two 400 MW ESPs. The ESPs are expected to be located along the northwest edge of the Lease Area.

Table A7-1 WTG Oil Storage

Oil Source	Volume (Liters)	Kilograms	Approximate Gallons
Gearbox, yaw, and hydraulics	8,000		2,113
Transformer	6,500		1,717
Grease for Yaw Ring	1,000		264.2
Diesel	3,000		792.5
TOTAL			**4,887**

Table A7-2 ESP Oil Storage

Oil Source	Volume (Liters)	Gallons
Emergency Generator – Diesel Day Tank	3,802	1,004
Emergency Generator – Lubrication Oil	53	14
Diesel Tank	16,896	4,463
Platform Crane – Hydraulic Oil	1,267	335
Power Transformers (2 units)	291,454	76,994
Reactors (2 units)	147,839	39,055
Auxiliary/Earthing Transformer	8,448	2,232
TOTAL		**124,097**

A7.2 Oil Volume and Spill Containment

If all the oils associated with the ESPs were released, the worst-case scenario would be 124,097 gallons per ESP. However, control measures (e.g. containment structures) would be in place to contain a release of oil. Where possible, biodegradable oils will be used. In addition, monitoring equipment will be used to detect a release of oil. Monitoring equipment being considered include closed circuit televisions (CCTVs), supervisory control and data acquisition (SCADA), alarm systems (e.g. tank level, containment liquids, etc.), and oil detection equipment for the sump tank. The equipment will be monitored remotely from a “control room”. Specific details will be identified in the final version of the OSRP.

The ESP platform is designed to be equipped with a drain system consisting of containment structures, piping, an oil water separator, and a sump tank. The containment structures are sized according to the largest container and are connected via a piping system, draining liquids under gravity to an oil water separator and a sump tank. The sump tank can store the largest oil volume on one transformer and its cooler. The sump tank may be emptied by a service vessel for proper disposal of the oily substances onshore.

In general, all equipment that contains an environmentally harmful substance is placed above drip trays. The central area of the platform where the transformers are placed is a plated area with drains, acting as drip trays. Drip trays that have the potential to collect rain water, such as the central area, are connected via the oil water separator to the sump tank. Other drip trays (e.g. indoor) which collect only harmful substances may be connected directly to the sump tank.

Rain water and oily substances are separated in the oil water separator before water is led overboard. Water being led overboard is monitored for oil contamination. The overboard line will be closed and the drained liquids are fed to the sump tank and stored, in the event of a release.

Any temporary piping connections transporting oily substances (e.g. between diesel storage container and emergency generator) will be made using off-shore certified dry-break connectors and placed above a drip tray. A simple oil spillage kit, allowing to mitigate small, local spillage during maintenance, will be part of the delivery. The WTGs contain approximately 4,887 gallons of oil per WTG. The WTGs are designed to have a fiberglass secondary containment system, which would be sized according to the largest container.

A7.3 Oil Spill Trajectory

An oil spill modeling study was performed to assess the trajectory and weathering of oil following a catastrophic release of all oil contents from the topple of an electrical service platform (ESP; the only project component containing 250 barrels or more of oil) located closest to shore within the Wind Development Area (WDA). This would be the worst-case discharge scenario, involving the unlikely release of a relatively small and finite amount of oil (on the order of 1,500-3,000 barrels (bbl) in comparison to a larger multi-million bbl catastrophic release such as the Deepwater Horizon oil spill). It is important to note that the modeling conducted includes the conservative assumption that no oil spill response or mitigation would occur. In fact, Vineyard Wind would employ containment and recovery methods, including response equipment employed on water that would be used to prevent the spread of the spill, contain the oil to as small an area as possible, and protect sensitive areas before they are impacted. A full description of the oil spill modeling and results are provided in Annex 11 of this OSRP.

A7.4 Resources of Special Economic or Environmental Importance

According to the Regional Oil and Hazardous Substances Pollution Contingency Plan, MassDEP is the designated representative of Region I RRT for the Commonwealth of Massachusetts. In addition, MassDEP is the Trustee for Natural Resources under OPA. MassDEP has established a Priority Resource Map, which includes data such as sole source aquifers, wellhead protection areas, protected open space areas, areas of critical environmental concern, and estimated habitats of rare wildlife. The mapping does not include the Project area, since it is in the OCS.

The nearest land mass to the Project is the island of Martha's Vineyard, which is located approximately 14.4 miles north of the Project. The island of Martha's Vineyard is an EPA designated sole source aquifer. The central and eastern portions of Martha's Vineyard have been identified as potentially productive aquifers. An area that has been designated as a NHESP Estimated Habitat of Rare Wildlife is located south of Martha's Vineyard in the Atlantic Ocean. This area extends approximately 1 mile offshore in the western and central portions of Martha's Vineyard to approximately 4.5 miles offshore in the eastern portion of Martha's Vineyard. Open spaces on Martha's Vineyard include Manuel F. Correllus State Forest in the central portion of the island and several beaches located along the perimeter of the island.

Environmental Sensitivity Index (ESI) maps, available from NOAA, provide a summary of coastal resources that are at risk if an oil spill occurs in the area. Maps with coverage of Martha's Vineyard are contained in: Massachusetts and Rhode Island: Volume 3 Buzzards Bay. The maps are available in pdf format at: https://response.restoration.noaa.gov/maps-and-spatial-data/download-esi-maps-and-gis-data.html.

The oil spill modeling results (provided in Annex 11 of this OSRP) conservatively assume that no oil spill response or mitigation would occur. This is a very conservative assumption as the ESP will be designed with containment and Vineyard Wind would employ containment and recovery methods to contain and recover onshore and aquatic petroleum spills. Under these very conservative assumptions, the modeling results indicate there is a <30-40%% probability that oil above a threshold of concern for ecological impacts would reach the shorelines of Martha's Vineyard and Nantucket within 1-3 days of the release during all seasons. There is a lower probability (<10%) of oil above the threshold reaching the shorelines of Rhode Island and Massachusetts >3 days following the release. There is the relatively small (<10%) potential for shoreline contamination to occur above the threshold on parts of Long Island and

Connecticut; however, the timing for this to happen is much longer (>10 days) in most cases, and would likely be largely mitigated with response measures. When comparing the oil spill modeling results with the ESI data for Massachusetts and Rhode Island, the southern shores of Martha's Vineyard and Nantucket, which would likely be the first shorelines to be impacted by a spill (prior to response equipment being deployed), are primarily dominated by tidal flats. The shorelines of Rhode Island and Massachusetts on which there would be a lower probability of oiling above the threshold for ecological effects are predominately comprised of sand and gravel beaches and riprap. Some of the specific areas of environmental concern along the southern shores of Martha's Vineyard and Nantucket that would be taken into special consideration in the event of an oil spill include the Long Point Wildlife Refuge, Katama Plains Nature Preserve, Head of Plains Wildlife Management Area, Smooth Hummock Coastal Preserve and Miacoment Heath Wildlife Management Area.

A7.5 Response

The Project has not yet been approved. Details regarding spill response materials, services, equipment, and response vessels have not been finalized at this time.

The WTGs and ESPs have been designed to utilize secondary containment systems to prevent a release of oil to the environment. Containment will be provided considering the size of the largest container. The secondary containment for the ESPs are connected to a sump tank. In addition, an oil/water separator will be in use. It is unlikely that a release of oil would not be contained by the containment systems.

Oils used by the Project have a specific gravity of less than 1.0. Therefore, any releases of oil to water would float on the surface of the water and on-water techniques could be used to recover the released oil.

Vineyard Wind will retain a third-party Oil Spill Response Contractor to assist in the unlikely event of a release of oil to the environment. In addition, Vineyard Wind will maintain pier space for Crew Transport Vessels (CTV) and other support vessels. CTVs are purpose built to support offshore wind energy projects; they are typically 75 feet in length and set up to safely and quickly transport personnel, parts and equipment. In addition to vessels, Vineyard Wind will maintain spill response equipment such as a spill overpack drum, containment bladders, absorbent booms, pigs, socks, and other sorbent materials. In addition, Vineyard Wind will have on-hand personal protective equipment (PPE) such as goggles or safety glasses, face shields, gloves, and disposable chemical and oil resistant suits (e.g. Tyvek suits).

Massachusetts Department of Environmental Protection (MassDEP) maintains a list of companies licensed as hazardous waste transporters who provide emergency response services and cleanups of oil and/or hazardous material (OHM) spills. MassDEP SERO emergency response contractors located in close proximity to the Project include Frank Corporation (New Bedford), Global Remediation Services, Inc. (Sandwich), Clean Harbors, Incorporated (Braintree), and Cyn Oil Corporation (Stoughton). Both companies maintain boats and other equipment to respond to releases of oil on the in a marine environment. Once a spill response contractor has been selected, additional details will be provided regarding spill response resources and the time needed for procurement of the spill response resources. In addition, a discussion of response to worst case scenario in adverse weather conditions will be addressed once a spill response contractor has been selected. Per 33 CFR 115.1020, factors to consider when evaluating adverse weather include, but are not limited to, significant wave height, ice, temperature, weather-related visibility, and currents.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) restricts dispersant use to only areas where agreements have been established. In addition, the NCP limits restricts dispersant use to only those approved by EPA. Per Appendix 4 of the RRT Regional Oil and Hazardous Substances Pollution Contingency Plan, pre-authorization for the use of chemical dispersants has been established.

The Massachusetts/Rhode Island Dispersant Pre-Authorization Policy establishes conditional approval zone for areas in Massachusetts and Rhode Island within two nautical miles of the mainland or designated islands, or areas that have a mean low water depth of less than 40 feet. The Project is located in the OCS and is beyond two nautical miles of the mainland or designated islands. In addition, water depths in the area of the Project are approximately 115 to 161 feet. Therefore, the Project is not located in an area that has pre-authorization for the use of dispersants. Vineyard Wind does not propose to use dispersants, and a dispersant use plan is not warranted.

In-situ burning is regulated by Subpart J of the NCP. In addition, the NCP restricts in-situ burning to areas where agreements have been made between state and federal regulatory authorities. Per Appendix 2 of the RRT Regional Oil and Hazardous Substances Pollution Contingency Plan, Region 1 has established an In-Situ Burning Memorandum of Understanding (MOU). The MOU establishes three zones and designates decision of authority for use of in-situ burning in these zones. Zone A is defined as all waters subject to the jurisdiction of the United States located seaward of a line measured six miles from the mean waterline along the coasts and islands of Maine, Massachusetts, New Hampshire, and Rhode Island. Zone B is defined as all waters subject to the jurisdiction of the United States located seaward of a line measured one mile and terminating six miles from the mean low waterline along the coasts and islands of Maine, Massachusetts, New Hampshire, and Rhode Island. Zone C is defined as waters that are shoreward of a line measured 1 mile seaward of the mean low water mark along the coasts and islands of Maine, Massachusetts, New Hampshire, and Rhode Island. The nearest land to the Project is the island of Martha's Vineyard, which is located approximately 14.4 miles north of the Project. Therefore, the Project is not located in an area that has pre-authorization for the use of in-situ burning. Vineyard Wind does not propose to use in-situ burning, and an in-situ burning plan is not warranted.

Annex 8 – Agreement with Oil Spill Response Organization

The Project has not yet been approved. Construction of the Project is scheduled to begin in 2020. Details regarding contractual agreements have not been finalized at this time.

Per 30 CFR 254.25, the contractual agreements appendix must furnish proof of any contracts or membership agreements with OSROs, cooperatives, spill-response service providers, or spill management team members who are not Vineyard Wind employees that are cited in the OSRP. Documentation should include copies of the contracts, or membership agreements, or certification that contracts or membership agreements are in effect. The contract or membership agreement must include provisions for ensuring the availability of the personnel and/or equipment on a 24-hour-per-day basis.

Vineyard Wind will retain a third-party OSRO. MassDEP SERO emergency response contractors located in close proximity to the Project include Frank Corporation (New Bedford), Global Remediation Services, Inc., (Sandwich), Clean Harbors, Incorporated (Braintree), and Cyn Oil Corporation (Stoughton).

Appendix 9 of the Regional Oil and Hazardous Substances Pollution Contingency Plan contains the Coast Guard/Environmental Protection Agency Response Jurisdiction Boundary. This document demarcates the boundary between inland and coastal zones for the purpose of pre-designation of on-scene coordinators for pollution response. Martha’s Vineyard, Nantucket, and all other islands lying off the coast of Massachusetts are the responsibility of the US Coast Guard for providing the predesignated Federal On-Scene Coordinator. USCG will be responsible for general agency and incident specific responsibilities under the NCP and Area Contingency Plan.

Annex 9 – Equipment Inventory

The Project has not yet been approved. Details regarding spill response materials, services, equipment, and response vessels has not been finalized.

A9.1 Maintenance Facilities

In support of Project operations and the necessary maintenance activities, Vineyard Wind will have a management and administrative team, a “control room” operation, and maintenance facilities. These functions will be co-located, if feasible. Vineyard Wind is in the early stages of evaluating possible locations for the O&M facilities; possible locations include Martha’s Vineyard, New Bedford, and other locations.

The technicians and engineers responsible for long term Project maintenance will operate from the maintenance facilities. The maintenance operation will include office and training space, shop space, warehouse space for parts and tools, and pier space for Crew Transport Vessels (CTV), and other support vessels. CTVs are purpose-built to support offshore wind energy projects; they are typically 75 to 85 feet in length and set up to safely and quickly transport personnel, parts, and equipment. The CTVs are typically used in conjunction with helicopters. Helicopters can be used for fast response visual inspections and repair activities, as needed. The maintenance operation may also make use of larger Service Operations Vessels (SOVs). SOVs are typically 260 to 300 feet in length with a deadweight of approximately 4,000 tons at maximum draft. SOVs are usually diesel electric powered with dynamic positioning.

In addition to the vessels above, it is anticipated that Vineyard Wind will maintain spill response equipment such as a spill overpack drum, containment bladders, absorbent booms, pigs, socks, and other sorbent materials. In addition, Vineyard Wind will have on-hand personal protective equipment (PPE) such as goggles or safety glasses, face shields, gloves, and disposable chemical and oil resistant suits (e.g. Tyvek suits).

A9.2 Electrical Service Platform (ESP)

The offshore substations or electrical service platforms (ESPs) will include step-up transformers (66 kV to 220 kV) and other electrical gear. The Project will include either one 800 MW ESP or two 400 MW ESPs. The ESPs are expected to be located along the northwest edge of the Lease Area.

Vineyard Wind will maintain spill response equipment at the ESPs. Brooms, shovels, sorbents, pigs, socks, and a spill overpack drum will be maintained at the ESP for response to minor leaks and spills. In addition, Vineyard Wind will have on-hand personal protective equipment (PPE) such as goggles or safety glasses, face shields, gloves, and disposable chemical and oil resistant suits (e.g. Tyvek suits).

A9.3 Oil Spill Response Contractor

Vineyard Wind will retain a third-party OSRO. Massachusetts Department of Environmental Protection (MassDEP) maintains a list of companies licensed as hazardous waste transporters who provide emergency response services and cleanups of oil and/or hazardous material (OHM) spills. The list is updated annually by MassDEP and is organized by MassDEP Regions. The Southeast Regional Office (SERO) is affiliated with Martha’s Vineyard and New Bedford. The list of contractors for the SERO Region is available at: http://www.mass.gov/eea/docs/dep/cleanup/serohwtr.pdf. MassDEP emergency response contractors located in close proximity to the Project include Frank Corporation (New Bedford), Global Remediation Services, Inc. (Sandwich), Clean Harbors, Incorporated (Braintree), and Cyn Oil Corporation (Stoughton).

The selected spill contractor will be responsible for the inspection and maintenance of their equipment. The equipment should be inspected on at least a monthly basis.

A9.4 Inspections (30 CFR 254.43)

Response equipment will be inspected when the WTG is otherwise visited or at least quarterly and maintained to ensure optimal performance. Records of inspections of response equipment must be maintained for at least two years and made available to authorized BSEE representatives upon request. Inspections of contractor equipment is addressed in A9.8.

The program of maintenance and testing of emergency response equipment involves four activities: Operability Check, Inventory, Inspection, and Maintenance. The Emergency Response Team (ERT) Coordinator or designee is required to sign the inspection form, and will be responsible for any follow-up actions that may be required as a result of the inspection, inventory or test of emergency response equipment. For any items that cannot be replaced or repaired during the inspection, test or inventory, the inspector will indicate need of further action on the inspection form. It will then become the responsibility of the ERT Coordinator to take further actions(s) as required.

A9.5 Operability Check (Semi-annual)

This activity is intended to periodically insure the operability of certain items of equipment in the Project's emergency equipment inventory so that it is in a constant state of readiness for deployment. The designated inspector will check the operability of equipment including safety monitoring equipment and outboard motors. Any equipment that is electronic, electrical, or mechanical will be tested under actual load or use conditions.

During the operability check, the inspector will also perform routine maintenance on the equipment, as needed, such as battery replacements, oil and filter changes, and cleaning of boom. The inspector will indicate on the inspection form any problems encountered with the equipment and corrective measures taken or needed.

A9.6 Inventory (Monthly)

The inspector will verify the availability and condition of the variety of supplies, materials, and tools that are maintained in storage. The inspector will work from a list of items that are required to be maintained at all times. Any discrepancies in the list, or item replacement needs, will be noted on the inventory form. Inspection for condition of emergency resources will be checked semi-annually.

A9.7 Inspections

The semi-annual inspection of the sorbent booms will involve complete removal of booms from storage and the laying-out of the booms in an area that would not cause damage to the fabric of the booms. The inspector will examine each length of boom closely, making note of any fabric damages or wear, broken or frayed cable, missing weights and damaged connectors. The inspector will also verify the quantity of boom that is in storage to ensure there is sufficient supply. Any damages will be repaired, if possible. If the length of boom cannot be economically repaired, the inspector will request replacement.

A9.8 Contractor Equipment

The ERT will ensure that the contractor has a maintenance program established for its equipment. A copy of the program would be requested and kept on file.

Annex 10 – Safety Data Sheets

Include SDSs for oils to be located at the Project.

Annex 11 – Vineyard Wind Offshore Wind Project Oil Spill Modeling Study

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Final Report

Vineyard Wind Offshore Wind Project Oil Spill Modeling Study

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Disclaimer:

Executive Summary

Vineyard Wind, LLC ("Vineyard Wind") is proposing an 800 megawatt ("MW") wind energy project within BOEM Lease Area OCS-A 0501, consisting of offshore wind turbine generators ("WTGs") each placed on a foundation support structure; electrical service platforms ("ESPs"); an Onshore Substation; offshore and onshore cabling; and onshore Operations & Maintenance Facilities (these facilities will hereafter be referred to as the "Project"). Pursuant to 30 CFR 585.627(c), as part of the requirement to submit an Oil Spill Response Plan (OSRP), BOEM states that if any component of the proposed offshore facility contains 250 barrels or more of oil, the OSRP should include a stochastic spill trajectory analysis that addresses the following:

a. The worst-case discharge (WCD) from each component containing 250 barrels or more of oil.

b. The longest period of time that the oil discharged from each component containing 250 barrels or more of oil would reasonably be expected to persist on the water's surface, or 14 days, whichever is shorter.

c. The probabilities for oiling on the water's surface and on shorelines, and minimum travel times for the transport of the oil, over the duration of the model simulation. Oiling probabilities and minimum travel times calculated for exposure threshold concentrations reaching 10 g/m^2. Stochastic analysis incorporating a minimum of 100 different trajectory simulations using random start dates selected over a multi-year period.

Therefore, as an Annex to the Vineyard Wind OSRP (COP Appendix I-A), an oil spill modeling study was performed to assess the trajectory and weathering of oil following a catastrophic release of all oil contents from the topple of an electrical service platform (ESP; the only project component containing 250 barrels or more of oil) located closest to shore within the Wind Development Area (WDA). This would be the worst case discharge scenario, involving a relatively small and finite release of oil (on the order of 1,500-3,000 barrel [bbl] in comparison to a larger multi-million bbl catastrophic release such as the Deepwater Horizon oil spill). Based on the results of a previous BOEM study (Bejarano et al. 2013) assessing potential catastrophic oil spills from offshore wind structures, the probability of occurrence of this type of catastrophic release, such as the topple of an ESP, is extremely small. In addition to the low probability of such an event, the oil spill scenarios modeled in this study assume that no oil spill response or mitigation would occur. This is also a very conservative assumption as the ESP will be designed with containment and Vineyard Wind would employ containment and recovery methods to contain and recover onshore and aquatic petroleum spills. As discussed in further detail in Section 2.3.4 of the OSRP (COP Appendix I-A), response equipment employed on water would be used to prevent the spread of the spill, contain the oil to as small an area as possible, and protect sensitive areas before they are impacted.

The oil spill model, OILMAP/SIMAP, was used to conduct this assessment. Model inputs included winds, currents, chemical composition and properties of oils of interest and specifications of the release (amount, location, etc.). Environmental conditions (i.e., wind and current forcing, water temperature and salinity) play a critical role in the assessment of the trajectory and weathering of oil in a marine spill. Therefore, a data analysis of these conditions as input to the model was also performed. The data analysis also helped to identify the site-specific seasons in which the modeling scenarios should be performed. As a result of this analysis, a total of eight stochastic modeling scenarios (one per season for two spill volumes) were assessed.

Based on the environmental datasets analyzed as input for the oil spill modeling, the following conclusions can be drawn:

- Winds in the region are moderate, generally blowing from the northwest (winter) or southwest sector (summer) with monthly average wind speeds ranging from 6 to 10 m/s. The strongest winds are found in December and January with the weakest in August.
- Currents at the spill site are up to approximately 30 cm/s speed on average, and their direction changes in the representative seasons.
- In the area of interest, winds are usually more influential than the associated currents in regards to surface transport; however the winds in this region are often much more variable. During the month of July when wind intensity decreases, surface current may control the movement of floating slicks.
- Though there are strong seasonal trends in winds, it is important to note that the direction and magnitude of winds can change from day to day, and the wind roses presented below show monthly averages.

Based on the results of the stochastic oil spill trajectory analysis, the following conclusions can be made:

- The sea surface area exposed to oil exceeding the 10 g/m^2 threshold is contained within approximately 20-25 miles of the 400 MW ESP spill location and 30-50 miles of the 800 MW ESP spill location for all four seasons, with the area for the winter simulation being relatively smaller than the other three seasons.
- In all seasons, there is a 1-40% probability of oil above a minimum thickness of 100 µm (100 g/m^2 on average over the grid cell) reaching the shorelines of Martha's Vineyard and Nantucket within 1-3 days of the release. There is an even lower probability (<10%) of oil above the threshold reaching the shorelines of Rhode Island and Massachusetts >3 days following the release. There is the relatively small (<10%) potential for shoreline contamination to occur above 100g/m^2 on parts of Long Island and Connecticut; however, the timing for this to happen is much longer (>10 days) in most cases, and would likely be largely mitigated with response measures.

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1. Introduction

1.1. Project Background

Pursuant to 30 CFR 585.627(c), in which a stochastic spill trajectory analysis is required as part of the Oil Spill Response Plan (OSRP) for any component of the proposed offshore facility containing 250 barrels or more of oil, this Annex documents the oil spill modeling study performed in support of the Vineyard Wind Offshore Wind Project Construction and Operations Plan (COP).

As described in the Vineyard Wind OSRP (COP Appendix I-A), the project components containing oil include the offshore wind turbine generators ("WTGs") placed on a foundation support structure and the electrical service platforms ("ESPs"). The Project will include either one 800 MW conventional ESP or two 400 MW conventional ESPs. The oil sources in the WTGs include gear boxes, transformers, yaw gears, grease for yaw rings, diesel, and the pitch system, which total approximately 4,887 gallons (116 bbl) per WTG. Oil sources in the ESPs include lubrication oil, diesel tanks, hydraulic oil for a platform crane, power transformers, reactors, and auxiliary/earthing transformers. Oil sources associated with one ESP, which is the only project component containing 250 barrels or more of oil, totals approximately 64,634 gallons (1,539 bbl) for a 400 MW ESP and 124,097 gallons (2,954 bbl) for an 800 MW ESP. Therefore, this oil spill modeling study assesses the trajectory and weathering of a catastrophic release of all oil contents from two different scenarios in four seasons (8 total scenarios), including

1. the topple of a 400 MW ESP located closest to shore within the Wind Development Area (WDA). This would be the lower volume worst case discharge scenario involving a relatively small and finite release of oil from one ESP station (1,539 bbl or 245 m^3), in comparison to a larger multi-million bbl catastrophic release (such as the Deepwater Horizon oil spill); and
2. the topple of an 800 MW ESP located closest to shore within the WDA[1], releasing a conservative volume of 2,954 bbl (460 m^3) of oil for a higher end worst case discharge.

Based on the results of a previous BOEM study (Bejarano et al. 2013) assessing potential catastrophic oil spills from offshore wind structures, the probability of occurrence of this type of catastrophic release, such as the topple of an ESP, is extremely small. In addition to the low probability of such an event, the oil spill scenarios modeled in this study assume that no oil spill response or mitigation would occur. This is also a very conservative assumption as the ESPs will be designed with containment and Vineyard Wind would employ containment and recovery

[1] The Project includes two ESP locations: one closer to shore (ESP 1) and one farther from shore (ESP 2). The model scenarios both use the ESP position that is located closest to shore (ESP 1); however, in the time interval between the first and second drafts of this report, a review of ongoing survey data led to the relocation of the ESP closest to shore to a new position that is slightly farther offshore (referred to as ESP 1 – revised). Therefore, the model scenario for the 800 MW ESP incorporates the revised ESP position (ESP 1 – revised) that is slightly farther offshore than the original ESP position (ESP 1) modeled for the 400 MW ESP scenario. The ESP 2 position was not modeled since it is located farthest from shore.

methods to contain and recover onshore and aquatic petroleum spills. As discussed in further detail in Section 2.3.4 of the OSRP (COP Appendix I-A), response equipment employed on water would be used to prevent the spread of the spill, contain the oil to as small an area as possible, and protect sensitive areas before they are impacted.

1.2. Objectives, Tasks and Study Output

The goals of spill modeling include projecting the probable behavior of accidentally spilled oil using a state-of-the-art 3-dimensional transport model, and producing modeled trajectory and fate output such as visual representations (e.g., probability of oiling and minimum travel time maps) for various scenarios. RPS's proprietary oil spill modeling framework, OILMAP/SIMAP, was used for the simulations performed in this study. Model inputs included winds, currents, chemical composition and properties of oils of interest and specifications of the release (amount, location, etc.). The model was run in stochastic mode, as described further in Section 3, providing two types of information: 1) the footprint of sea surface and shoreline areas exposed to oil above a certain threshold of concern and the associated probability of oil contamination, and 2) the shortest time required for oil to reach any point within the areas predicted to be oiled.

Environmental conditions (i.e., wind and current forcing, water temperature and salinity) play a critical role in the assessment of the trajectory and weathering of oil in a marine spill. Therefore, a data analysis of these conditions as input to the model was performed. The data analysis also helped to identify the site-specific seasons in which the modeling scenarios should be performed. As a result of this analysis, a total of eight stochastic modeling scenarios (one per season for two oil volumes) were assessed.

This report describes the models, modeling approach, model inputs and outputs used in this study. A description of environmental data sources is provided in Section 2. The oil spill modeling approach and scenario specifications are provided in Section 3. Section 4 provides a summary of the stochastic modeling results and conclusions. References are provided in Section 5.

2. Environmental Conditions and Data Analysis

In order to understand the behavior of a marine oil spill, it is necessary to evaluate the predominant environmental conditions in the area. Winds and currents are the key forcing agents that control the transport and weathering of oil. To reproduce the natural variability of the environment, the OILMAP/SIMAP model requires wind and current datasets that vary both spatially and temporally. Optimally, the minimum time window for stochastic simulations is 5 to 10 years; therefore, long-term records of wind and current data were obtained from the outputs of global numerical atmospheric and circulation models. The following section describes the key environmental conditions that dominate in the region of interest and more specifically in the model domain (Figure 1) for which the environmental datasets have been subset.

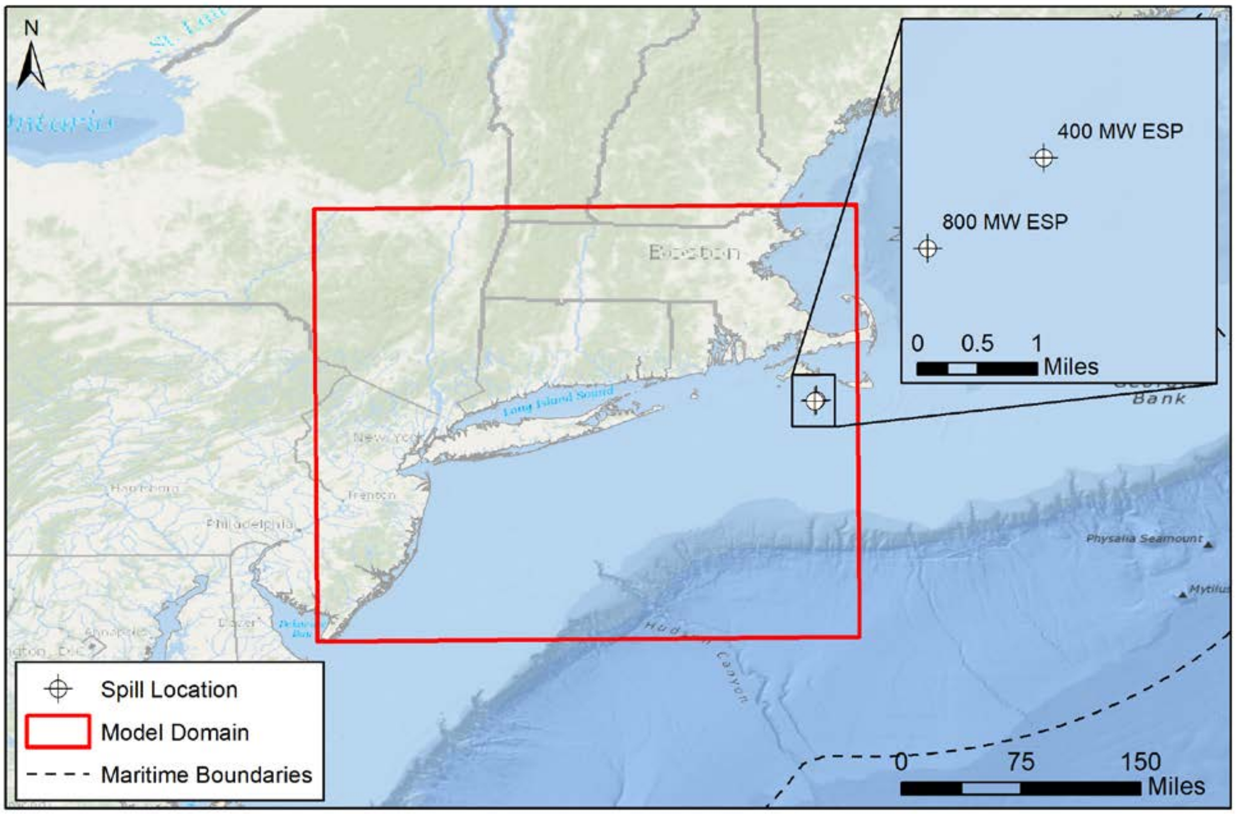


Figure 1. Oil Spill Model domain defined for this study, south of Martha's Vineyard.

2.1. General Dynamics and Climatology

The site of interest is located in the inner shelf of Martha's Vineyard, Massachusetts. Based on the types of spills and the predominant environmental conditions in the region, the modeling domain was defined to encompass the region located south of Martha's Vineyard (Figure 1).
This is an area which has been heavily investigated in terms of the dynamics of depth-dependent across-shelf circulation caused by wind and wave forcing. Fewings et al. (2008) and Lentz et al.

(2008) found significant across-shelf circulation driven by across-shelf winds, as well as evidence of a circulation resulting from waves in the inner shelf. The seasonal (both summer and winter) mean circulations found in the moored observations of Lentz et al. (2008) and Fewings et al. (2008) were generally attributed to the effects of pressure gradients (Lentz 2008; Fewings and Lentz 2010) or surface gravity waves (Lentz et al. 2008). However, modeling studies by He and Wilkin (2006) and Wilkin (2006) indicated that large tidal velocities in the gap between the islands of Martha's Vineyard and Nantucket play a critical role in the formation of upwelling centers near Martha's Vineyard, despite uniform winds.

Data obtained from the World Ocean Atlas (WOA) 2013 climatology dataset (Levitus et al. 2014) for the potential spill site shows the monthly sea surface water temperature typically varies from 4°C to 19°C. The temperature starts to increase from April and reaches the peak during August. After this period, the temperature decreases and reaches the minimum of 4°C in March. The salinity at the spill site stays relatively stable throughout the year, around 32 ppt. The monthly average values of sea surface temperature and salinity at the spill site location are presented in Figure 2.

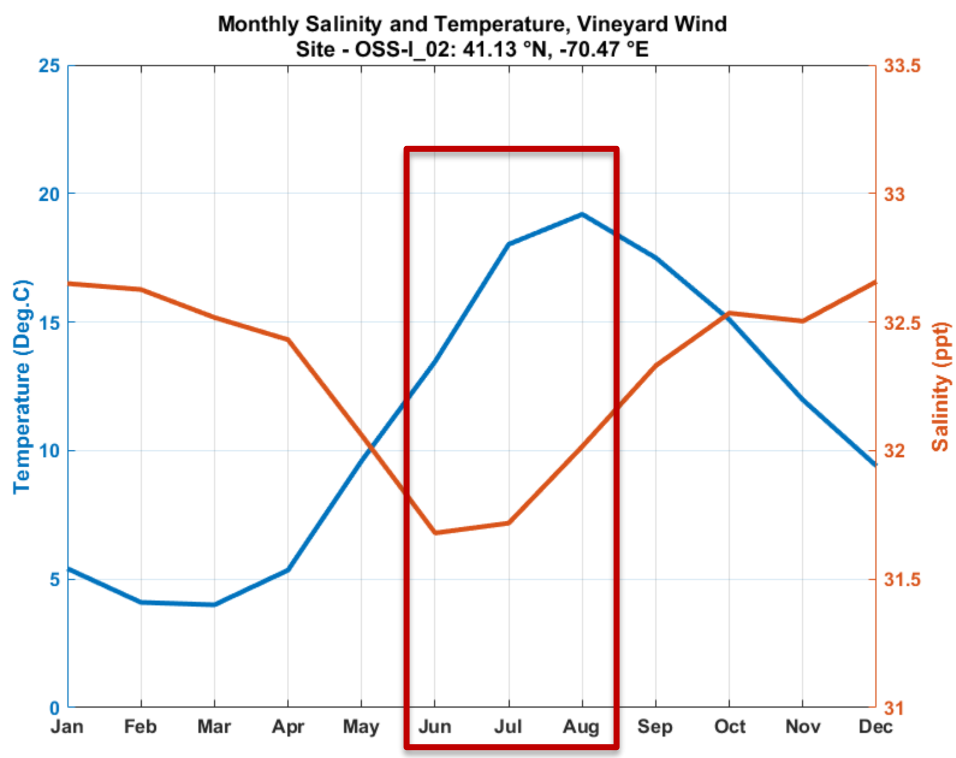


Figure 2. Monthly sea surface temperature (°C) in blue and salinity (ppt) in red at the spill location (data source: WOA 2013). Summer season highlighted with a red box.

From a modeling perspective, the year was split into four representative periods which correspond to the meteorological seasons (winter, spring, summer and fall).
Table 1 lists the months and predominant environmental conditions for each representative period.

Table 1. Summary of season breakdown used for the oil spill modeling.

Season	Representative Months	Season Description
Winter	December-February	Higher Wind, predominately from NW
Spring	March-May	Transition of wind direction from NW to SW with relatively lower wind speed than Winter
Summer	June-August	Lower wind speed, predominantly from SW
Fall	September-November	Transition of wind direction from SW to NW with relatively higher wind speed than Summer

2.2. Wind Dataset – NCEP CFSR

For this study, wind data were obtained from the U.S. National Centers for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR) for a 10-year period (2001 to 2010). The CFSR was designed and executed as a global, high-resolution, coupled atmosphere-ocean-land surface-sea ice system to provide the best estimate of the state of these coupled domains (Saha et al. 2010). This atmospheric model has a horizontal resolution of 38 km, with 64 vertical levels extending from the surface to the height at which air pressure reaches 0.26 hPa. CFSR winds were also one of the main driving forces used in the HYCOM Reanalysis, the global hydrodynamic currents dataset used in this study. To validate the CFSR product for the purposes of it being included as the wind forcing for oil spill modeling, wind measurements were obtained from a meteorological station located in Buzzards Bay, MA. The name of the station is BUZM3 and it is a Coastal-Marine Automated Network (C-MAN) station, established and operated by National Data Buoy Center (NDBC). Annual wind roses along with monthly statistics were compared between BUZM3 wind data and CFSR wind output (at a grid point close to the location of BUZM3) for a 5-year period (2006-2010). The observation was recorded at an elevation of 24.8m and for comparison with 10m wind from CFSR[2].

The following figures provide qualitative and statistical description of the CFSR winds in this region in order to understand their variability, both spatially and temporally:

- Annual wind roses (in m/s) from BUZM3 observation and CFSR model (Figure 3) in the direction from which the wind is blowing;
- Monthly wind roses (in m/s) from BUZM3 observations (Figure 4) and CFSR model (Figure 5) (near the BUZM3 location) in the direction from which the wind is blowing;
- Wind speed statistics (Figure 6): Monthly average and 95th percentile wind speed statistics (in m/s) from BUZM3 station and CFSR model output (near the BUZM3 location);

[2] The altitude factor has been applied by using the wind shear formula, $u=(u_{ref})*((z/z_{ref})^{\alpha})$ where the shear exponent is typically assumed to be equal to 0.2.
(Source: https://www.esrl.noaa.gov/csd/projects/lamar/windshearformula.html)

- Comparison between BUZM3 observation and CFSR model (Figure 7): Wind speed (in m/s) and direction (degrees) time-series compared between BUZM3 observation and CFSR output.
- Windrose map (Figure 8): Spatial distribution of CFSR annual windroses (in m/s) off the southern coast of New England in the direction from which the wind is blowing;
- Annual windrose (Figure 9): Annual CFSR windrose (in m/s) near the spill site in the direction from which the wind is blowing;
- Wind speed statistics (Figure 10): Monthly average and 95th percentile CFSR wind speed (in m/s) statistics near the spill site, and
- Monthly windroses (Figure 11): Monthly CFSR windroses (in m/s) near the spill site, in the direction from which the wind is blowing.

Based on this analysis of the BUZM3 station observations and the CFSR global wind dataset for a 5-year period (2006-2010), the following conclusions can be drawn:

- CFSR was able to reproduce the wind speed magnitude and direction close to what are seen from observational data (BUZM3), and captured the seasonal variation of wind intensity and directionality. Monthly statistics and time-series (speed and direction) comparison between BUZM3 and CFSR wind indicates the CFSR slightly underestimates the BUZM3 observation in terms of speed, though the seasonal trend of wind direction and magnitude is clearly similar to the observation.
- Winds are mostly consistent during winter and summer, in terms of direction and speed. During winter (December-February), it is predominantly northwesterly with higher speed while throughout summer (June-August), it is mostly southwesterly with lower speed. Spring (March-May) and fall (September-November) are the transition seasons. In spring, predominant wind direction changes from northwest to southwest and average wind speed decreases. Fall marks the period when wind direction changes from southwest to northwest and the speed starts to rise.
- Wind speed and direction are mostly consistent throughout the domain of interest. The spatial distribution of wind (Figure 8) shows that winds are predominantly blowing from the northwest and southwest sectors.
- Monthly average wind speeds range from 6 to 10 m/s, with the weakest winds in August.

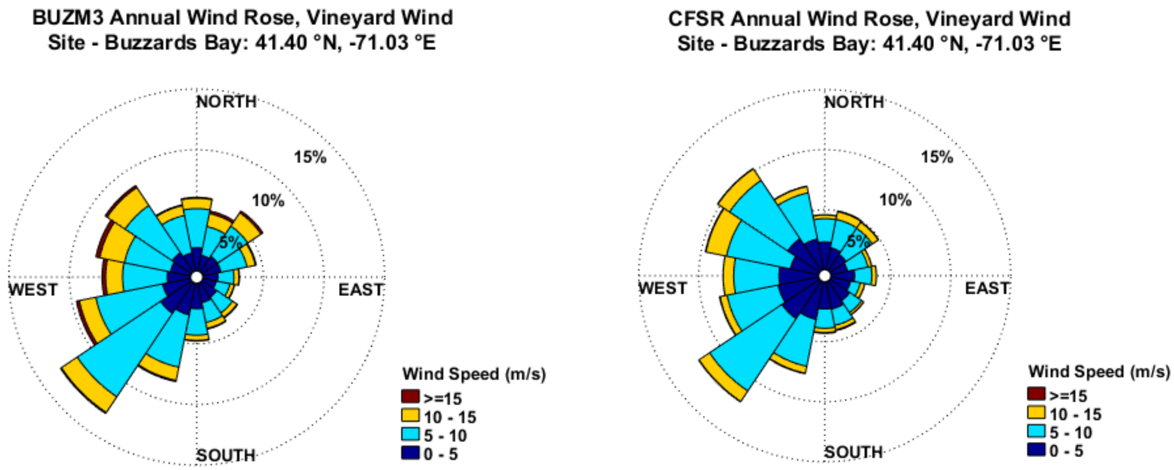


Figure 3. Annual BUZM3 wind rose (left panel) and CFSR wind rose (right panel) near BUZM3 station located in Buzzards Bay for 5 year period (2006-2010). Wind speeds in m/s, using meteorological convention (i.e., direction from which wind is blowing).

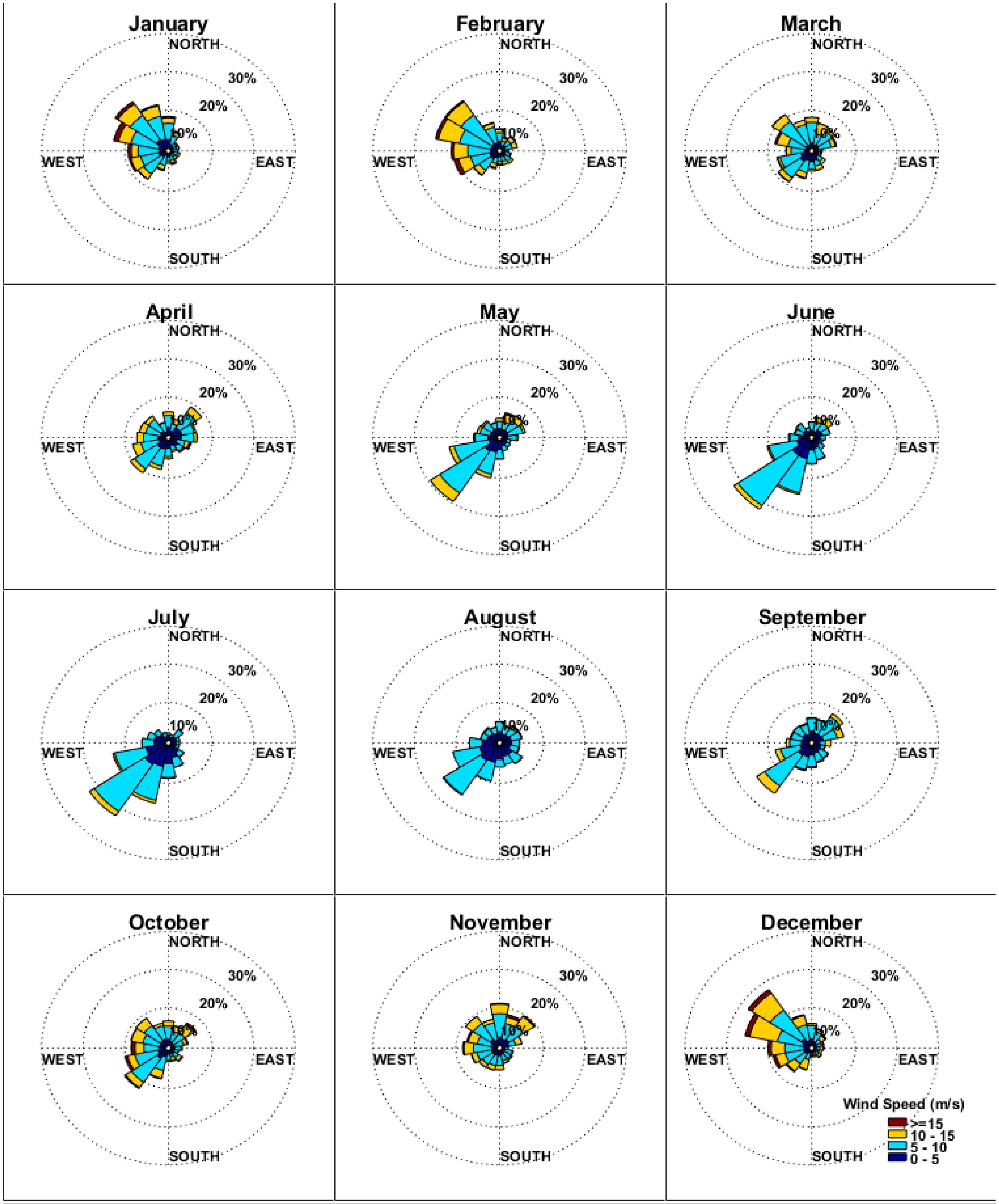


Figure 4. Monthly BUZM3 windroses for 5 year period (2006-2010). Wind speeds in m/s, using meteorological convention (i.e., direction from which wind is blowing).

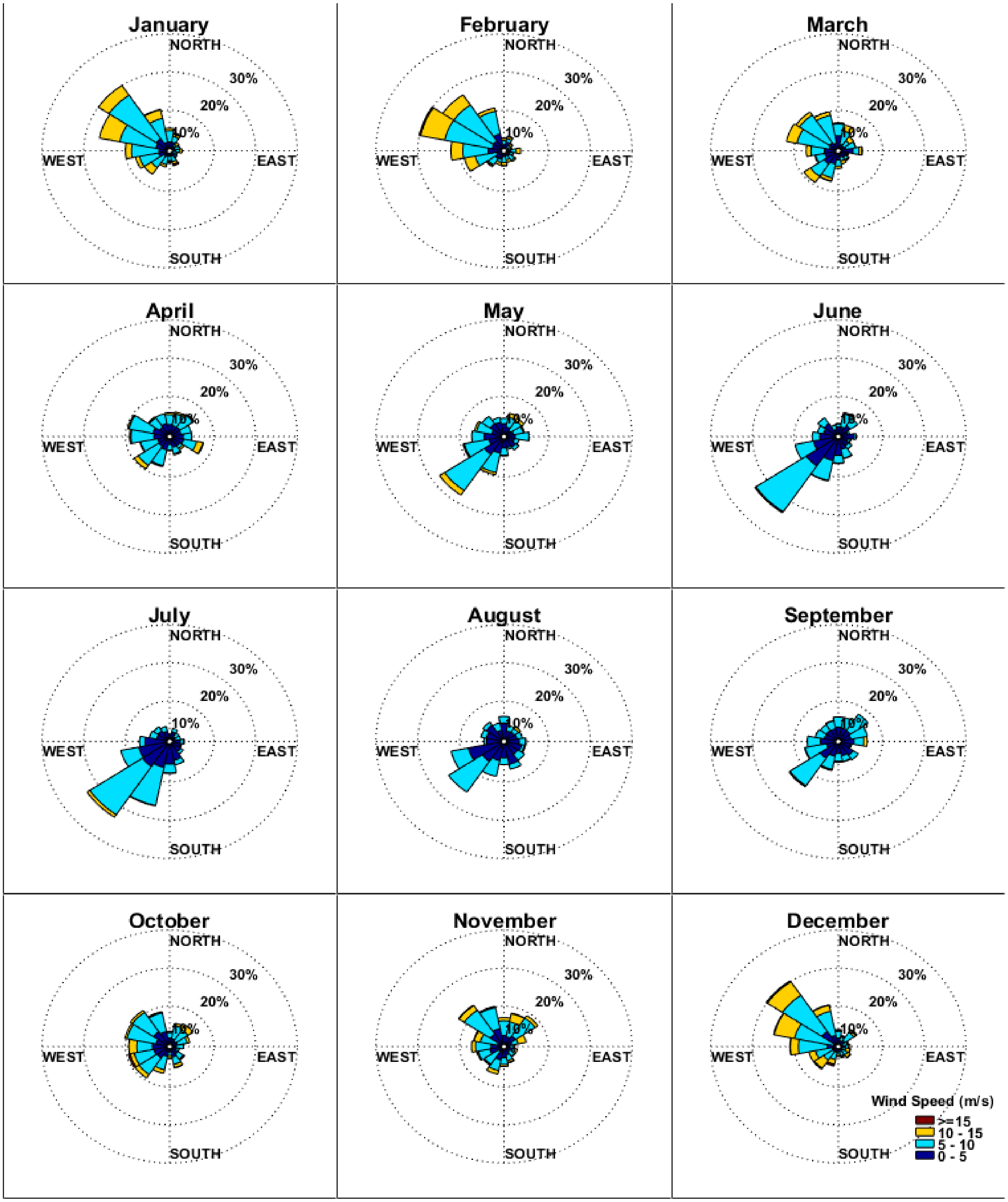


Figure 5. Monthly CFSR wind roses for 5 year period (2006-2010) near BUZM3 station located in Buzzards Bay. Wind speeds in m/s, using meteorological convention (i.e., direction from which wind is blowing).

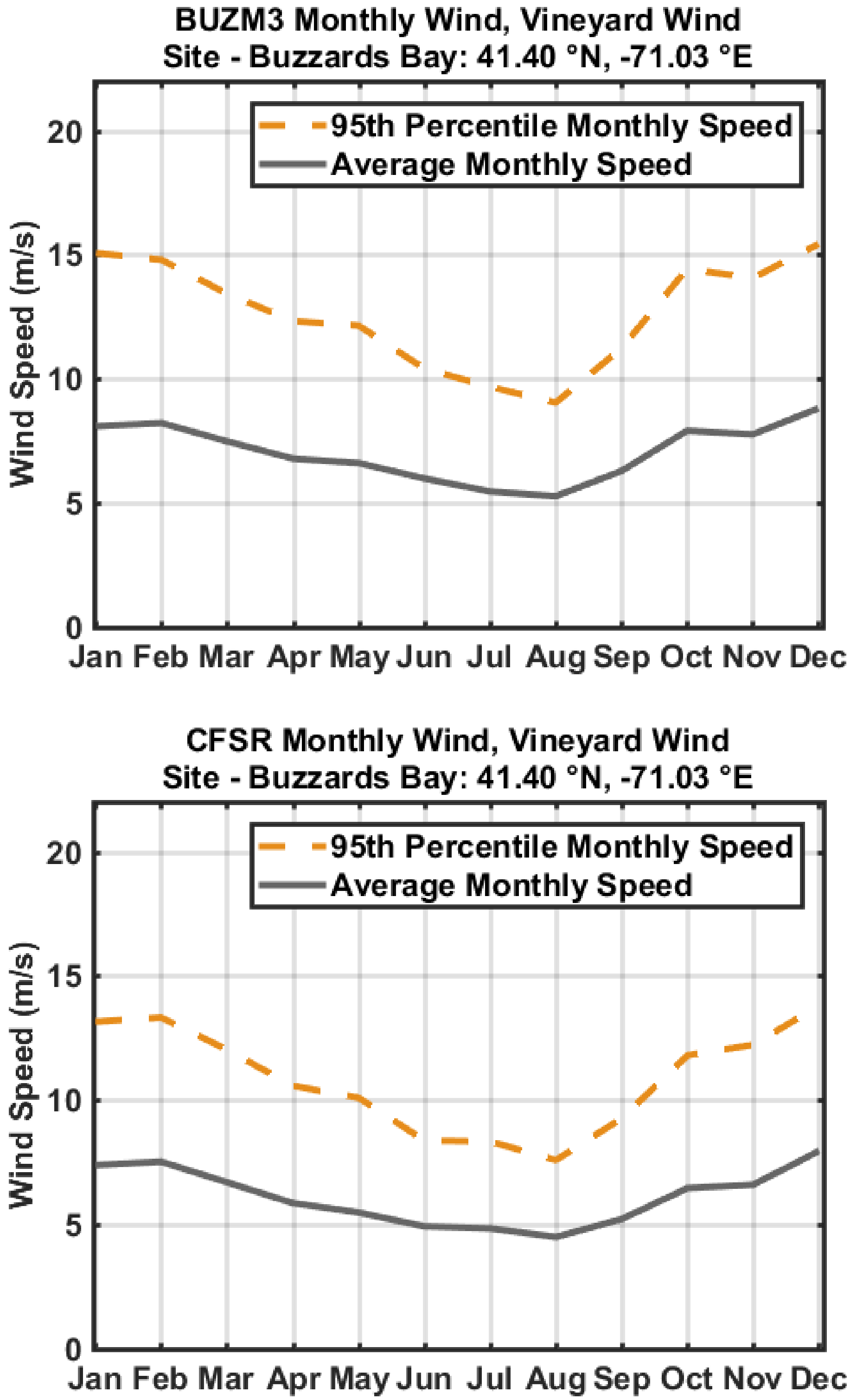


Figure 6. Monthly average and 95th percentile wind speed statistics for BUZM3 station (upper panel) and CFSR (lower panel) for 5 year period (2006-2010): monthly average (grey solid) and 95th percentile (orange dashed).

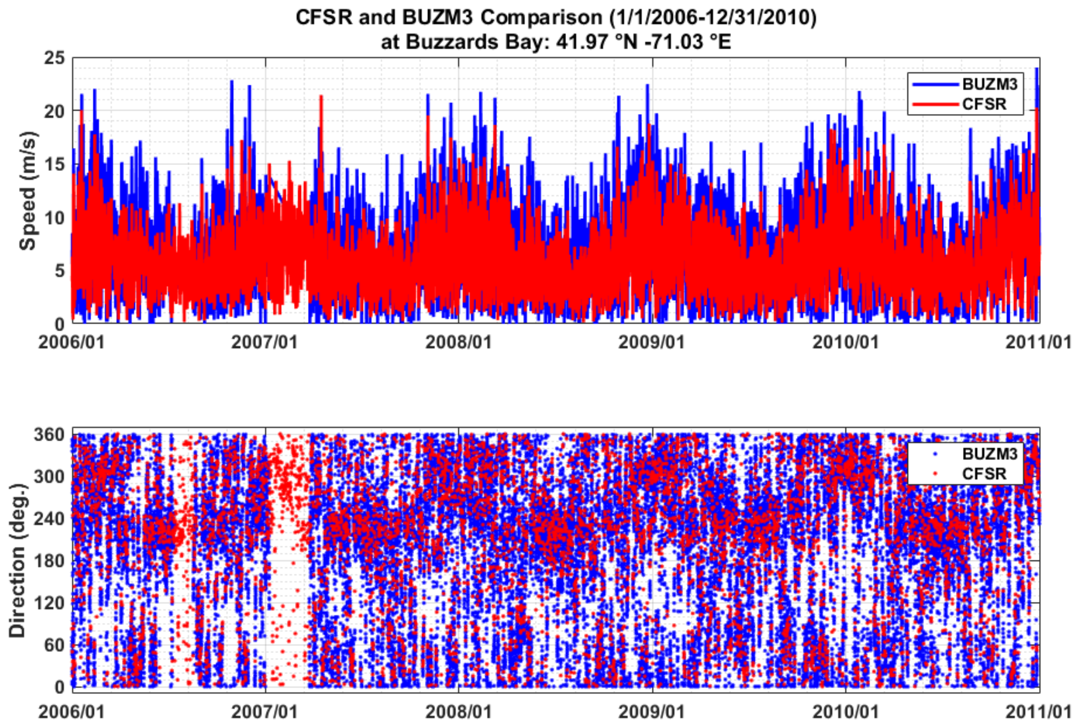


Figure 7. Comparison of speed (upper panel) and direction (lower panel) from BUZM3 and CFSR wind.

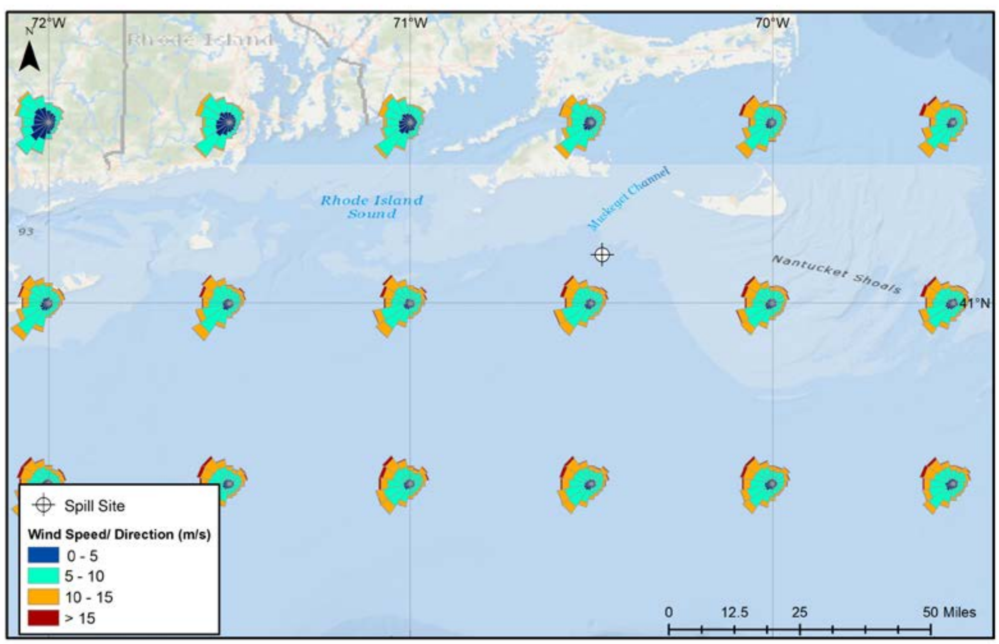


Figure 8. Spatial distribution of CFSR wind speed (in m/s) and direction off the coast of southern New England. The white crosshairs symbol indicates the modeled spill location.

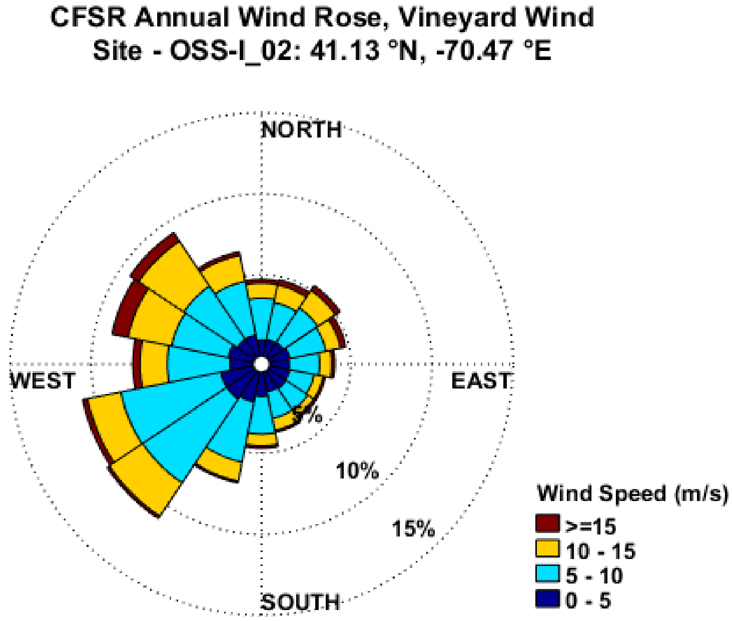


Figure 9. Annual CFSR rose near the spill site located south of Martha's Vineyard. Wind speeds in m/s, using meteorological convention (i.e., direction from which wind is blowing).

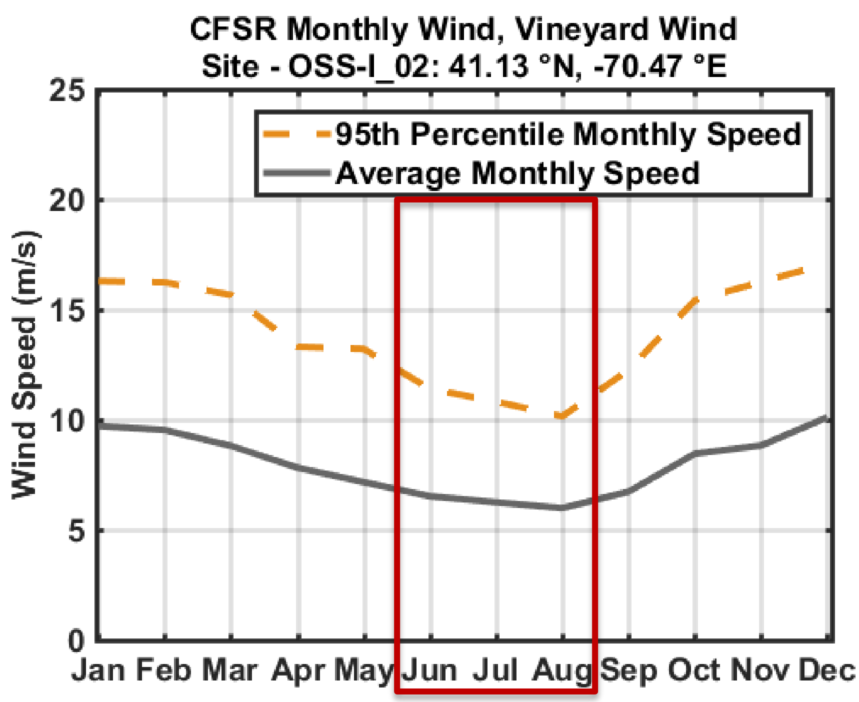


Figure 10. Monthly average and 95th percentile CFSR wind speed statistics (in m/s) near the spill site: monthly average (grey solid) and 95th percentile (orange dashed). Summer months are highlighted with a red box.

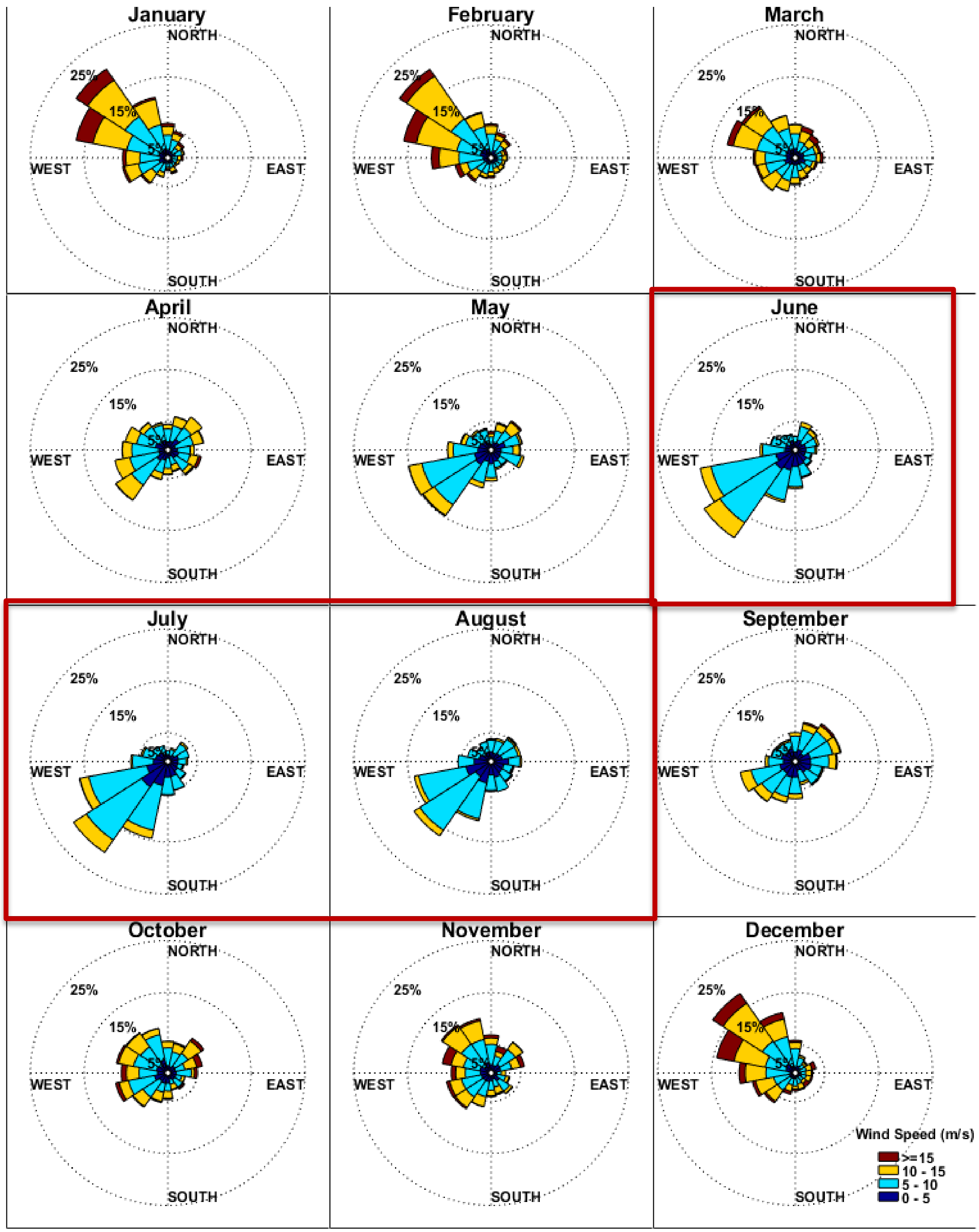


Figure 11. Monthly CFSR windroses near the spill site. Wind speeds in m/s, using meteorological convention (i.e., direction from which wind is blowing). Summer highlighted with red boxes.

2.3. Hydrodynamic Data Used in Oil Spill Model

The oil spill model uses hydrodynamic data as one of its inputs influencing the trajectory and fate of the spilled oil. The hydrodynamic input is in the form of files which define the current speed and direction throughout the water column across the model domain. The oil spill model is able to combine multiple current data files which represent different physical processes, different spatial domains, or different time domains depending on the particular scenario being modeled. For this oil spill modeling analysis, two data sets, including output from a global current data set (HYCOM Reanalysis) and output from a tidal model application (HYDROMAP), were used in combination to define the circulation in the area in which oil could be transported from the site. HYCOM Reanalysis (described in Section 2.3.1) is a subset from a model run over a large domain (global) that captures large scale currents at a relatively coarse resolution in space with a grid on the order of ten kilometers and time with output on the order of multiple hours (daily 24 hours). The HYDROMAP tidal model application (described in Section 2.4.1) is of a smaller regional extent which has variable resolution that is relatively finer in space with a grid on the order of tens of meters to a kilometer and time with output on the order of tens of minutes. The oil spill model is able to combine these two data sets in order to produce the full circulation in the area of interest.

2.3.1. Global Current Dataset – HYCOM Reanalysis

Current data were obtained from the HYCOM (HYbrid Coordinate Ocean Model) hindcast reanalysis, 1/12-degree global simulation assimilated with NCODA (Navy Coupled Ocean Data Assimilation) which was done by the U.S. Naval Research Laboratory (Halliwell 2004). These data capture the oceanic large-scale circulation in the area of interest. NCODA uses the model forecast as a first guess in a three-dimensional (3D) variational scheme and assimilates available satellite altimeter observations from the Naval Oceanographic Office (NAVOCEANO) Altimeter Data Fusion Center, *in-situ* Sea Surface Temperature (SST), and available *in-situ* vertical temperature and salinity profiles from XBTs (Expendable Bathythermographs), Argo floats, and moored buoys. Surface forcing of HYCOM was derived from the 1-hourly U.S. NCEP CFSR atmospheric model with a horizontal resolution of 0.3125 degree, which induces wind stress, wind speed, heat flux, and precipitation (HYCOM 2016). The bathymetry was derived from the General Bathymetric Chart of the Oceans (GEBCO) dataset. For this study, a 10-year period of daily model output was collected (2001 to 2010).

The following figures describe the variability of current speed and direction near the potential spill site based on the regional HYCOM Reanalysis dataset:

- Current intensity and direction maps (Figure 12): Spatial distribution of HYCOM averaged surface current speeds (in cm/s) and current directions for the area of interest;
- Monthly current speed statistics (Figure 13): Monthly average and 95th percentile HYCOM current speed (in cm/s) near the spill site;
- Vertical profile of horizontal current speed (Figure 14): Annual average and 95th percentile of HYCOM horizontal current speed profile (in cm/s) with depth at the site

location, and the corresponding current roses at surface, 20 m, and 35 m presenting the direction towards which the current is flowing, and

- Monthly current roses (Figure 15): Monthly HYCOM current roses (in cm/s) near the spill site, and the direction towards which current is flowing.

Based on the analysis of these regional data, the following conclusions can be drawn:

- Surface currents at the spill site are not very strong (around 20 cm/s in average) and quite consistent throughout the year.
- Currents are mostly going towards an east and east-southeast direction at the surface layer.
- The vertical profile indicates the current speed decreases from the surface to the bottom layer. Although the direction of surface current is mostly eastward/east-southeastward, the middle and bottom layer show relatively more variability with current going towards both an east and west direction.

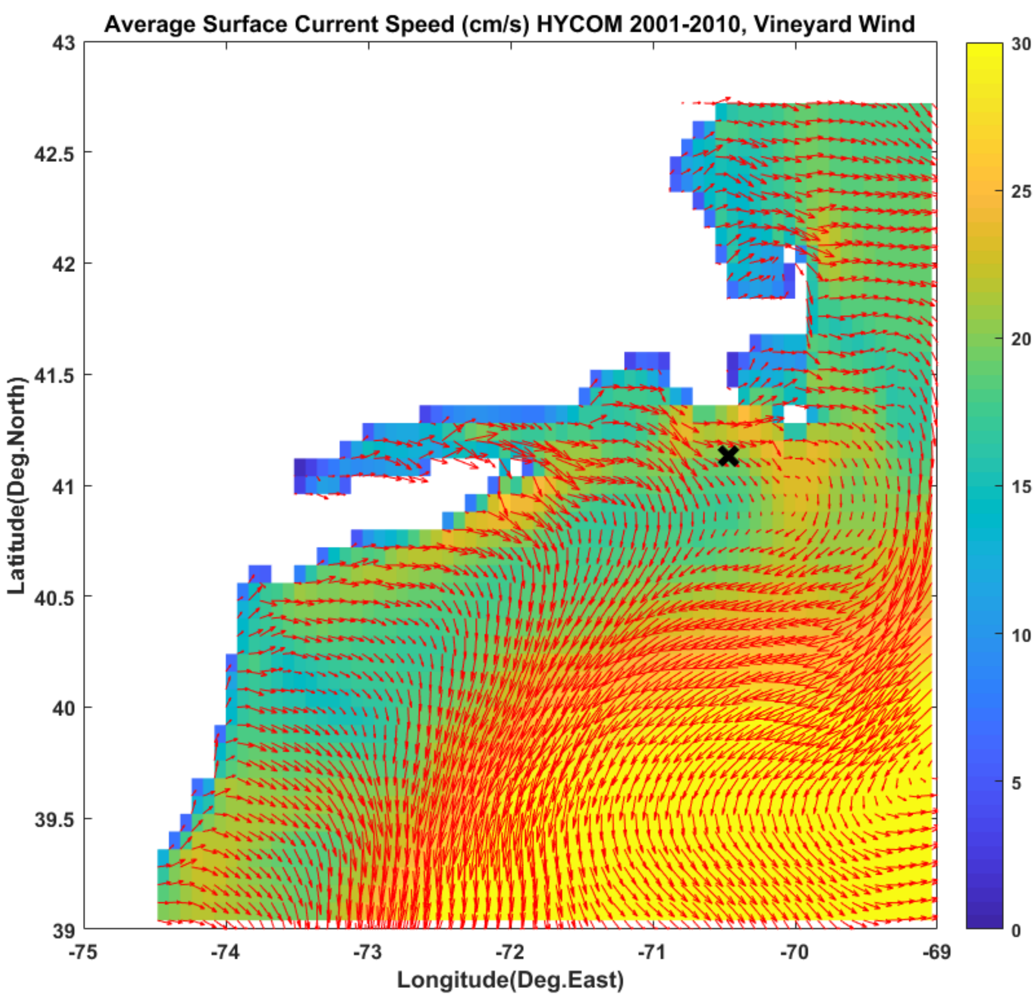


Figure 12. Spatial distribution of HYCOM averaged surface current directions (current speeds in cm/s). The black "x" mark indicates the potential spill site.

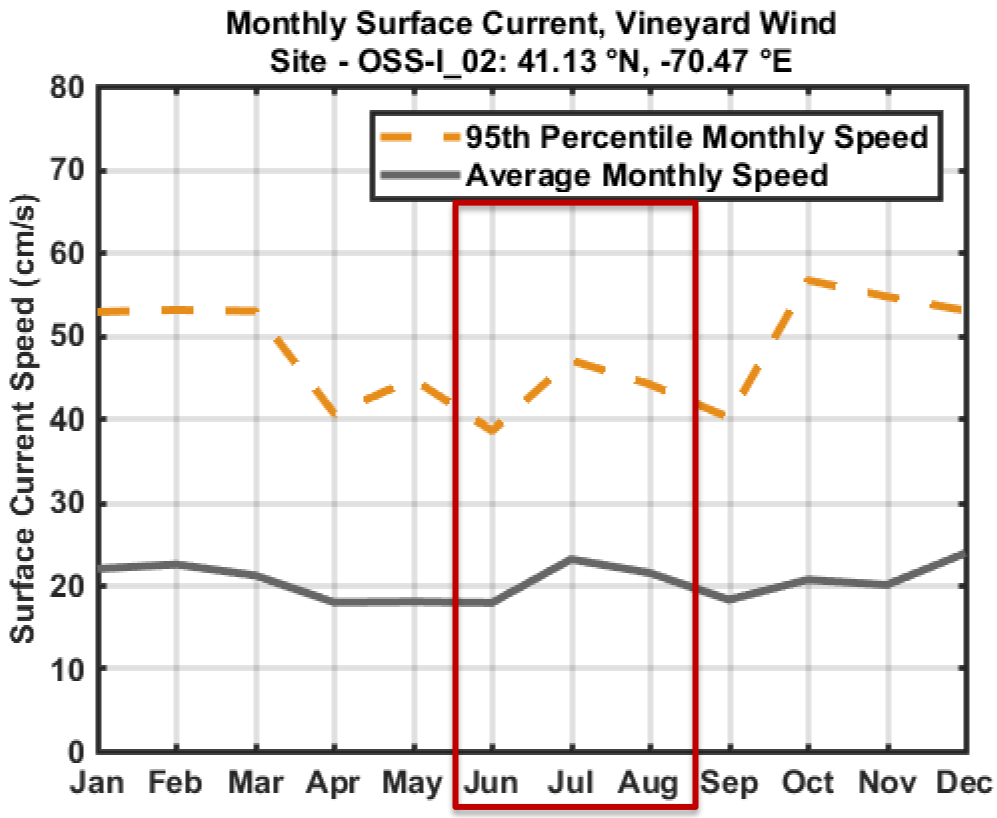


Figure 13. Monthly average (grey solid) and 95th percentile (orange dashed) HYCOM current speed (cm/s) statistics near the spill site. Summer highlighted with a red box.

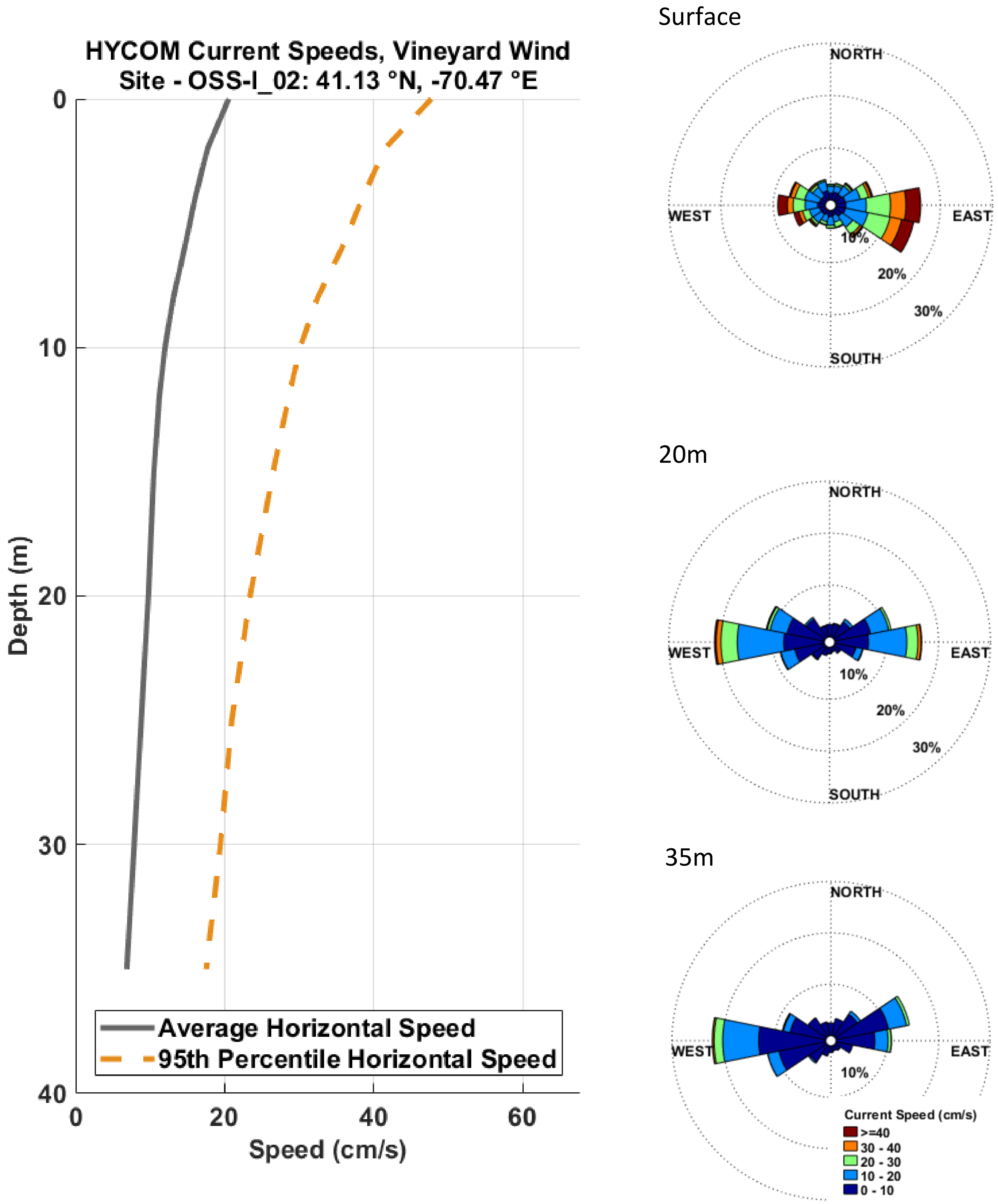


Figure 14. HYCOM average (solid grey) and 95th percentile (dashed orange) of 2001-2010 horizontal current speed (cm/s) dataset variation with depth near the spill site; and the current roses of annual current at surface, 20 m, and 35 m water depths. The roses show the direction towards which the current is flowing.

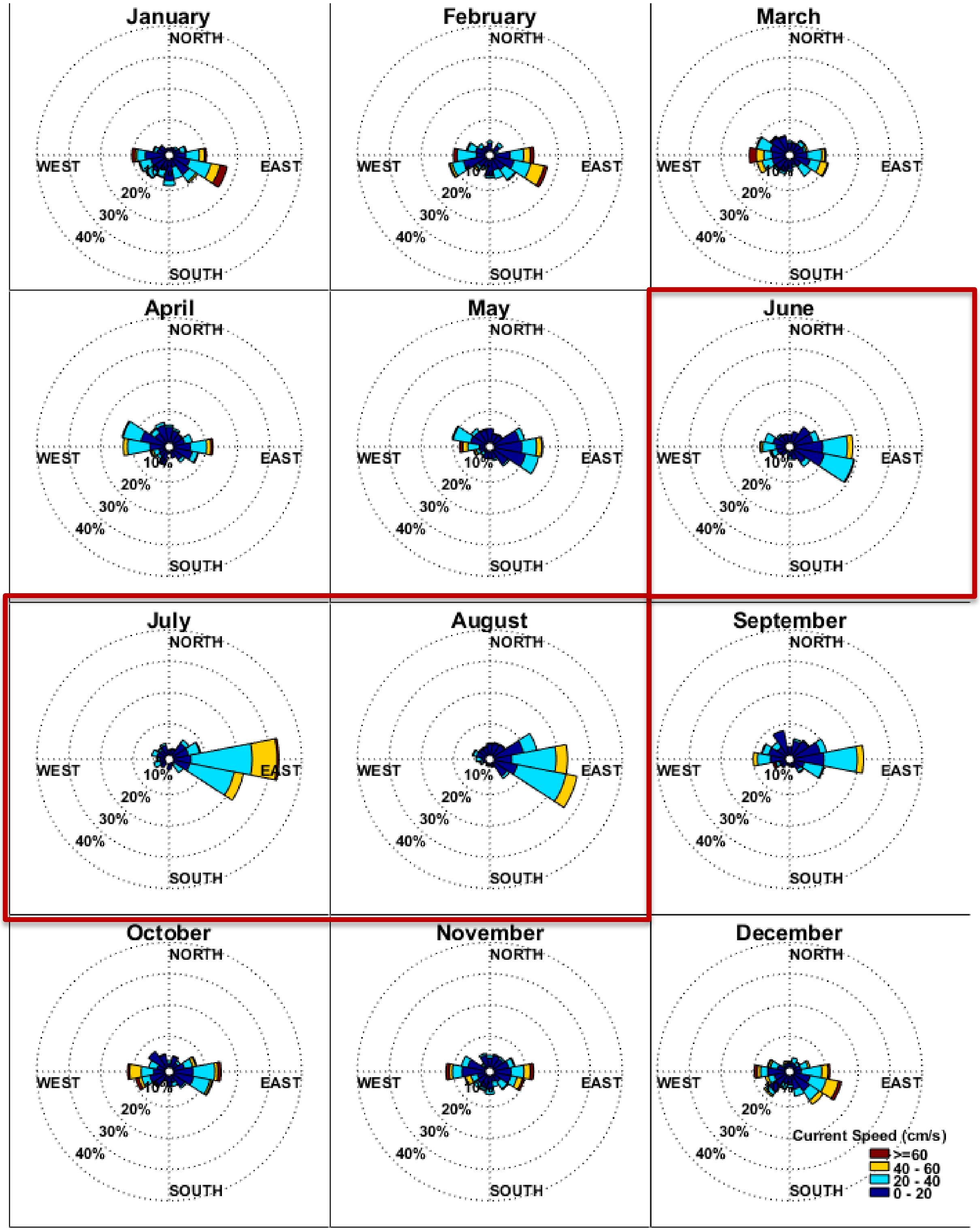


Figure 15. Monthly HYCOM surface current roses near spill site located south of Martha's Vineyard; following oceanographic convention (direction towards which currents are heading), current speeds in cm/s. Summer highlighted with red boxes.

2.4. Surface Transport

To compare the potential for surface wind-driven transport versus current-driven transport, an assessment of the wind drift speed versus current speed was performed close to the spill site as shown in Figure 16. For this study, the wind drift was estimated as 3.5% of the wind speed. Based on this analysis, wind drift seems to be the primary agent of the surface transport most of the year, indicating that the winds control most of the movement of the surface floating slicks at the site. However, during the month of July, wind intensity decreases; consequently, surface currents may control the movement of floating slicks during this period.

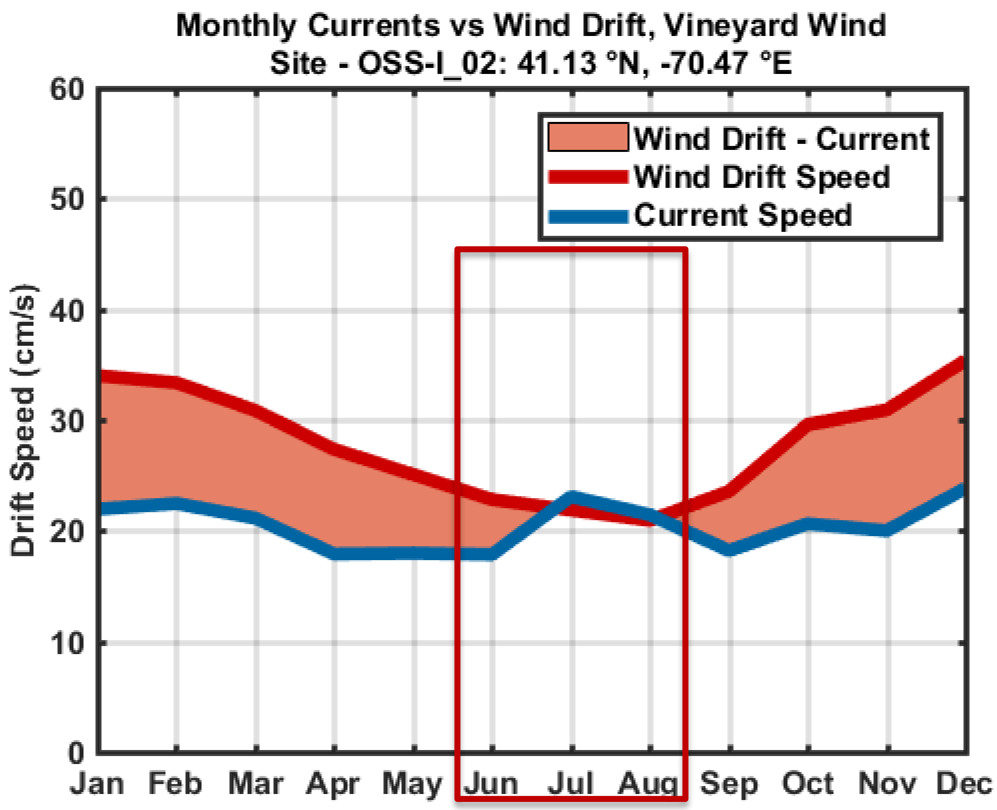


Figure 16. Surface drift forcing comparison statistics near the Vineyard Wind spill site: monthly-averaged CSFR wind drift compared with HYCOM current speed. Wind drift is calculated as 3.5% of the wind speed. Periods with predominant current transport are shaded pink. Summer highlighted with a red box.

2.4.1. HYDROMAP Tidal Circulation Model

A regional hydrodynamic model application was developed that encompassed the Vineyard Wind Offshore Project (Wind Development Area and Offshore Export Cable Corridors) for use in the sediment transport modeling of the cable installation activities. That model application (grid and tidal forcing) was used to generate cyclical tidal model output for the oil spill modeling; surface wind forcing was not included since the net wind driven effects would be captured by the other model inputs (HYCOM large scale currents and CFSR driven wind drift).

The previous model application was generated using RPS's in-house developed hydrodynamic model HYDROMAP. HYDROMAP is a globally re-locatable hydrodynamic model capable of simulating complex circulation patterns due to tidal forcing, wind stress and fresh water flows quickly and efficiently anywhere on the globe. HYDROMAP employs a novel step-wise-continuous-variable rectangular ("SCVR") gridding strategy with up to six levels of resolution. The term "step-wise-continuous" implies that the boundaries between successively smaller and larger grids are managed in a consistent integer step. The advantage of this approach is that large areas of widely differing spatial scales can be addressed within one consistent model application. Grids constructed by the SCVR are still "structured," so that arbitrary locations can be easily located to corresponding computational cells. This mapping facility is particularly advantageous when outputs of the hydrodynamics model are used in subsequent application programs (e.g., Lagrangian particle transport model) that use another grid or grid structure.

The details of the model and the model application which was validated to periods with *in-situ* data can be found in the "Hydrodynamic and Sediment Dispersion Study for the Vineyard Wind Project" (COP Appendix III-A). The present model application utilized the same grid and bathymetry and the same model forcing with the exception of surface winds. The model generated output in the form of cyclical set of current fields for each tidal constituent (M2, S2,N2, O1,K1) over its respective cycle (e.g., 12.42 hours for the M2) relative to a time datum; a summary of the harmonic constituent properties is presented in Table 2. The oil spill model is able to then reconstruct the full tidal circulation by combining, through superposition, the current components (u[east-west] and v[north-south] velocities) from each individual constituent for any time based its characteristics.

Table 2. Summary of harmonic constituents for which the associated current fields were generated.

Name	Period (hours)	Speed (deg/hour)	Description
M2	12.421	28.98410	Principal lunar semidiurnal constituent
S2	12.000	30.00000	Principal solar semidiurnal constituent
N2	12.658	28.43973	Larger lunar elliptic semidiurnal constituent
K1	23.934	15.041069	Lunar diurnal constituent
O1	25.819	13.943035	Lunar diurnal constituent

The tidal currents in the model domain are highly variable in space and time. Tidal currents are always changing in response to the rising and falling waters levels. In this region, the currents are dominated by the M2 tide, and therefore have approximately two cycles daily (meaning the water elevation rises and falls twice daily [two high tides and two low tides]), resulting in an oscillation of current speeds and directions with four peaks daily (i.e., max flood current as water moves into a region, max ebb current as water moves out of a region). Snapshots of the associated speed and directions for instances of ~ peak ebb and ~ peak flood current for the vertically averaged M2 tidal constituent are shown in Figure 17 and Figure 18, respectively. Note that the vertical average is shown in these figures; however, the three-dimensional profiles were generated for use in the oil spill modeling. These figures show the spatial variability of current speed through color contours and direction with arrows (subset from the model grid resolution for clarity). The other constituents have similar patterns with much less magnitude and the total tidal current is the addition of all constituents which can increase or decrease the speed relative to the M2 alone. However, the M2 constituent provides a good picture of the relative spatial trends in speed and direction. From these figures, it is noted that speeds in the Wind Development Area (WDA) have tidal current peaks less than ~ 0.30 m/s, while current speeds through the Muskeget Channel (between Martha's Vineyard and Nantucket) and over Nantucket shoals (South East of Nantucket) peak over 1 m/s, though the speeds are reduced as the currents oscillate between ebb and flood.

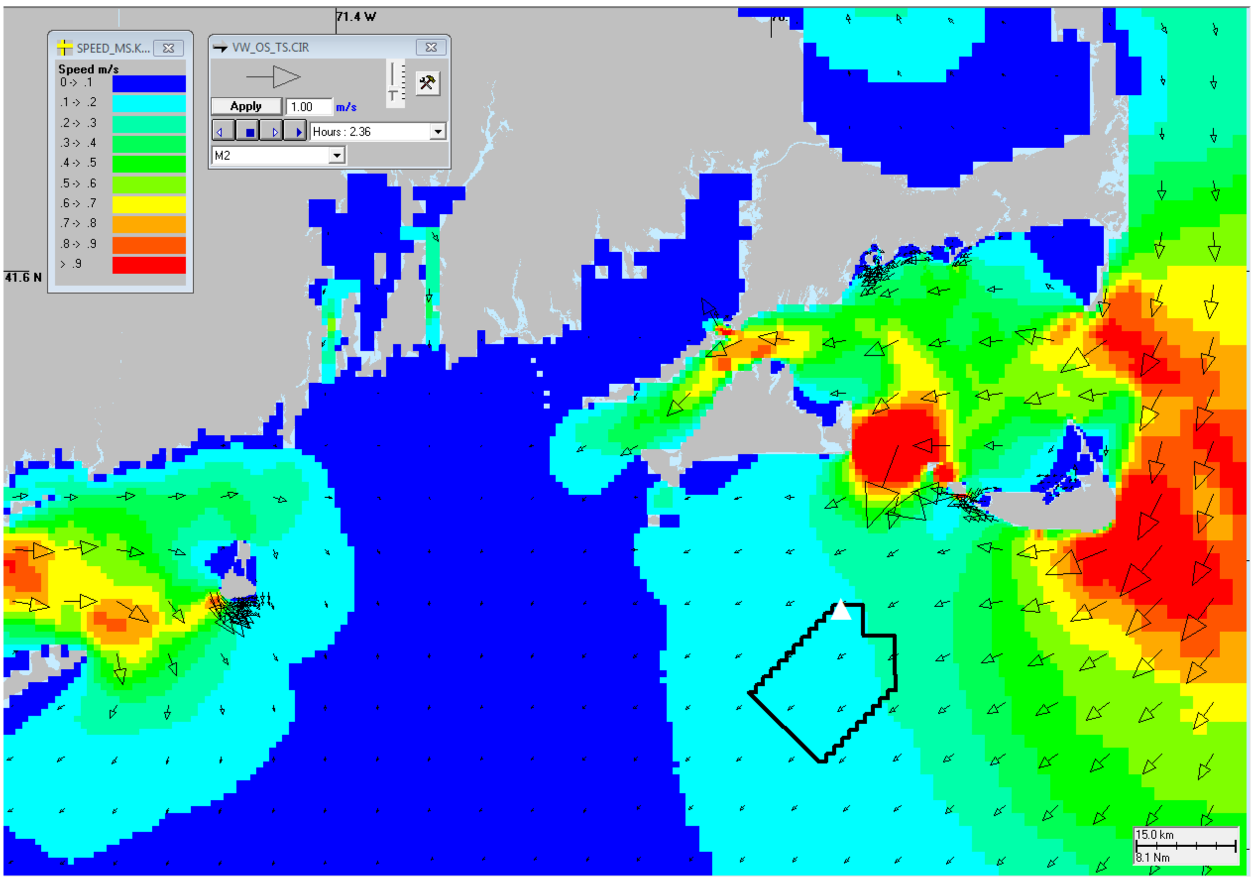


Figure 17. Snapshot of M2 ~ peak ebb current speeds and directions. Colors represent speed in accordance to legend in the upper left corner of the image and arrows indicate the direction current is flowing. The WDA outline is shown in black and the ESP is shown with a white triangle marker.

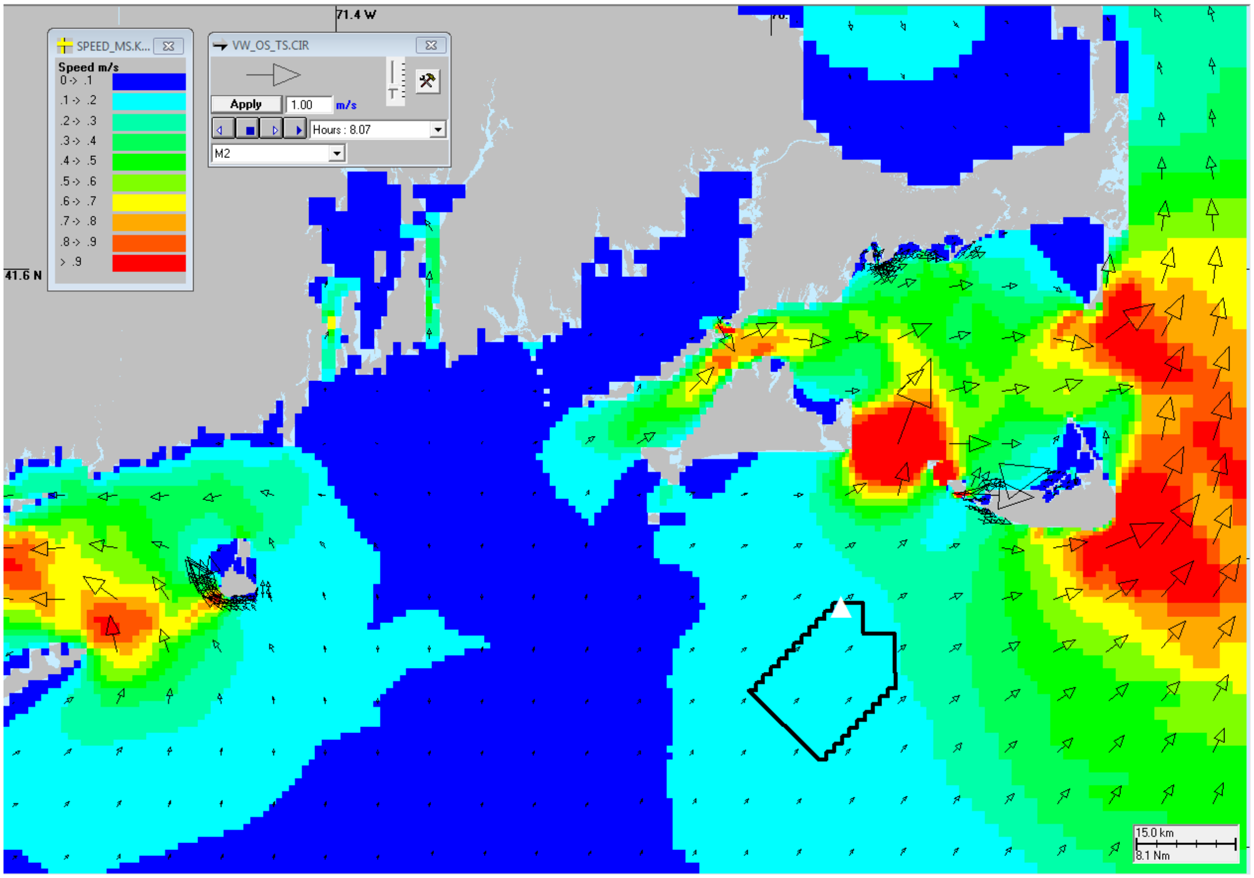


Figure 18. Snapshot of M2 ~ peak flood current speeds and directions. Colors represent speed in accordance to legend in the upper left corner of the image and arrows indicate the direction current is flowing. The WDA outline is shown in black and the ESP is shown with a white triangle marker.

3. Oil Spill Modeling Setup

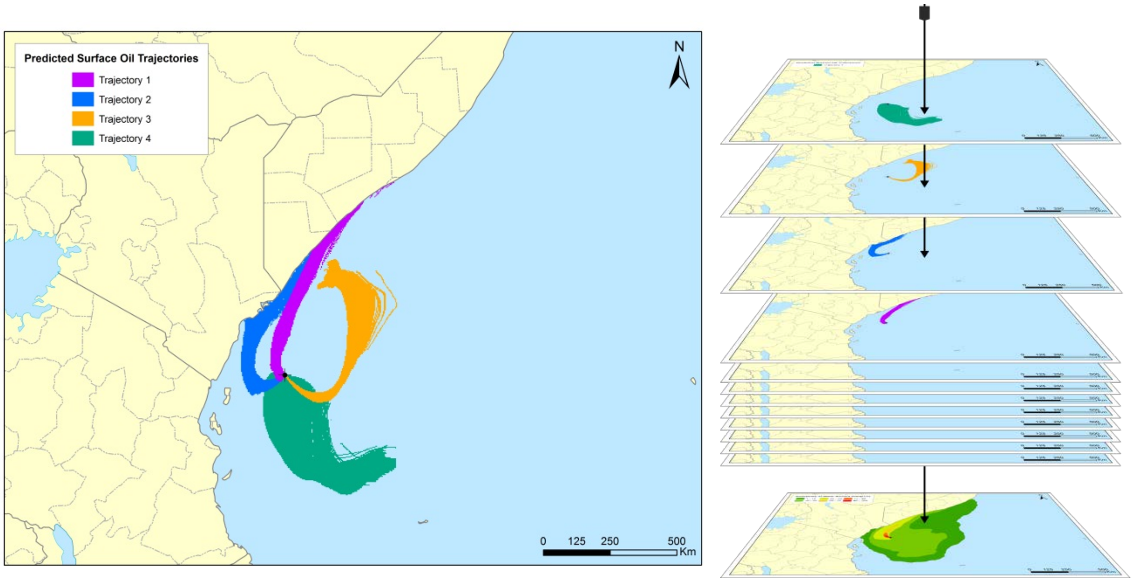
3.1. Modeling Methodology

RPS's proprietary oil spill modeling framework OILMAP/SIMAP was used for all simulations performed in this study. The model quantifies the transport and fate of different components of hydrocarbon mixtures through different compartments of the marine environment over time. The modeling system uses a three-dimensional Lagrangian model where each component of the spilled oil (floating, dispersed, shoreline, etc.) is represented by an ensemble of independent mathematical particles or "spillets". Each spillet comprises a subset of the total mass of hydrocarbons spilled and is transported by both currents and surface wind drift. Additional information on the modeling system is contained in Appendix A.

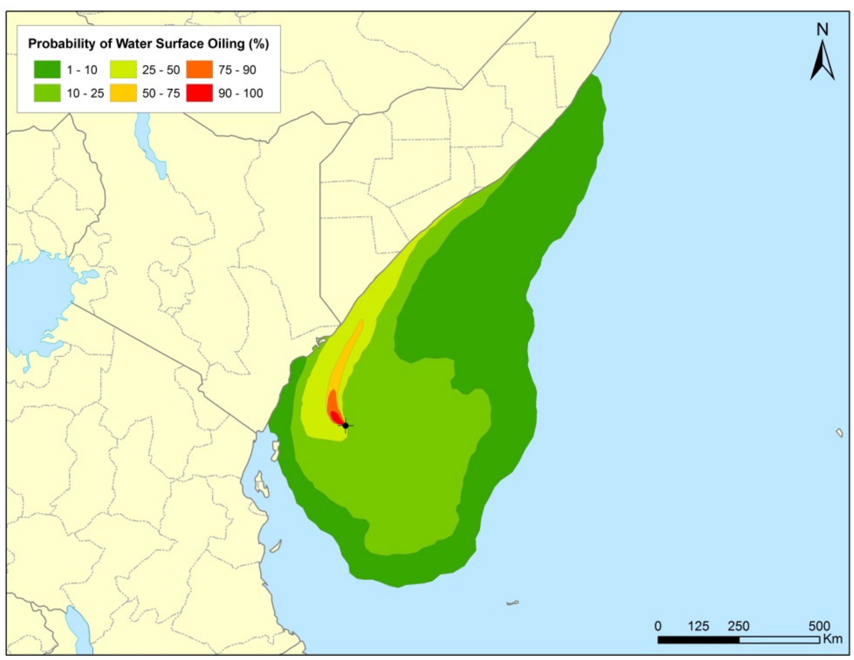
Stochastic Simulations

Stochastic simulations provide insight into the probable behavior of potential oil spills in response to temporally- and spatially-varying meteorological and oceanographic conditions in the study area. The stochastic model computes surface trajectories for an ensemble of hundreds of individual cases for each spill scenario, thus sampling the variability in regional and seasonal wind and current forcing by starting the simulation at different dates within the timeframe of interest.

The stochastic analysis provides two types of information: 1) the footprint of sea surface and shoreline areas exposed to oil above a certain threshold of concern and the associated probability of oil contamination, and 2) the shortest time required for oil to reach any point within the areas predicted to be oiled. The areas and probabilities of oiling are generated by a statistical analysis of all the individual stochastic runs (Figure 19). It is important to note that a single run will encounter only a relatively small portion of this footprint. In addition, the simulations provide shoreline oiling data expressed in terms of minimum and average times for oil to reach shore, and the percentage of simulations in which oil is predicted to reach shore. Results from this modeling step are presented in Section 4.



Examples of four individual spill trajectories predicted by OILMAP/SIMAP for a particular spill scenario. The frequency of contact with given locations is used to calculate the probability of impacts during a spill. Essentially, all 100+ model runs are overlain (shown as the stacked runs on the right) and the number of times that a trajectory reaches a given location is used to calculate the probability for that location.



Probability of surface oil exceeding a given threshold for the example scenario. This figure overlays 100+ individual model runs to calculate the percentage of runs that caused oiling above the threshold in a given area. This figure does not depict the areal extent of a single model run/spill.

Figure 19. Diagram of RPS stochastic modeling approach; an ensemble of individual trajectories creates the stochastic probability footprint.

3.2. Thresholds of Concern and Weathering

The stochastic approach applied in the spill risk assessment provided an evaluation of the likelihood of exposure to oil above ecological thresholds of concern, expressed as mass per unit area and concentration. The thresholds listed in Table 3 were used in the stochastic analysis, and followed a similar methodology as used in BOEM's previous study assessing potential catastrophic oil spills from offshore wind structures (Bejarano et al. 2013).

Table 3. Oil thickness thresholds applied in the spill risk assessment for sea surface and shoreline probability determinations.

Threshold Type	Average Concentration Threshold	Rationale	Visual Appearance	References
Oil on Sea Surface	10 g/m^2 $\approx$ 10 µm (0.01 mm) on average over the grid cell	**Ecological:** Observed lethal effects to birds on water at this threshold. Sublethal impacts to marine mammals, sea turtles, and floating Sargassum mats.	Fresh oil at this thickness corresponds to a slick being a dark brown or metallic sheen.	French et al. 1996; French McCay et al. 2009;French McCay et al. 2011; French McCay et al. 2012; French McCay 2016
Shoreline Oil	100 g/m^2 $\approx$ 100 µm (0.1 mm) on average over the grid cell	**Ecological:** This is a screening threshold for potential ecological effects on shoreline flora and fauna, based upon a synthesis of the literature showing that shoreline life has been affected by this degree of oiling. Sublethal effects on epifaunal intertidal invertebrates on hard substrates and on sediments have been observed where oiling exceeds this threshold. Assumed lethal effects threshold for birds on the shoreline.	May appear as black opaque oil.	French et al. 1996; French McCay 2009; French McCay et al. 2011; French McCay et al. 2012; French McCay 2016

3.3. Oil Spill Scenarios

Vineyard Wind has identified two potential locations for ESPs, one closer to shore (ESP 1) and one farther from shore (ESP 2). Each location will include one 400 MW conventional ESP; if an 800 MW ESP is used, it will be installed in the ESP position located closest to shore (ESP 1) and the ESP 2 position will not be used. Release scenarios for the stochastic simulations assumed a spill from an instantaneous, catastrophic loss of the complete contents of the original or revised ESP locations closest to shore[3], which were assumed to be the worst case discharges, yet also very conservative (Table 4). Two thousand particles were used in OILMAP/SIMAP to simulate the surface release of oil, as a near instantaneous release tracked over the course of 20 days. The stochastic model was run for two oil spill volumes using over 400 simulations covering the span of 10 years (2001 to 2010). These results were then reanalyzed over 4 seasons, each consisting of over 100 simulations (Table 5). As described in Section 2, a combination of HYCOM Reanalysis and HYDROMAP modeled tidal circulation were used as current inputs to the model while CFSR was used as wind inputs.

Table 4. Release location used in oil spill modeling

Site	Description	Latitude N (decimal degrees)	Longitude W (decimal degrees)
400 MW ESP	ESP location closest to shore (ESP 1) includes 1 conventional ESP	41.13317	70.46972
800 MW ESP	ESP revised location closest to shore (ESP 1 – revised, located slightly farther offshore than original ESP 1 location)	41.122180	70.483691

Table 5. Oil spill scenarios defined for the oil spill modeling.

[3] The Project includes two ESP locations: one closer to shore (ESP 1) and one farther from shore (ESP 2). The model scenarios both use the ESP position that is located closest to shore (ESP 1); however, in the time interval between the first and second drafts of this report, a review of ongoing survey data led to the relocation of the ESP closest to shore to a new position that is slightly farther offshore (referred to as ESP 1 – revised). Therefore, the model scenario for the 800 MW ESP incorporates the revised ESP position (ESP 1 – revised) that is slightly farther offshore than the original ESP position (ESP 1) modeled for the 400 MW ESP scenario. The ESP 2 position was not modeled since it is located farthest from shore.

ID	Site	Oil Type	Season	Total Volume Released
1	400 MW ESP	Oil Mixture	Spring: (March-May)	1,539 bbl ($245\ m^3$)
2			Summer: (June-August)	
3			Fall: (September-November)	
4			Winter: (December-February)	
5	800 MW ESP	Oil Mixture	Spring: (March-May)	2,954 bbl ($460\ m^3$)
6			Summer: (June-August)	
7			Fall: (September-November)	
8			Winter: (December-February)	

3.4. Oil Characteristics

Characteristics of potential oils to be used within the ESPs were supplied by Vineyard Wind or drawn from existing OILMAP/SIMAP databases as summarized below. Naphthenic, hydraulic and diesel oil make up the largest portions of the ESP oils, and were used to create an oil mixture to use for simulations in OILMAP/SIMAP. Table 6 shows the breakdown of oils that make up the oil mixture used in modeling simulations. The properties for oils that make up the oil mixture are presented in Table 7 through Table 9, while Table 10 shows the oil mixture as a weighted average of each of the oil characteristics used in OILMAP/SIMAP.

Table 6. Oils used to create an oil mixture to simulate a single release for each site.

Site	Oil	Barrels	kg	% by Mass
400 MW ESP	Diesel	67.80	8,958	4.24
	Hydraulic	4.15	572	0.27
	Napthenic	1,466.77	200,778	95.48
800 MW ESP	Diesel	130.18	17,199.4	4.24
	Hydraulic	7.97	1,098.2	0.27
	Napthenic	2,816.20	385,493.8	95.48

Table 7. Oil properties for Diesel Oil

Property	Value	Reference
Density @ 25 deg. C (g/cm^3)	0.831	Jokuty et al. (1999)*
Viscosity @ 25 deg. C (cp)	2.76	Jokuty et al. (1999)*
Surface Tension (dyne/cm)	27.5	Jokuty et al. (1999)*
Fraction THC 1: boiling point < 180°C	0.164	Jokuty et al. (1999)*
Fraction THC 2: boiling point 180-264°C	0.490	Jokuty et al. (1999)*
Fraction THC 3: boiling point 264-380°C	0.319	Jokuty et al. (1999)*
Minimum Oil Thickness (mm)	0.00001	McAuliffe (1987)
Maximum Mousse Water Content (%)	0	-
Mousse Water Content as Spilled (%)	0	-
Water content of oil (not in mousse, %)	0	-

Table 8. Oil properties for Hydraulic Oil.

Property	Value	Reference
Density @ 25 deg. C (g/cm^3)	0.867	Anderson et al (2003)
Viscosity @ 25 deg. C (cp)	31.58	Anderson et al (2003)
Surface Tension (dyne/cm)	25.7	Anderson et al (2003)
Fraction THC 1: boiling point < 180°C	0	Kaplan et al (2010)
Fraction THC 2: boiling point 180-264°C	0.333	Kaplan et al (2010)
Fraction THC 3: boiling point 264-380°C	0.238	Kaplan et al (2010)
Minimum Oil Thickness (mm)	0.0001	NRC (1985); field data from actual spills
Maximum Mousse Water Content (%)	0	-
Mousse Water Content as Spilled (%)	0	-
Water content of oil (not in mousse, %)	0	-

Table 9. Oil properties for Napthenic Oil.

Property	Value	Reference
Density @ 25 deg. C (g/cm^3)	0.861	NYNAS Nytro 4000x MSDS
Viscosity @ 25 deg. C (cp)	14.55	NYNAS Nytro 4000x MSDS
Surface Tension (dyne/cm)	40.0	NYNAS Nytro 4000x MSDS
Fraction THC 1: boiling point < 180°C	0	Kaplan et al. (2010)
Fraction THC 2: boiling point 180-264°C	0.333	Kaplan et al. (2010)
Fraction THC 3: boiling point 264-380°C	0.238	Kaplan et al. (2010)
Minimum Oil Thickness (mm)	0.0001	NRC (1985); field data from actual spills
Maximum Mousse Water Content (%)	0	-
Mousse Water Content as Spilled (%)	0	-

Property	Value	Reference
Water content of oil (not in mousse, %)	0	-

Table 10. Oil properties for Oil Mixture used for modeling simulations.

Property	Value	Reference
Density @ 25 deg. C (g/cm^3)	0.860	Weighted average of 3 oils*
Viscosity @ 25 deg. C (cp)	14.09	Weighted average of 3 oils*
Surface Tension (dyne/cm)	39.4	Weighted average of 3 oils*
Fraction THC 1: boiling point < 180^{o}C	0.007	Weighted average of 3 oils*
Fraction THC 2: boiling point 180-264^{o}C	0.339	Weighted average of 3 oils*
Fraction THC 3: boiling point 264-380^{o}C	0.241	Weighted average of 3 oils*
Minimum Oil Thickness (mm)	0.0001	Weighted average of 3 oils*
Maximum Mousse Water Content (%)	0	-
Mousse Water Content as Spilled (%)	0	-
Water content of oil (not in mousse, %)	0	-

4. Stochastic Modeling Results

OILMAP/SIMAP's stochastic model computed the probable surface and shoreline trajectories of a surface release of an ESP oil mixture (assuming two sizes of ESP's) for four seasons. Over 100 simulations define each spill scenario. Stochastic trajectory results were summed to calculate probabilities of surface oiling and minimum travel time for each spill scenario including oil contamination to the water surface oil and shoreline.

The stochastic results for all spill scenarios are summarized in Table 11. The time to reach the shoreline and the average mass of oil washed ashore were calculated based on all the individual trajectories that led to oil reaching shore with more than 0.1% of the initial spilled volume. The percentage of simulations reaching shore was based on the number of trajectories out of the total number of individual simulations run for the stochastic modeling in which at least 0.1% of the spilled volume was predicted to reach shore. Thickness thresholds for shoreline contamination were not used in the below calculations, and as such results present conservative probabilities and timing. It is also important to note that the time to reach shore is based on the minimum time for any shoreline contamination to occur, and does not indicate the thickness of shoreline contamination occurring at that time.

Table 11. Oil spill stochastic results -- predicted shoreline impacts for each scenario.

ID	Oil Type	Season	Total Volume Released	Sims. Reaching Shore (%) [1]	Time to Reach Shore (days)		Contamination to shoreline (% of total release)	
					Min.	Avg.	Max.	Avg.
1	Oil Mixture	Spring: (Mar.-May)	1,539 bbl	80.8%	0.54	3.93	55.6%	22.1%
2	Oil Mixture	Summer: (June-Aug.)	1,539 bbl	88.3%	0.60	2.84	62.4%	25.32%
3	Oil Mixture	Fall: (Sept.-Nov.)	1,539 bbl	74.2%	0.62	3.65	61.8%	18.5%
4	Oil Mixture	Winter: (Dec.-Feb.)	1,539 bbl	37.3%	0.43	3.64	36.1%	13.2%
5	Oil Mixture	Spring: (Mar.-May)	2,954 bbl	80.0%	0.65	4.14	55.3%	22.0%
6	Oil Mixture	Summer: (June-Aug.)	2,954 bbl	85.0%	0.63	3.07	63.4%	24.8%
7	Oil Mixture	Fall: (Sept.-Nov.)	2,954 bbl	71.7%	0.65	3.75	62.4%	17.7%
8	Oil Mixture	Winter: (Dec.-Feb.)	2,954 bbl	34.7%	0.56	3.83	34.6%	12.7%

[1] The percentage of simulations reaching shore is based on the number of trajectories out of the ensemble of stochastic individual simulations. Since these calculations are based on total mass reaching shore, thickness thresholds were not incorporated.

Results from the stochastic modeling are provided in maps depicting the probability and timing of oil contamination on the surface and shoreline in excess of the threshold oil thicknesses described in Section 3.2. Figures 21 to 28 and Figures 33 to 40 present surface oiling for each spill scenario. Figures 29 to 32 and Figures 41 to 44 present shoreline oiling for each spill scenario. Each figure contains two maps portraying the following information:

1. **Probability of Oil Contact Figures**: The probability of oiling maps for each scenario define the area and the associated probability in which sea surface and shoreline oiling above the defined thresholds (Table 3) would be expected should a worst case oil release scenario occur. The colored area in the stochastic maps indicates areas that *may* receive oil pollution in the event of that particular spill scenario. The 'hotter' the color (e.g., reds), the more likely an area would be affected; the cooler the colors (e.g., greens), the less likely an area would be affected. The probability of oil contamination was based on a statistical analysis of the resulting ensemble of individual trajectories for each spill scenario. These figures do not imply that the entire contoured area would be covered with oil in the event of a spill, nor do they provide any information on the quantity of oil that would be found in a given area.

2. **Minimum Travel Time Figures**: The footprint of the one minimum travel time map per scenario corresponds to the oil contamination probability maps for oil above the threshold of concern (Table 3). These figures illustrate the shortest time required for oil to reach any point within the footprint at a thickness or concentration exceeding the defined threshold for surface and shoreline oil contamination. These results are based on the ensemble of all individual trajectories.

It is important to note that the probability of a spill trajectory passing through a certain water surface area and the probability of a spill trajectory hitting a shoreline segment near that water surface area are different. For example, in the schematic shown in Figure 20, there are four trajectories total, which do not overlap near the shore. Thus, the surface oiling probability at a surface water grid cell near the shore (yellow cell) is 25%, since only 1 out of 4 trajectories crosses that grid cell. However, the probability of shoreline oiling within the green bracketed segment near the yellow surface water cell is 75%, since 3 out of 4 trajectories intercept that particular shoreline segment. Where 2 of the 4 trajectories do overlap within a surface water grid cell, the probability of oiling is 50% (purple cell). In addition, oil contamination to the shoreline has a cumulative effect over an individual run, since oil that hits the shoreline is stranded there, and more oil can pile up. In contrast, oil contamination on the surface only shows the maximum concentration at each grid cell for any given time (i.e., oil can move through a cell in excess of the threshold but still not exceed the threshold at any given time).

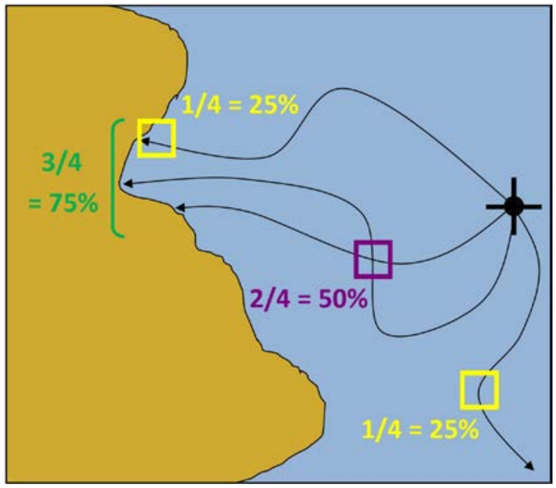


Figure 20. Illustration of the difference between surface and shoreline oiling probabilities. Surface probabilities in yellow and purple, shoreline probabilities in green.

4.1. 400 MW Site

4.1.1. Oil Contamination to Water Surface

Figures 21 to 28 provide the results of surface oil contamination for the spill scenarios over each season. In all four seasons, the sea surface area exposed to oil exceeding the 10 g/m^2 threshold is contained within approximately 20-25 miles of the 400 MW ESP spill location, with the largest stochastic contour being 1-10% probability. Three of the seasons (spring, summer and fall; Figures 21-26, respectively) demonstrate a sea surface area exposed to oil exceeding the threshold of similar size; while the winter scenario depicts a relatively smaller footprint centralized around the spill site. It is important to note again that these scenarios are very conservative and do not include the use of oil spill response equipment, which Vineyard Wind would implement in the case of a spill.

As described above and shown in Figure 20, the difference in the footprint for the surface and shoreline oil contamination is a result of the surface oil less than 100 µm (100 g/m^2 on average over the grid cell) traveling farther distances and beginning to pile up on shore. It is important to note that oil contamination on the surface only shows the maximum concentration at each grid cell for any given time (i.e., oil can move through a cell in excess of the threshold but still not exceed the threshold at any given time).

1,539 barrel instantaneous release of oil mixture (March to May)

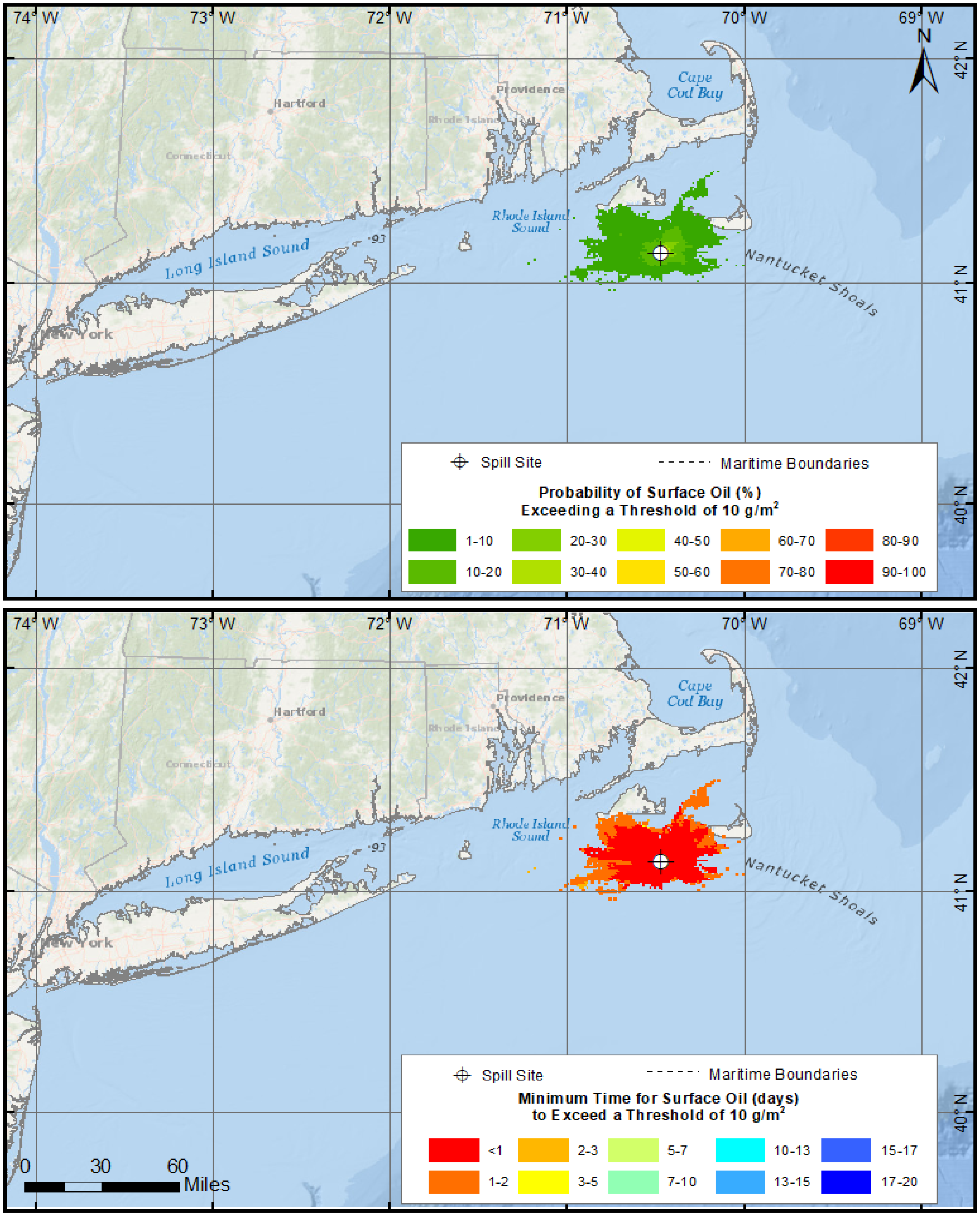


Figure 21. Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during spring months for an instantaneous release from the 400 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

1,539 barrel instantaneous release of oil mixture (March to May)

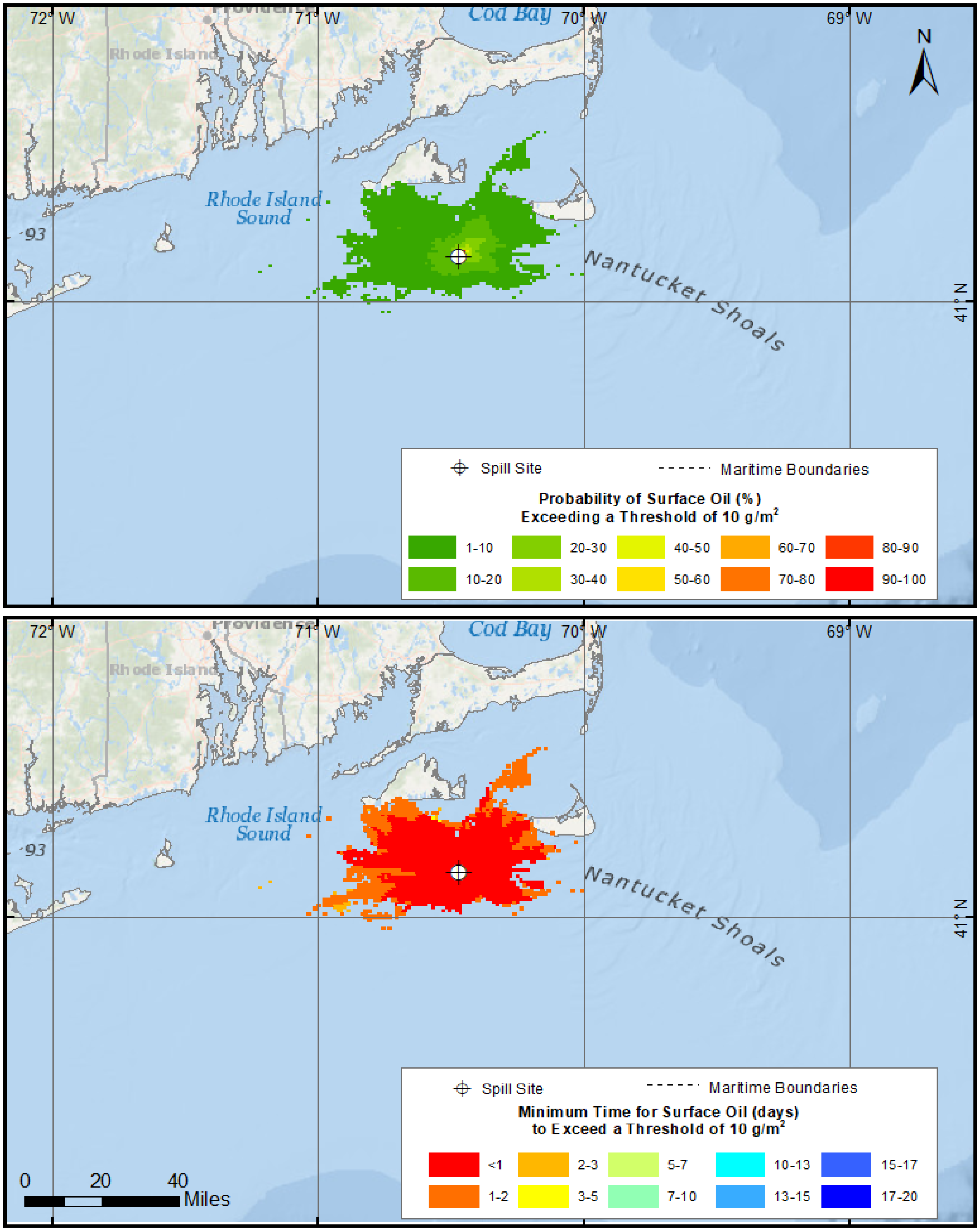


Figure 22. Detail View Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m^2 on average over the grid cell) during spring months for an instantaneous release from the 400 MW ESP location . Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m^2.

1,539 barrel instantaneous release of oil mixture (June to August)

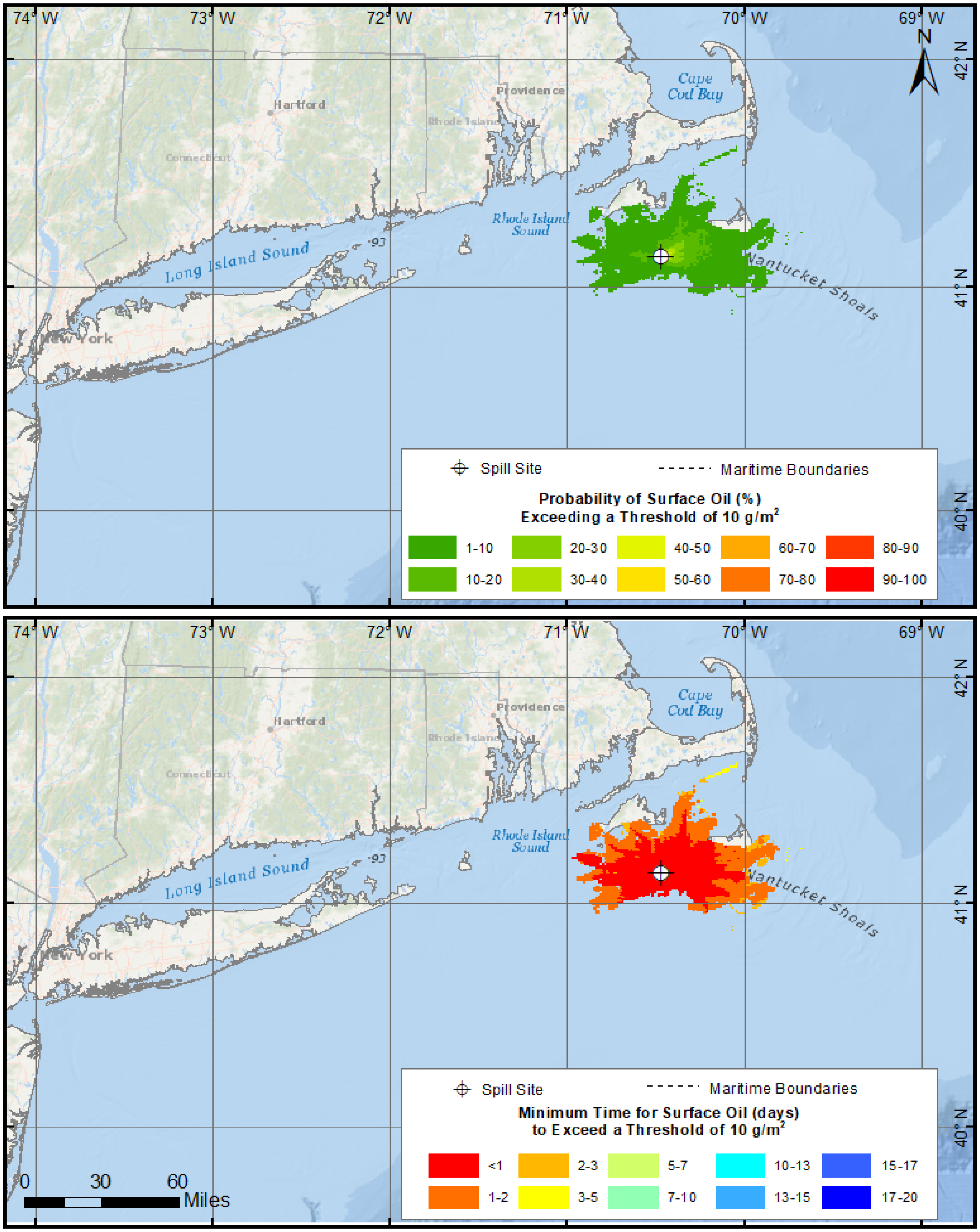


Figure 23. Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during summer months for an instantaneous release from the 400 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

1,539 barrel instantaneous release of oil mixture (June to August)

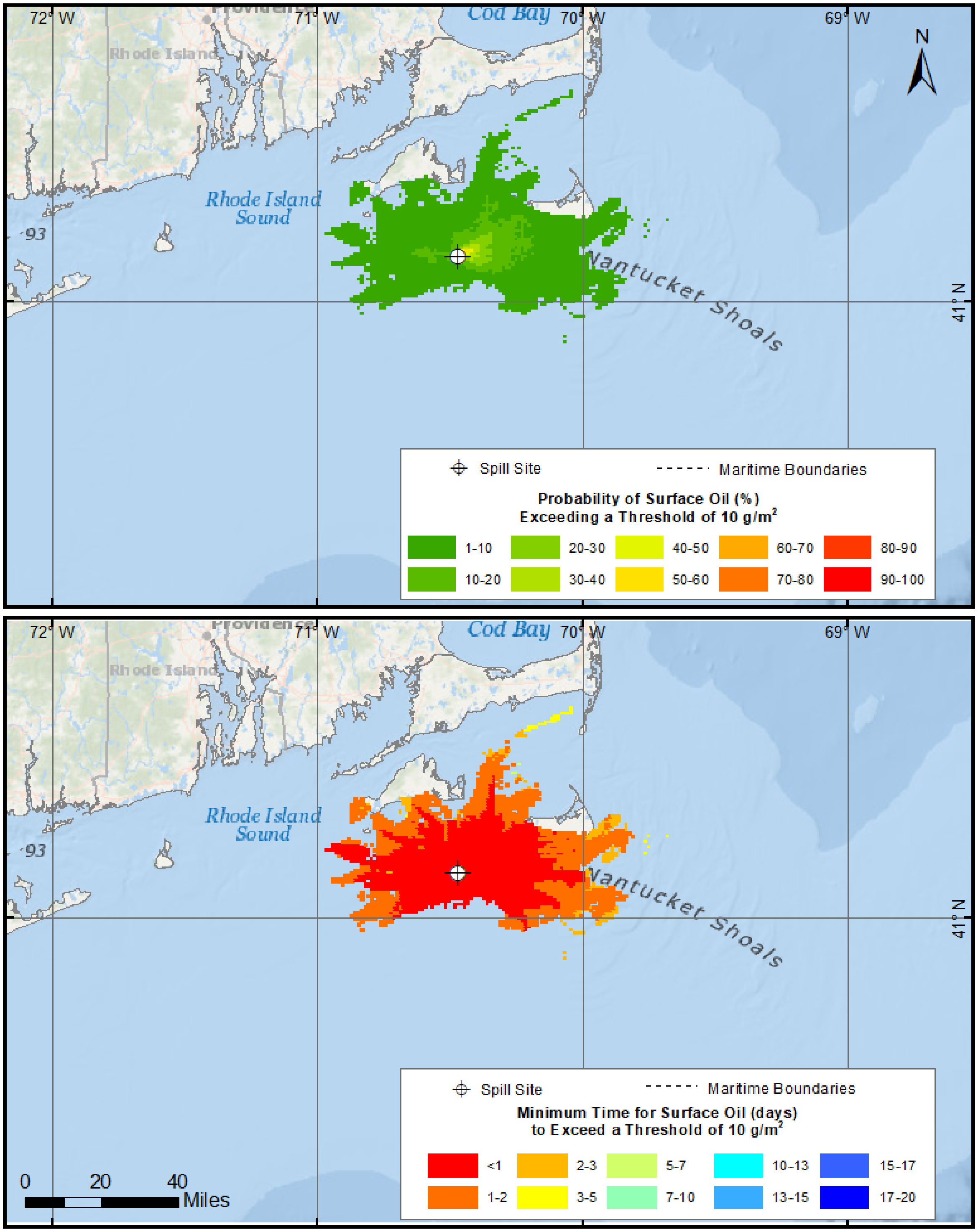


Figure 24. Detail View Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during summer months for an instantaneous release from the 400 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

1,539 barrel instantaneous release of oil mixture (September to November)

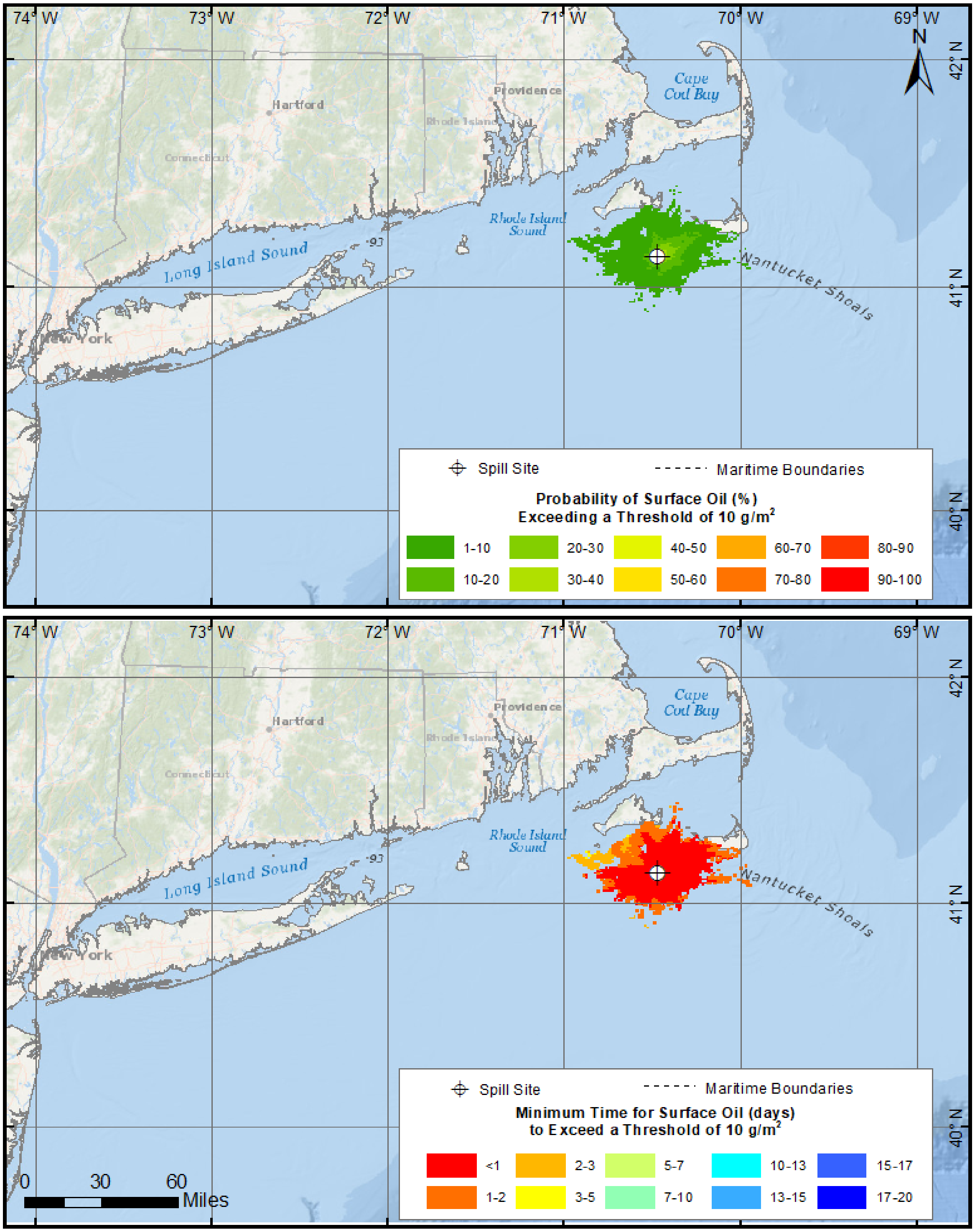


Figure 25. Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during fall months for an instantaneous release from the 400 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

1,539 barrel instantaneous release of oil mixture (September to November)

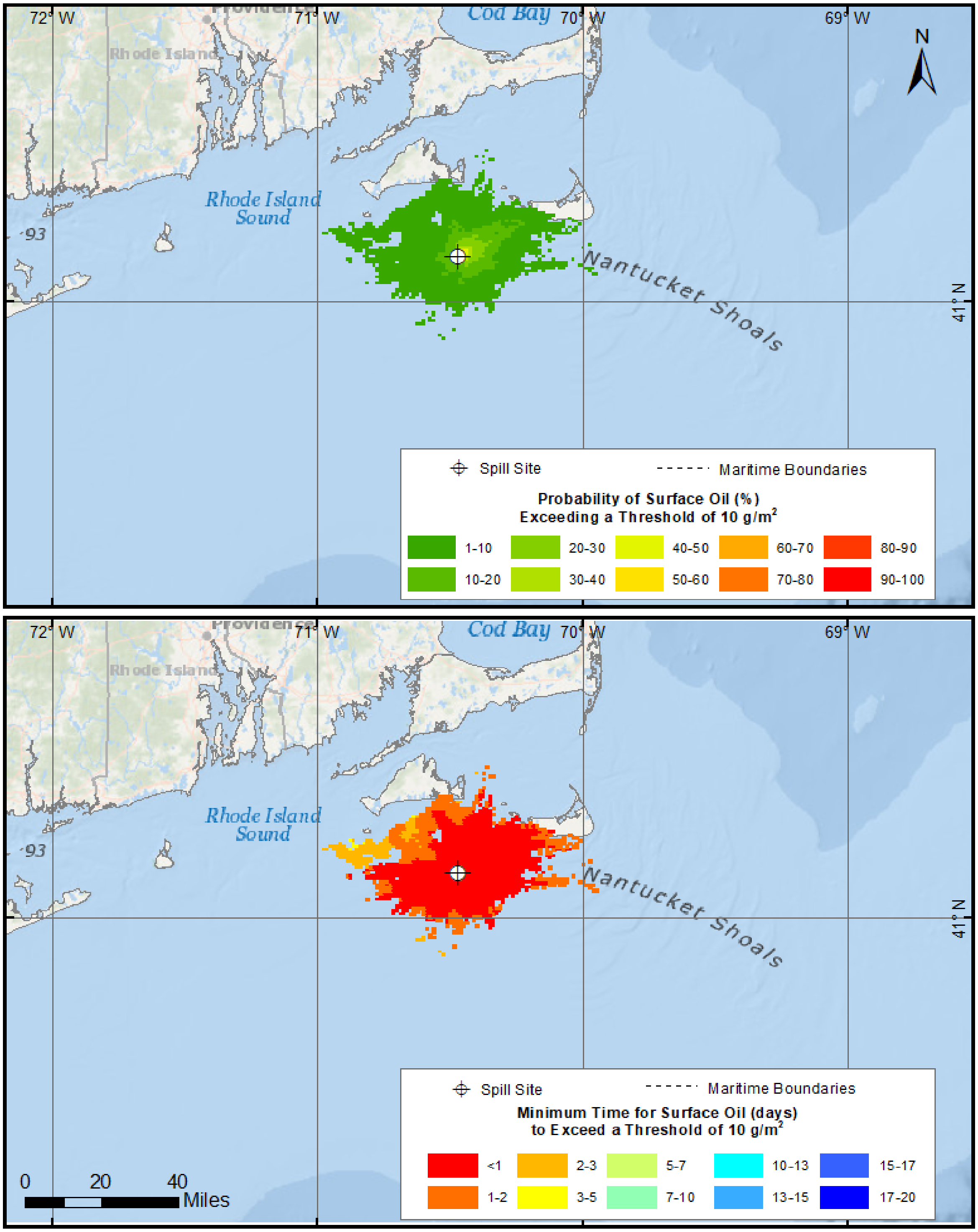


Figure 26. Detail View Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during fall months for an instantaneous release from the 400 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

1,539 barrel instantaneous release of oil mixture (December to February)

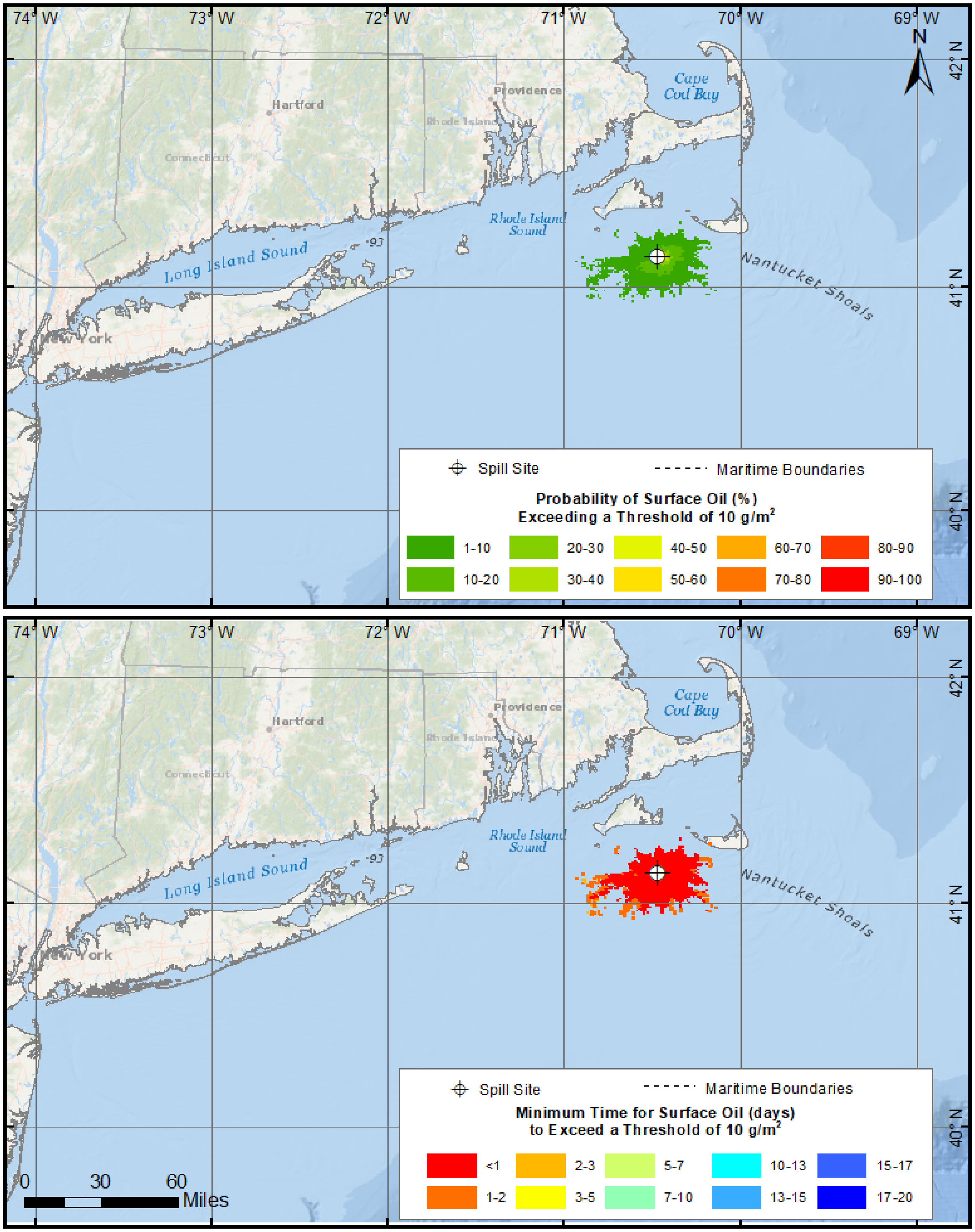


Figure 27. Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m^2 on average over the grid cell) during winter months for an instantaneous release from the 400 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m^2.

1,539 barrel instantaneous release of oil mixture (December to February)

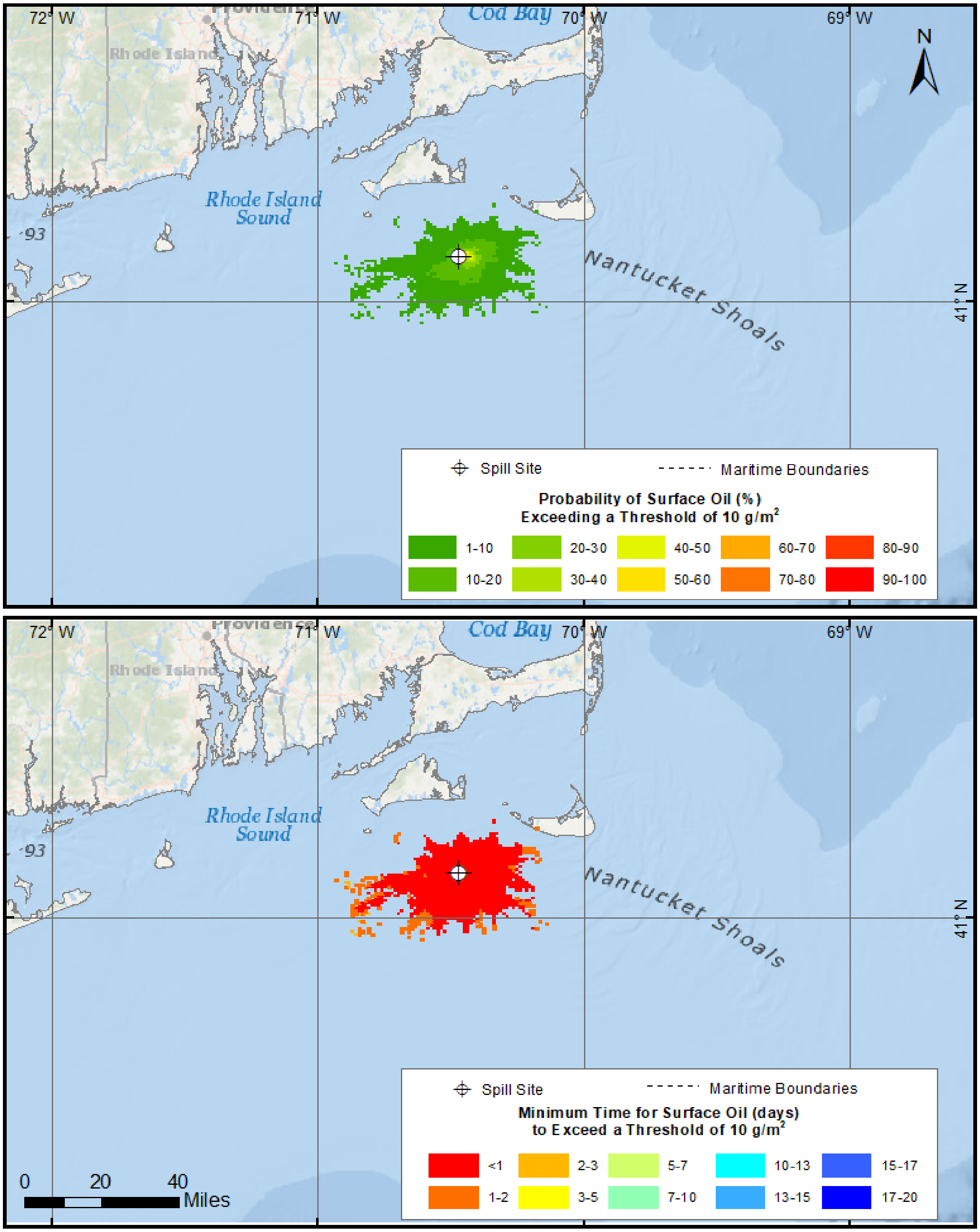


Figure 28. Detail View Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during winter months for an instantaneous release from the 400 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

4.1.2. Oil Contamination to Shore

The following figures illustrate the results of oil contamination to the shoreline for the worst-case oil spill scenarios over each season at the 400 MW site. Figures 29-32 indicate that, in all seasons, there is a 1-30% probability that oil above a minimum thickness of 100 µm (100 g/m^2 on average over the grid cell) released from the 400 MW ESP location would reach the shorelines of Martha's Vineyard and Nantucket within 1-3 days of the release. There is a lower probability (<10%) of oil above the threshold reaching the shorelines of Rhode Island and Massachusetts >3 days following the release. There is also a relatively small (<10%) potential for shoreline contamination to occur above 100g/m^2 on parts of Long Island and Connecticut; however, the timing for this to happen is much longer (>10 days) in most cases, and would likely be largely mitigated with response measures.

The season in which there would be expected to have the largest spatial extent of oiling is the spring due to the prevailing winds and currents during that time period. It is important to note again that these scenarios are very conservative and do not include the use of oil spill response equipment, which Vineyard Wind would implement in the case of a spill.

As described above and shown in Figure 20, the difference in the footprint for the surface and shoreline oil contamination is a result of the surface oil less than 100 µm (100 g/m^2 on average over the grid cell) traveling farther distances and beginning to pile up on shore. It is important to note that oil contamination to the shoreline has a cumulative effect over an individual run, since oil that hits the shoreline is stranded there, and more oil can pile up.

1,539 barrel instantaneous release of oil mixture (March to May)

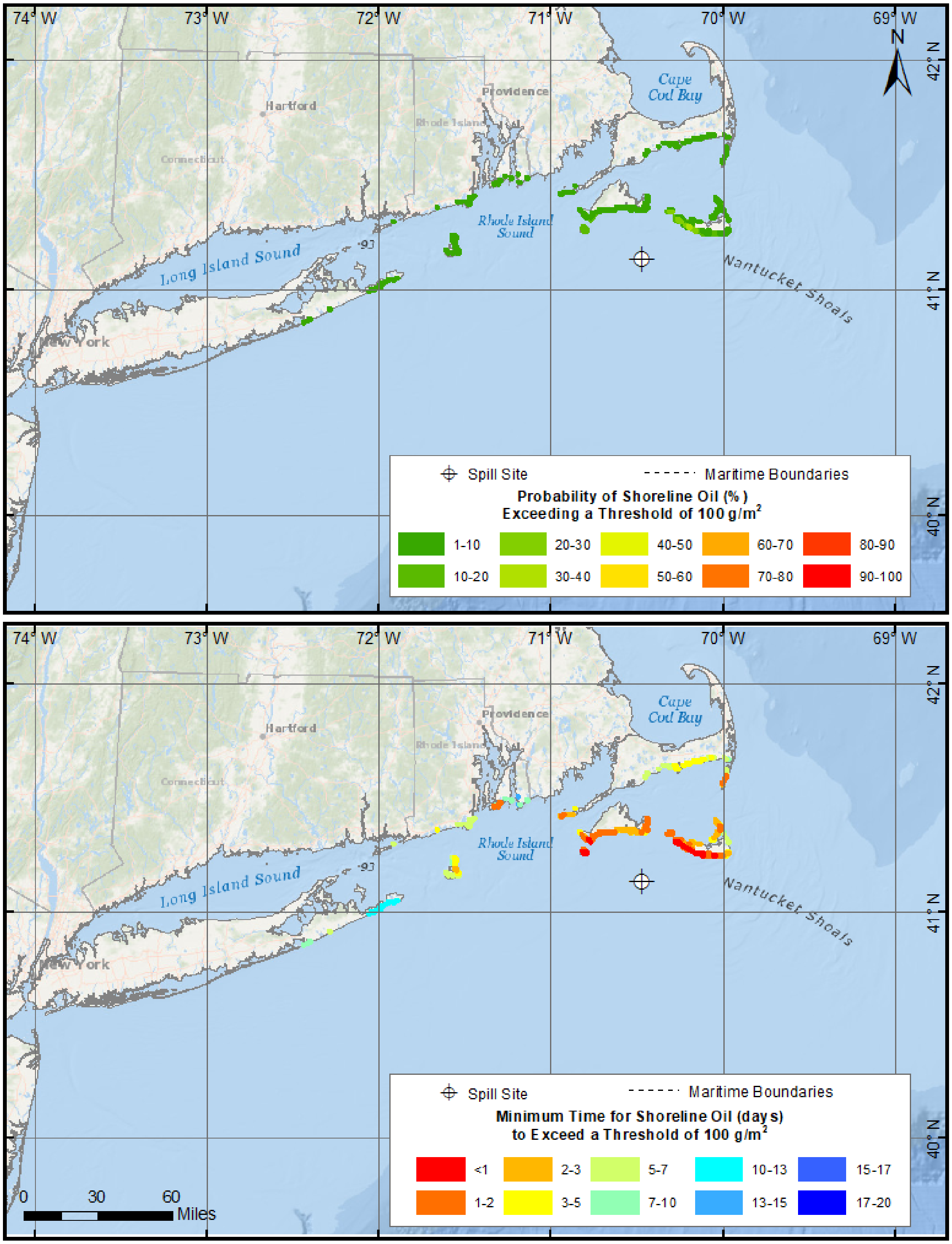


Figure 29. Top Panel - Probability of shoreline oiling above a minimum thickness of 100 µm (100 g/m² on average over the grid cell) during spring months for an instantaneous release from the 400 MW ESP location. Bottom Panel – Minimum time for shoreline oil thickness to exceed 100 g/m².

1,539 barrel instantaneous release of oil mixture (June to August)

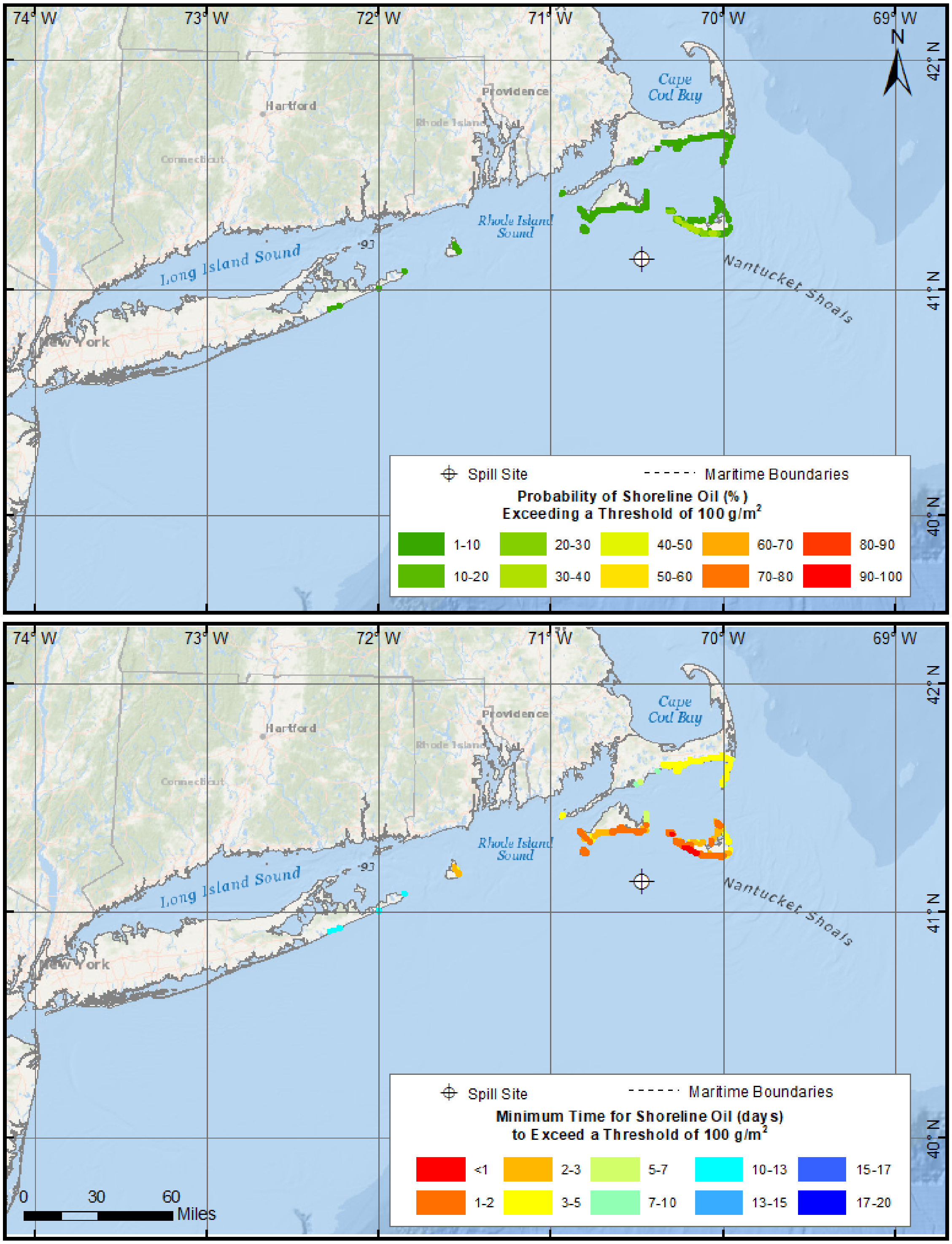


Figure 30. Top Panel - Probability of shoreline oiling above a minimum thickness of 100 µm (100 g/m² on average over the grid cell) during summer months for an instantaneous release from the 400 MW ESP location. Bottom Panel – Minimum time for shoreline oil thickness to exceed 100 g/m².

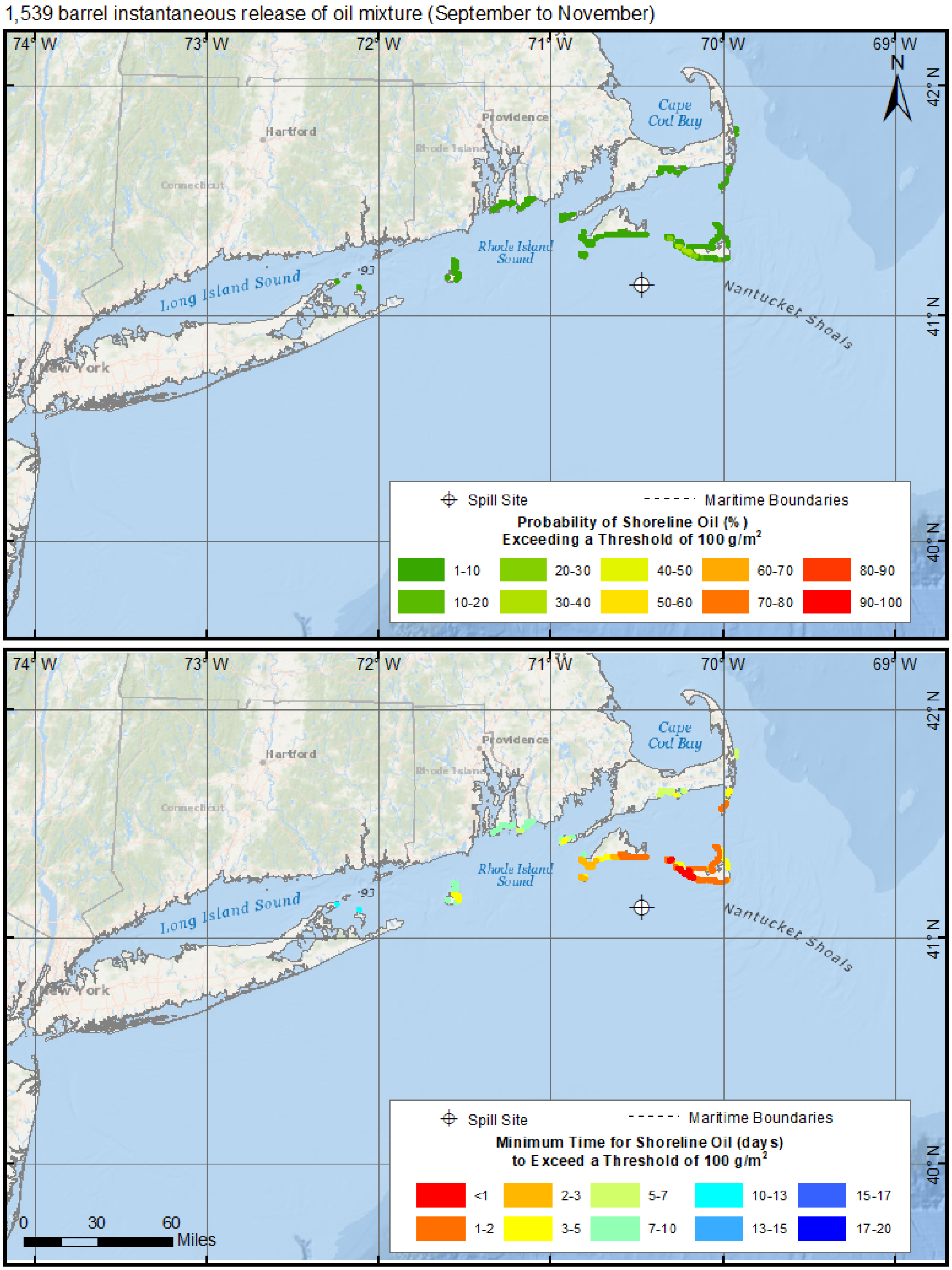


Figure 31. Top Panel - Probability of shoreline oiling above a minimum thickness of 100 µm (100 g/m^2 on average over the grid cell) during fall months for an instantaneous release from the 400 MW ESP location. Bottom Panel – Minimum time for shoreline oil thickness to exceed 100 g/m^2.

1,539 barrel instantaneous release of oil mixture (December to February)

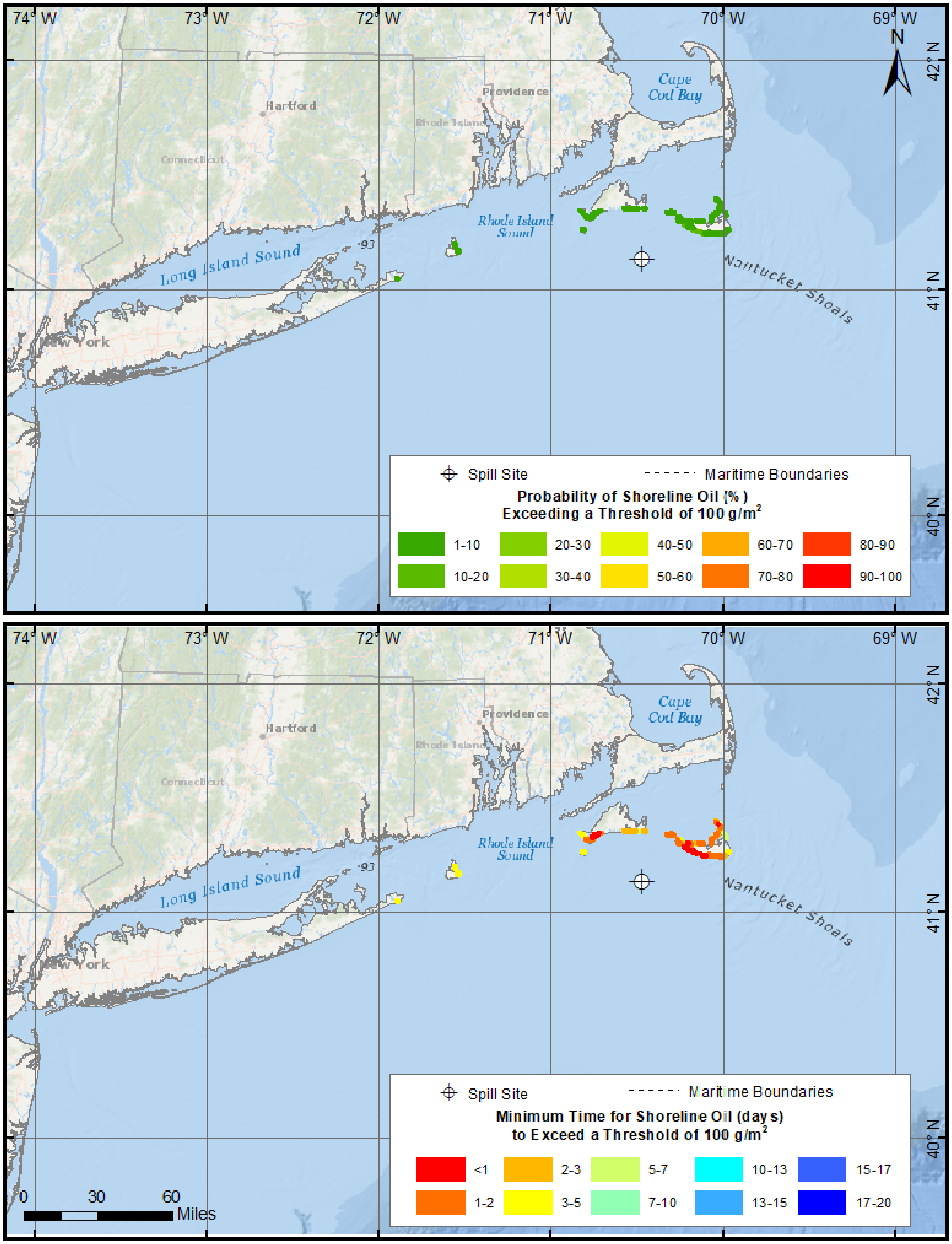


Figure 32. Top Panel - Probability of shoreline oiling above a minimum thickness of 100 µm (100 g/m² on average over the grid cell) during winter months for an instantaneous release from the 400 MW ESP location. Bottom Panel – Minimum time for shoreline oil thickness to exceed 100 g/m².

4.2. 800 MW Site

4.2.1. Oil Contamination to Water Surface

Figures 33 to 40 provide the results of surface oil contamination for the spill scenarios over each season. In all four seasons, the sea surface area exposed to oil exceeding the 10 g/m^2 threshold is contained within approximately 30-50 miles of the 800 MW ESP spill location, with the largest stochastic contour being 1-10% probability. Three of the seasons (spring, summer and fall; Figures 33-38, respectively) demonstrate a sea surface area exposed to oil exceeding the threshold of similar size; while the winter scenario depicts a relatively smaller footprint centralized around the spill site. It is important to note again that these scenarios are very conservative and do not include the use of oil spill response equipment, which Vineyard Wind would implement in the case of a spill.

As described above and shown in Figure 20, the difference in the footprint for the surface and shoreline oil contamination is a result of the surface oil less than 100 µm (100 g/m^2 on average over the grid cell) traveling farther distances and beginning to pile up on shore. It is important to note that oil contamination on the surface only shows the maximum concentration at each grid cell for any given time (i.e., oil can move through a cell in excess of the threshold but still not exceed the threshold at any given time).

2,954 barrel instantaneous release of oil mixture (March to May)

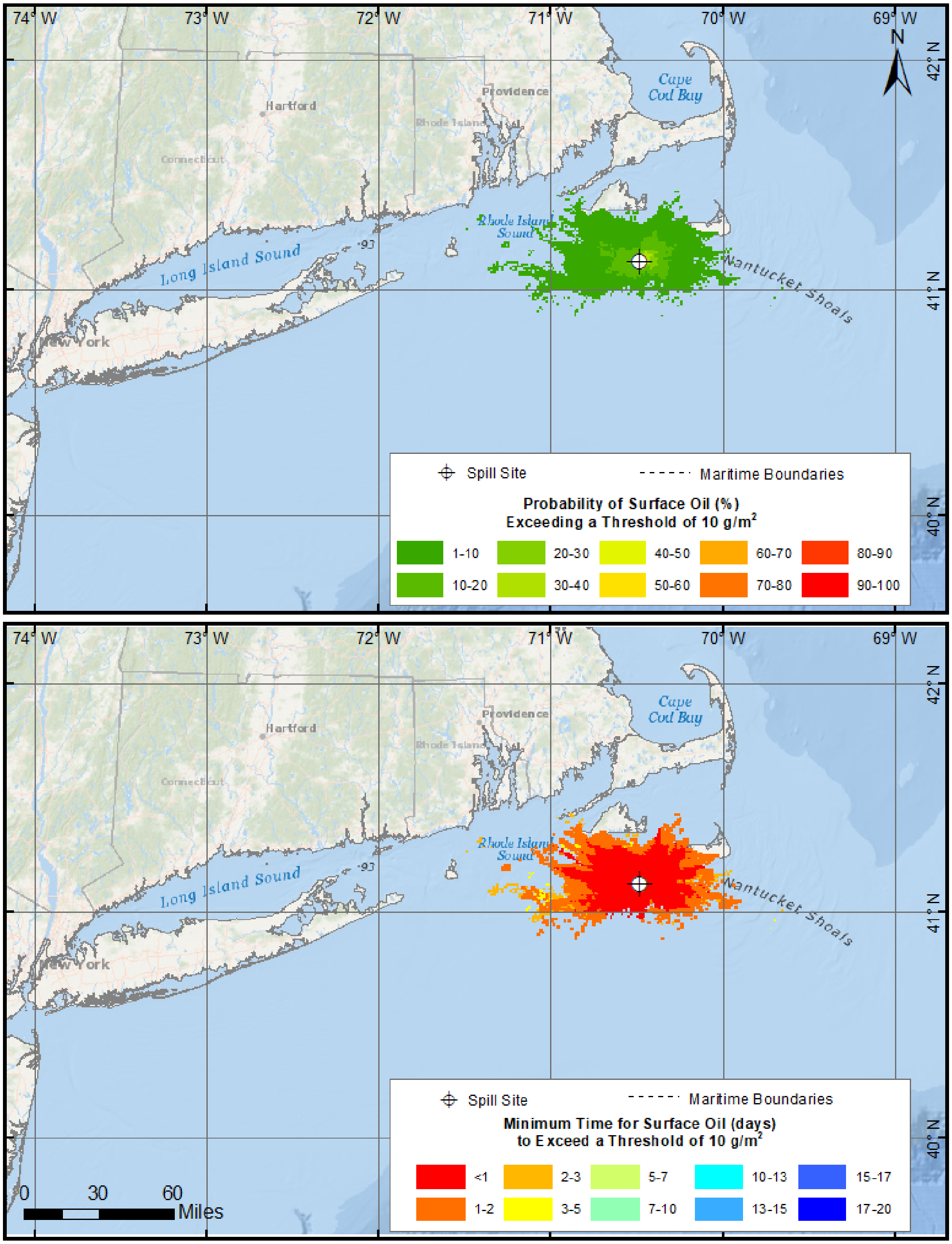


Figure 33. Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during spring months for an instantaneous release from the 800 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

2,954 barrel instantaneous release of oil mixture (March to May)

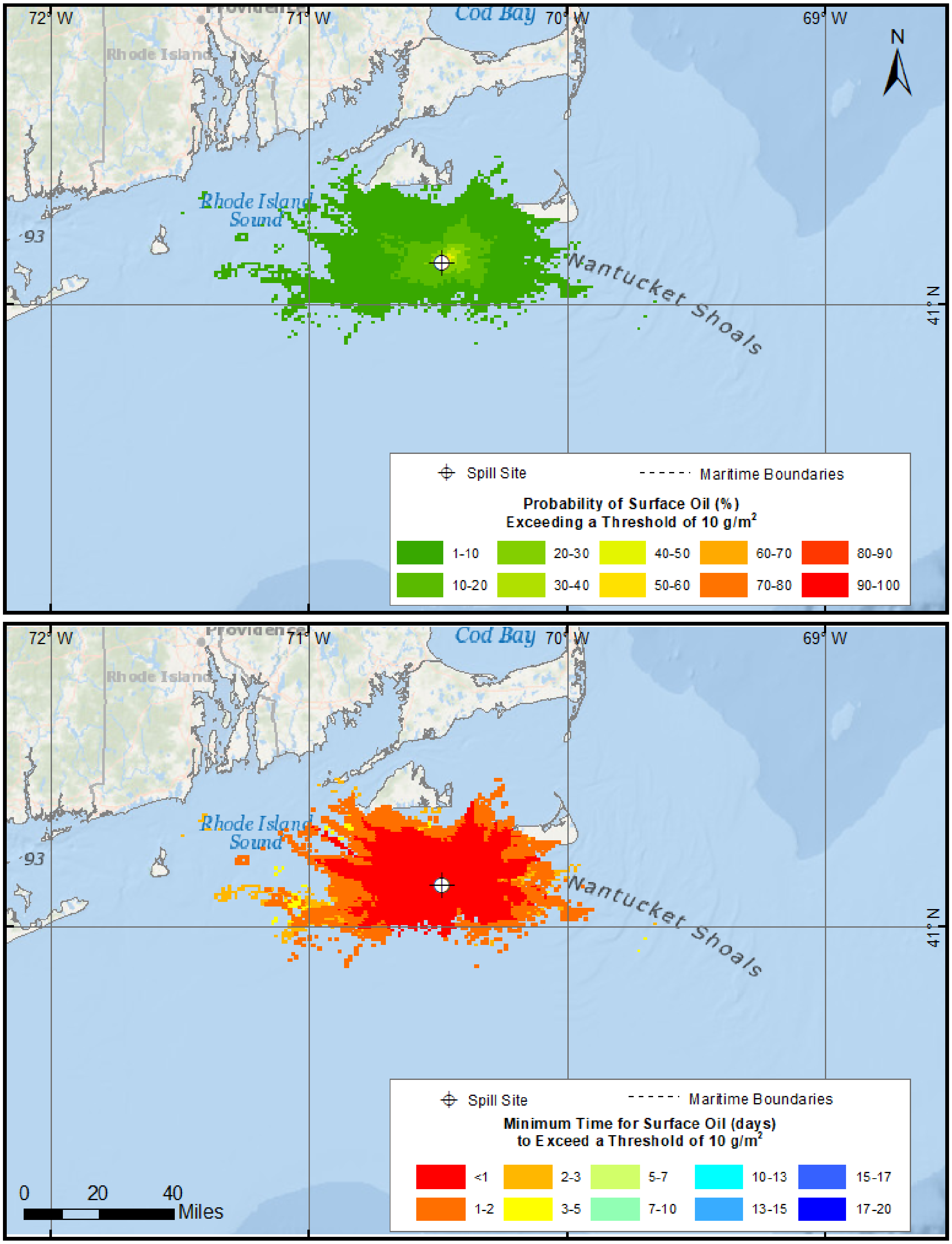


Figure 34. Detail View Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during spring months for an instantaneous release from the 800 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

2,954 barrel instantaneous release of oil mixture (June to August)

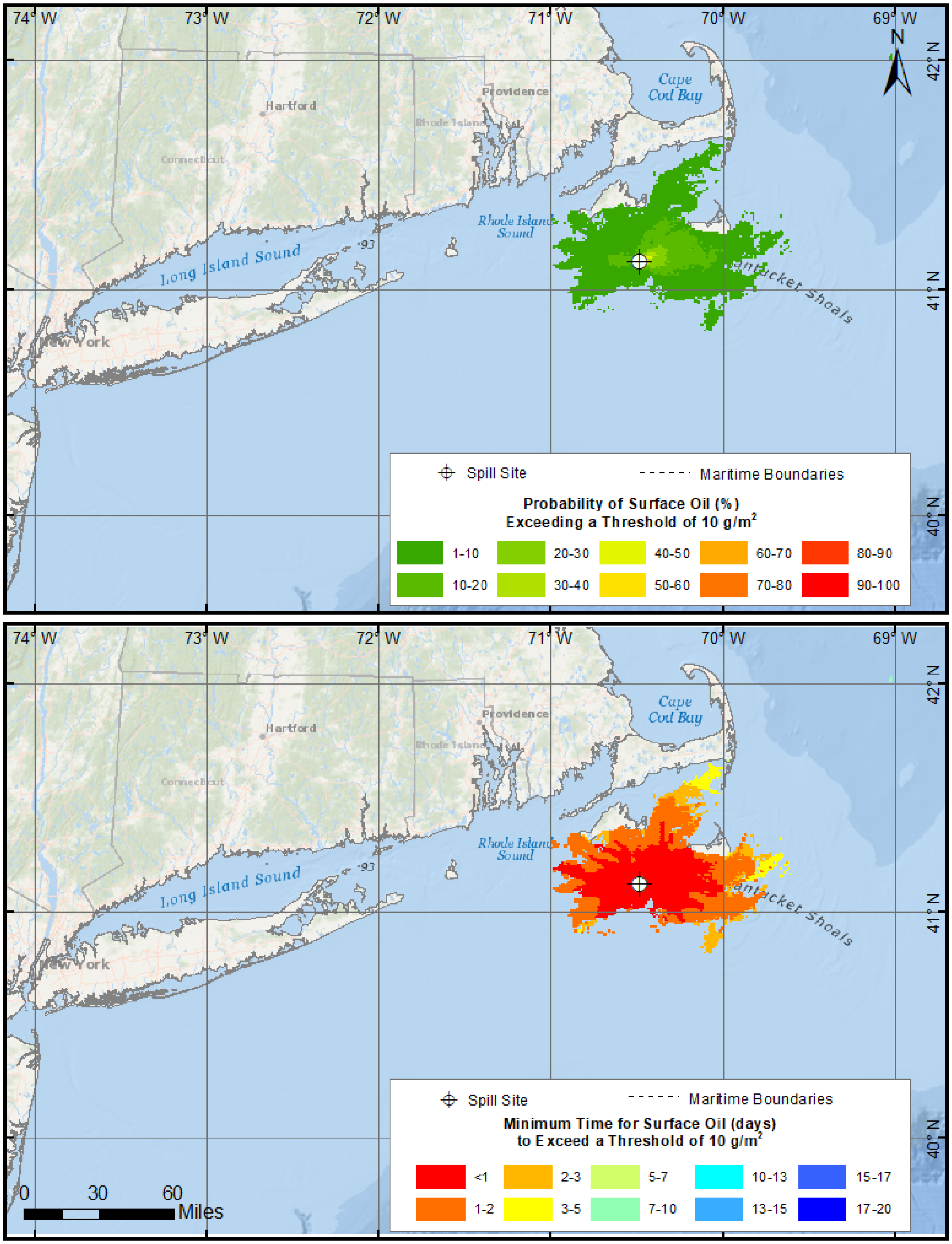


Figure 35. Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during summer months for an instantaneous release from the 800 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

2,954 barrel instantaneous release of oil mixture (June to August)

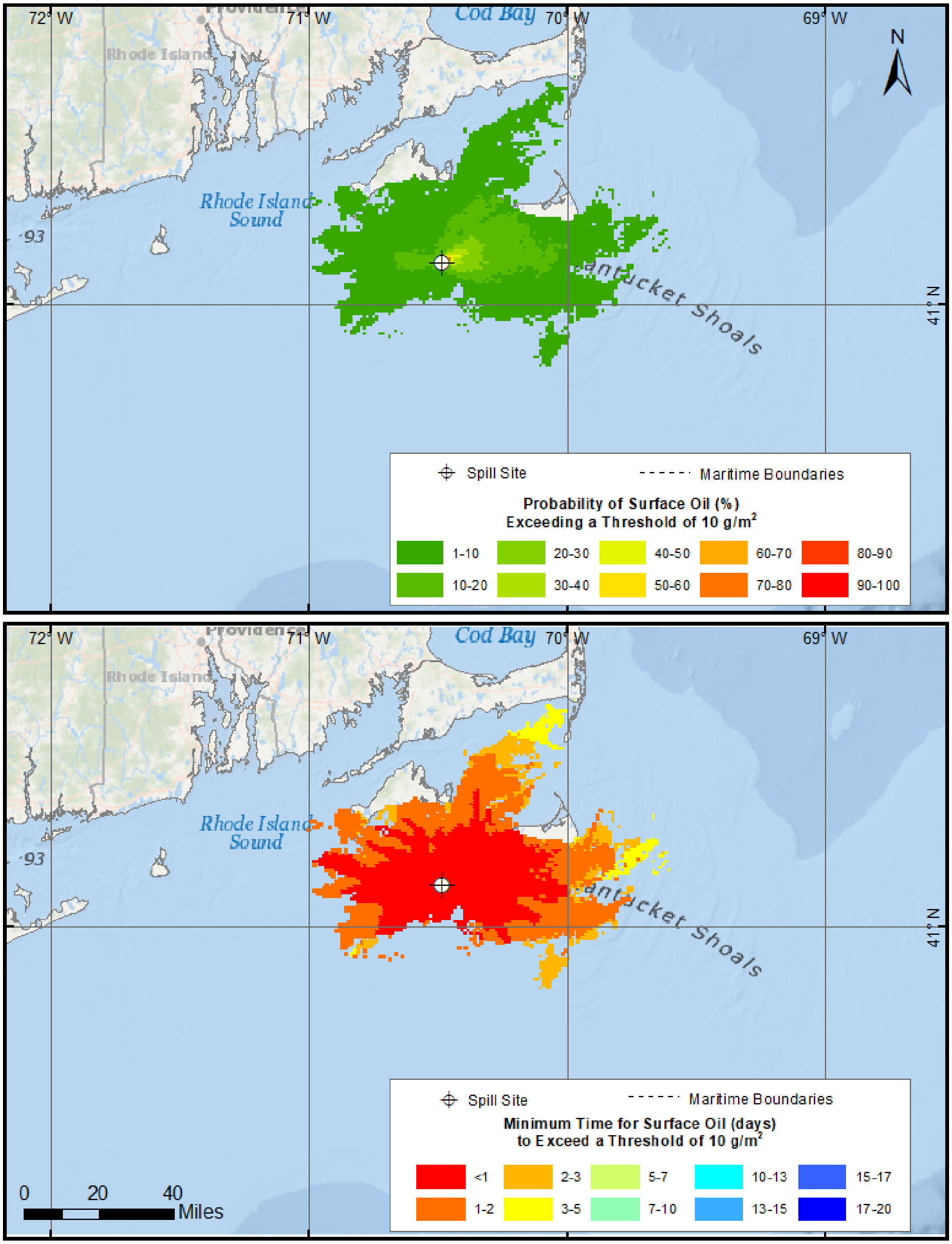


Figure 36. Detail View Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during summer months for an instantaneous release from the 800 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

2,954 barrel instantaneous release of oil mixture (September to November)

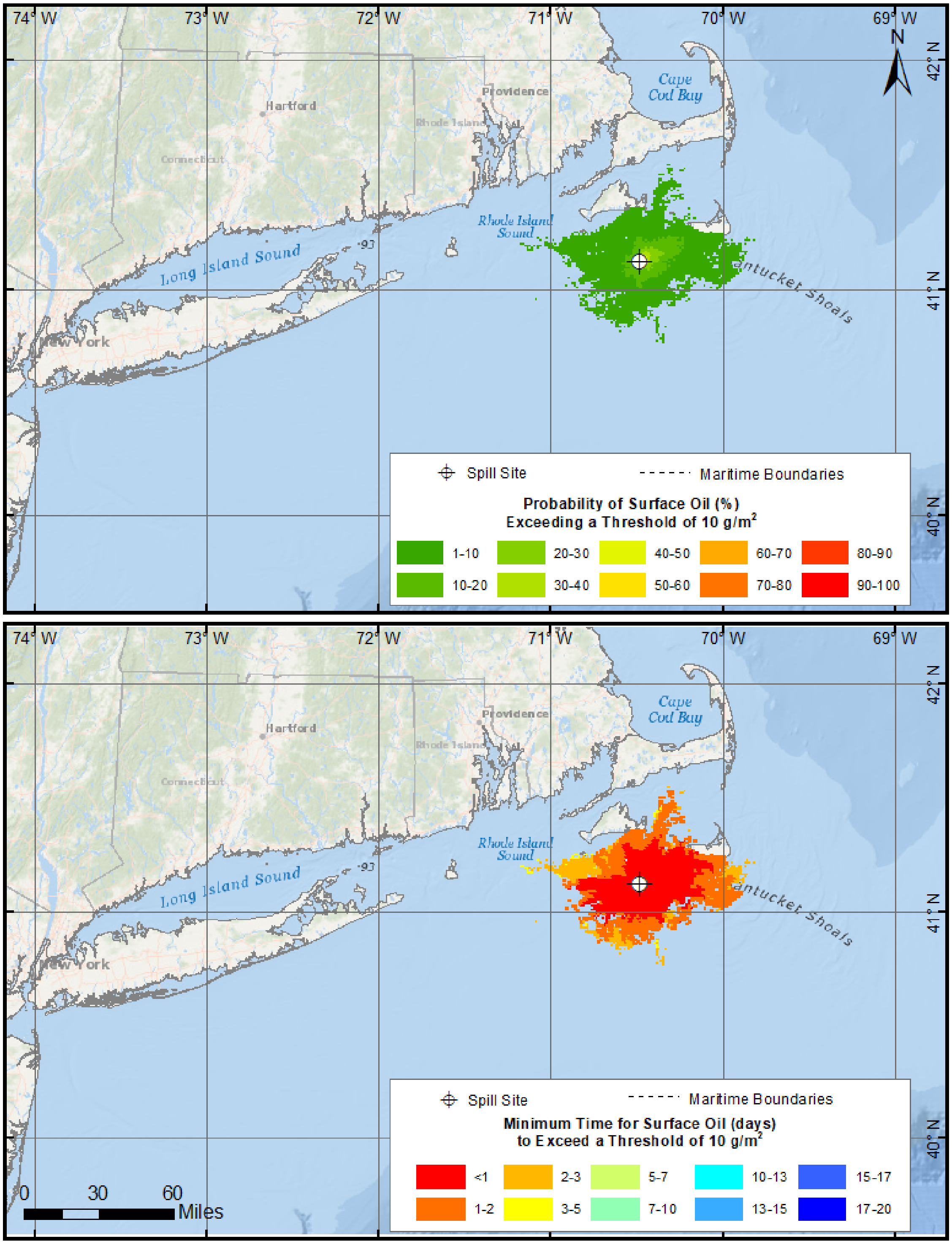


Figure 37. Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during fall months for an instantaneous release from the 800 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

2,954 barrel instantaneous release of oil mixture (September to November)

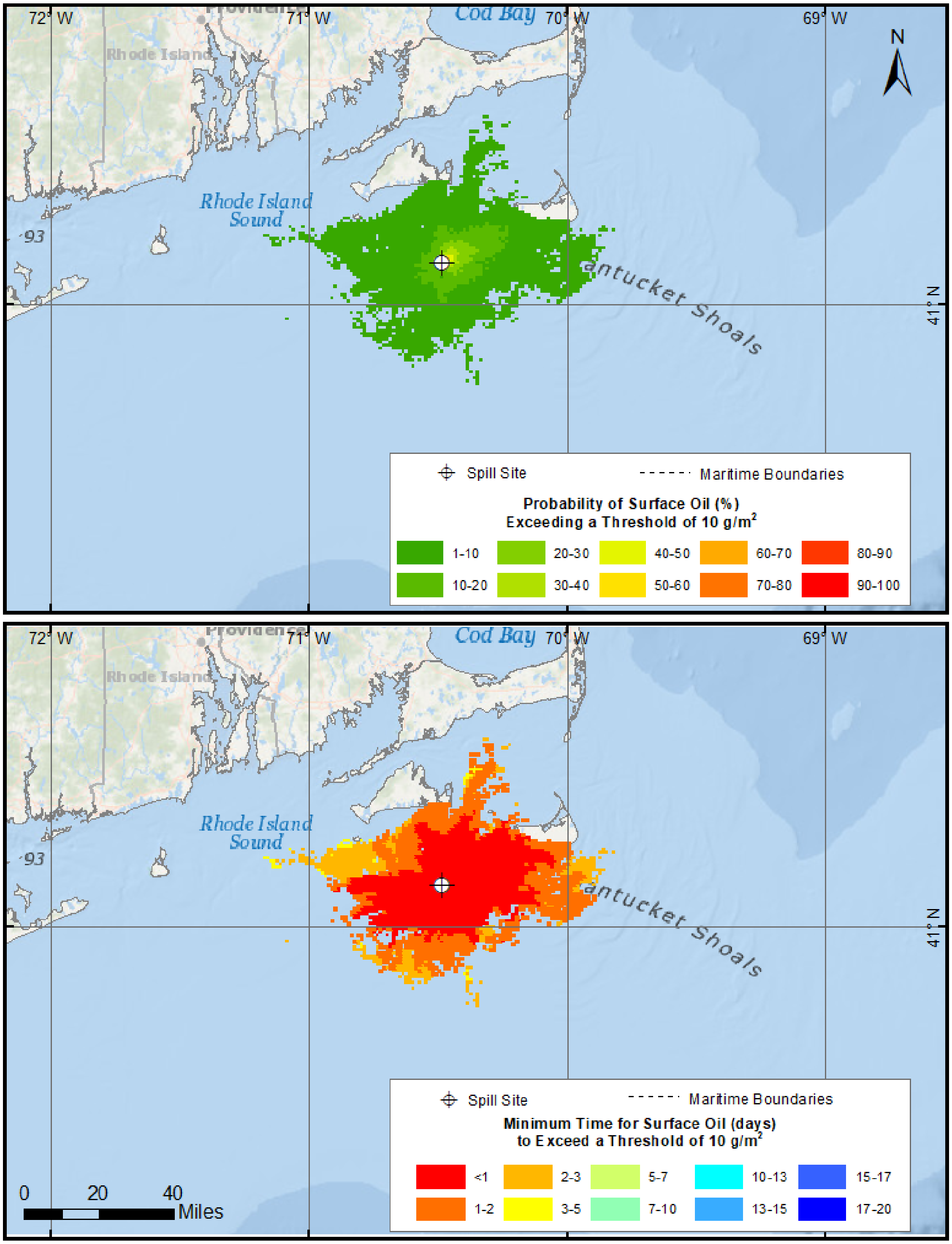


Figure 38. Detail View Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during fall months for an instantaneous release from the 800 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

2,954 barrel instantaneous release of oil mixture (December to February)

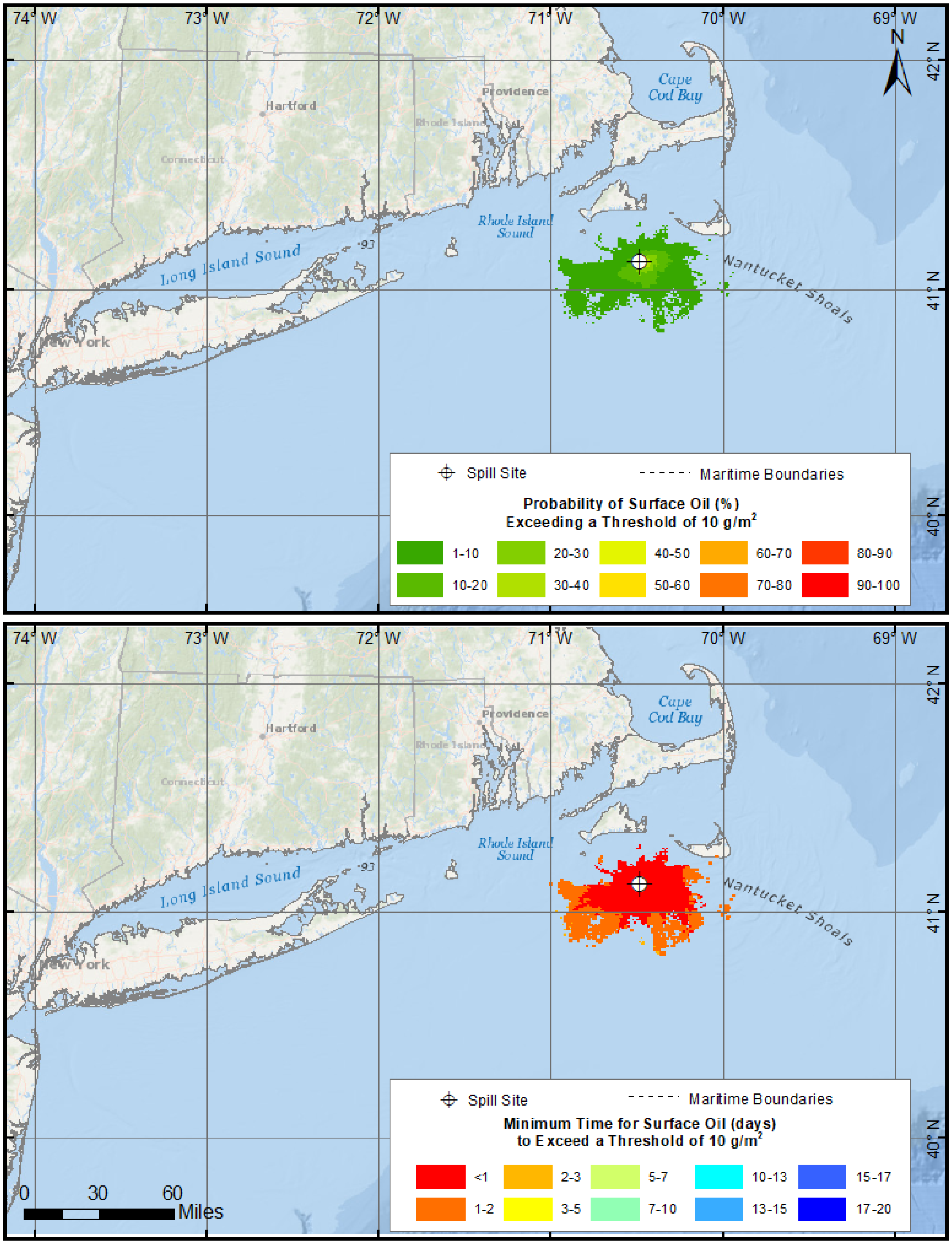


Figure 39. Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m^2 on average over the grid cell) during winter months for an instantaneous release from the 800 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m^2.

2,954 barrel instantaneous release of oil mixture (December to February)

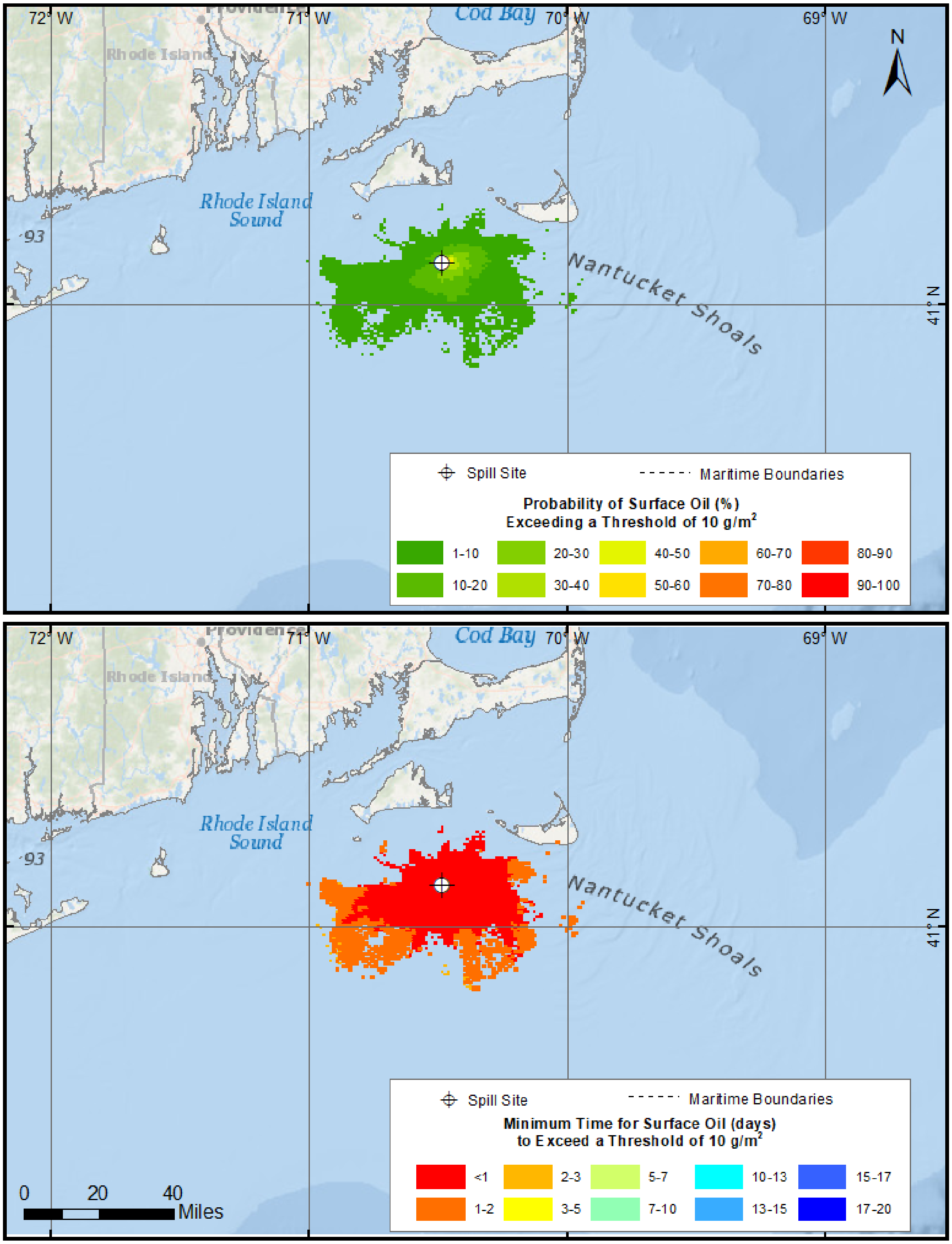


Figure 40. Detail View Top Panel - Probability of surface oiling above a minimum thickness of 10 µm (10 g/m² on average over the grid cell) during winter months for an instantaneous release from the 800 MW ESP location. Bottom Panel – Minimum time for surface oil thickness to exceed 10 g/m².

4.2.2. Oil Contamination to Shore

The following figures illustrate the results of oil contamination to the shoreline for the worst-case oil spill scenarios over each season at the 800 MW site. Figures 41 - 44 indicate that, in all seasons, there is a 1-40% probability of oil above a minimum thickness of 100 µm (100 g/m2 on average over the grid cell) reaching the shorelines of Martha's Vineyard and Nantucket within 1-3 days of the release. There is a lower probability (<10%) of oil above the threshold reaching the shorelines of Rhode Island and Massachusetts >3 days following the release. There is also a relatively small (<10%) potential for shoreline contamination to occur above 100 g/m^2 on parts of Long Island and Connecticut; however, the timing for this to happen is much longer (>10 days) in most cases, and would likely be largely mitigated with response measures.

As was the case for the oil release scenarios from the 400 MW site, the season in which there would be expected to have the largest spatial extent of oiling is the spring due to the prevailing winds and currents during that time period. It is important to note again that these scenarios are very conservative and do not include the use of oil spill response equipment, which Vineyard Wind would implement in the case of a spill.

As described above and shown in Figure 20, the difference in the footprint for the surface and shoreline oil contamination is a result of the surface oil less than 100 µm (100 g/m^2 on average over the grid cell) traveling farther distances and beginning to pile up on shore. It is important to note that oil contamination to the shoreline has a cumulative effect over an individual run, since oil that hits the shoreline is stranded there, and more oil can pile up.

2,954 barrel instantaneous release of oil mixture (March to May)

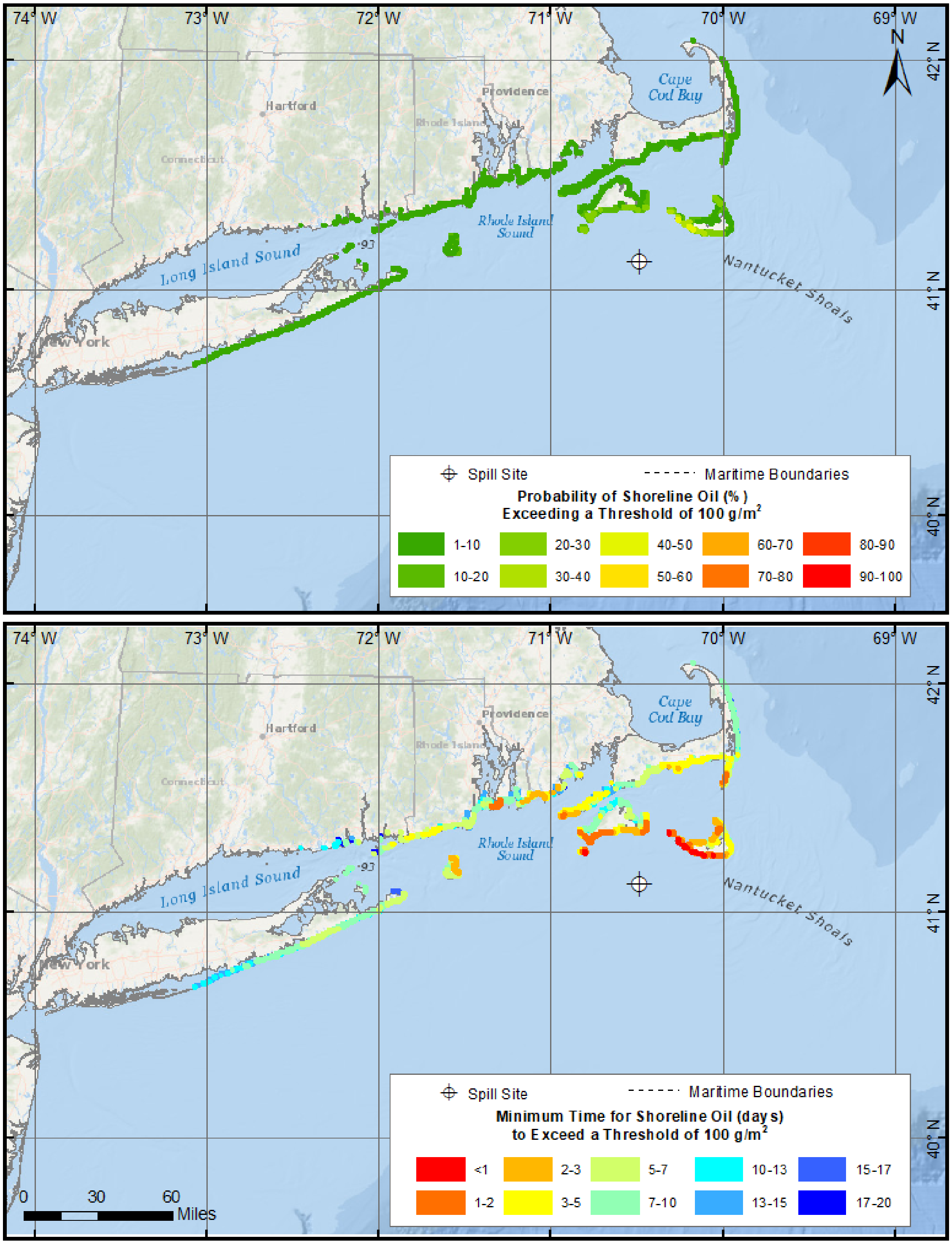


Figure 41. Top Panel - Probability of shoreline oiling above a minimum thickness of 100 µm (100 g/m² on average over the grid cell) during spring months for an instantaneous release from the 800 MW ESP location. Bottom Panel – Minimum time for shoreline oil thickness to exceed 100 g/m².

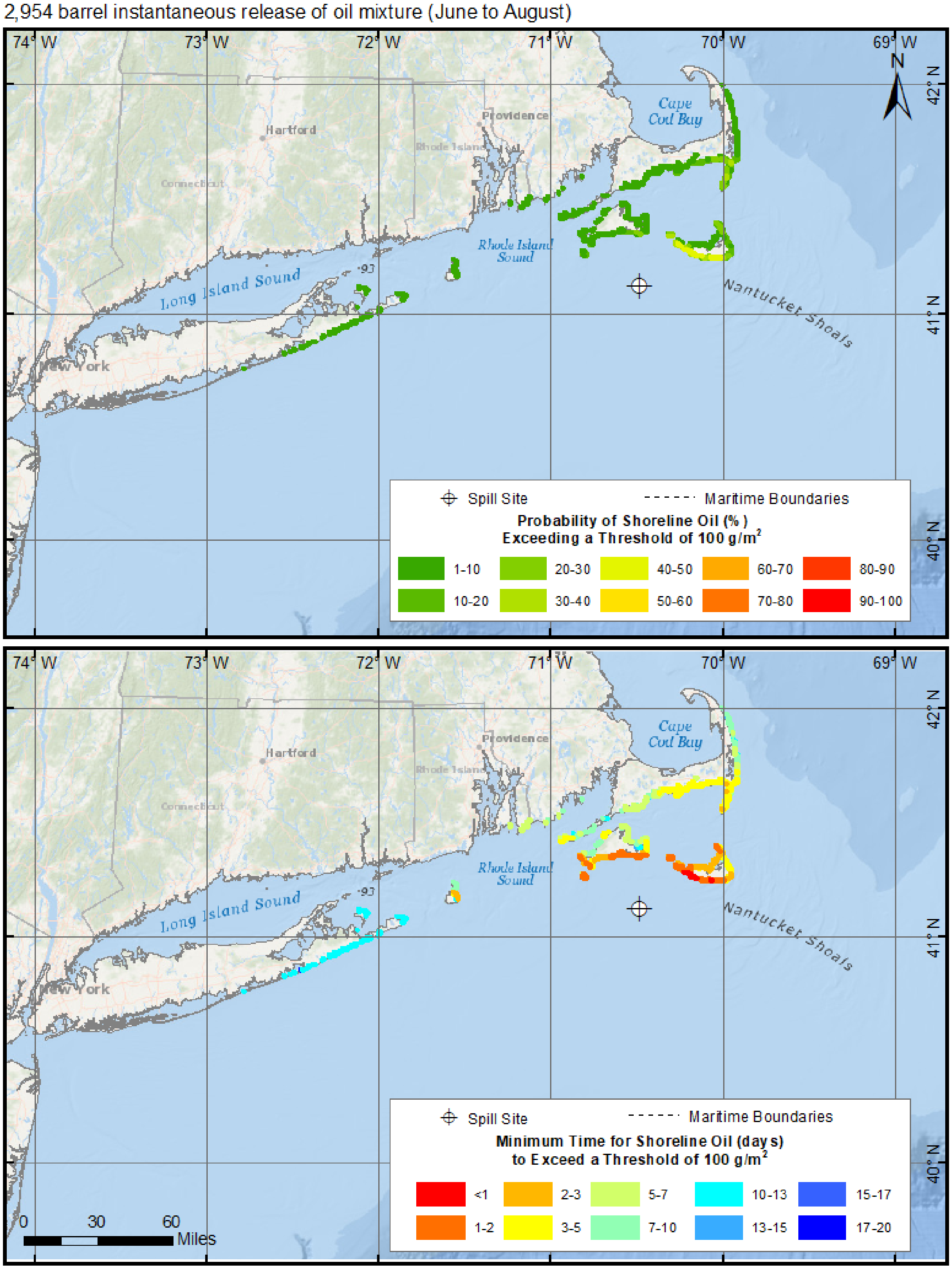


Figure 42. Top Panel - Probability of shoreline oiling above a minimum thickness of 100 µm (100 g/m² on average over the grid cell) during summer months for an instantaneous release from the 800 MW ESP location. Bottom Panel – Minimum time for shoreline oil thickness to exceed 100 g/m².

2,954 barrel instantaneous release of oil mixture (September to November)

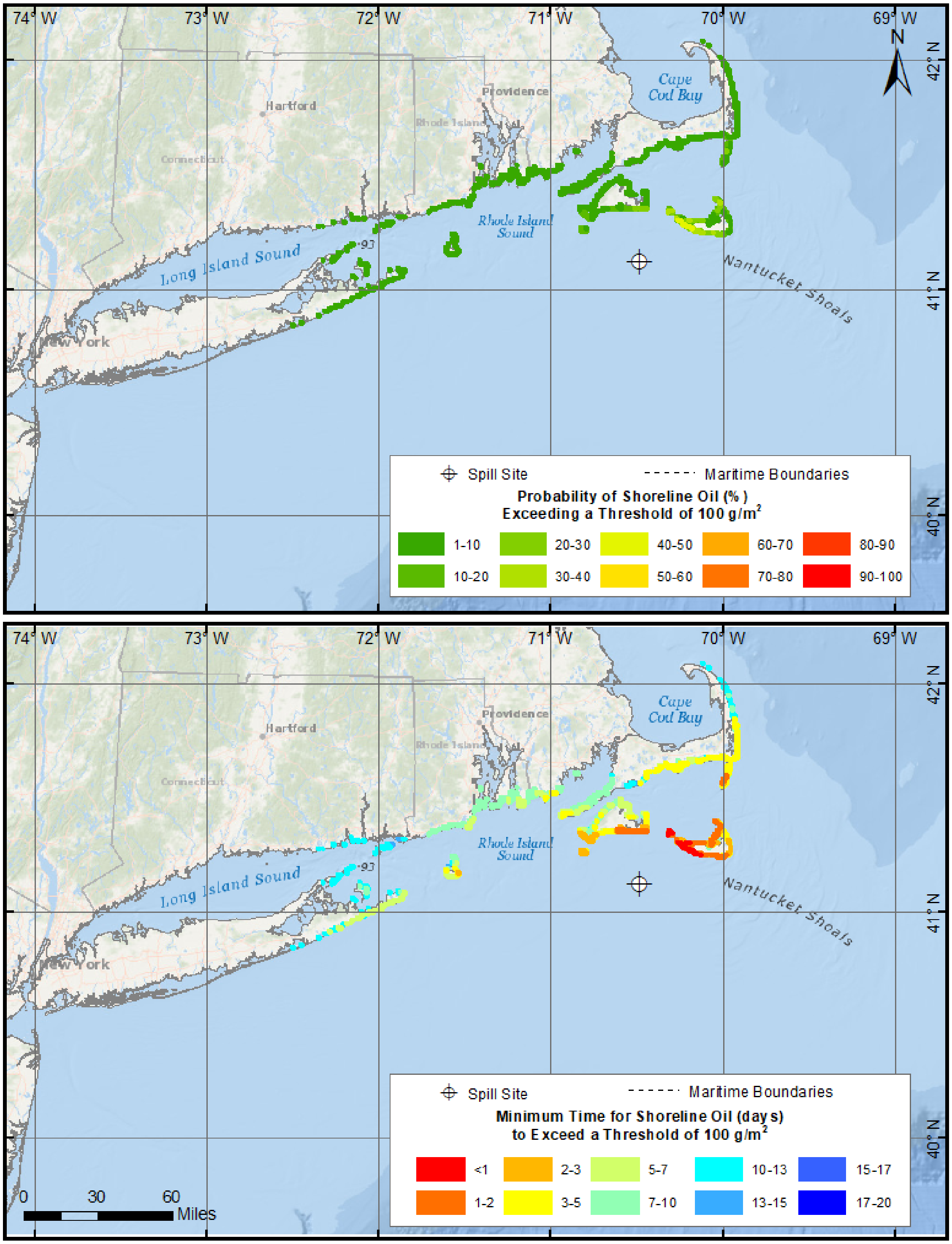


Figure 43. Top Panel - Probability of shoreline oiling above a minimum thickness of 100 µm (100 g/m² on average over the grid cell) during fall months for an instantaneous release from the 800 MW ESP location. Bottom Panel – Minimum time for shoreline oil thickness to exceed 100 g/m².

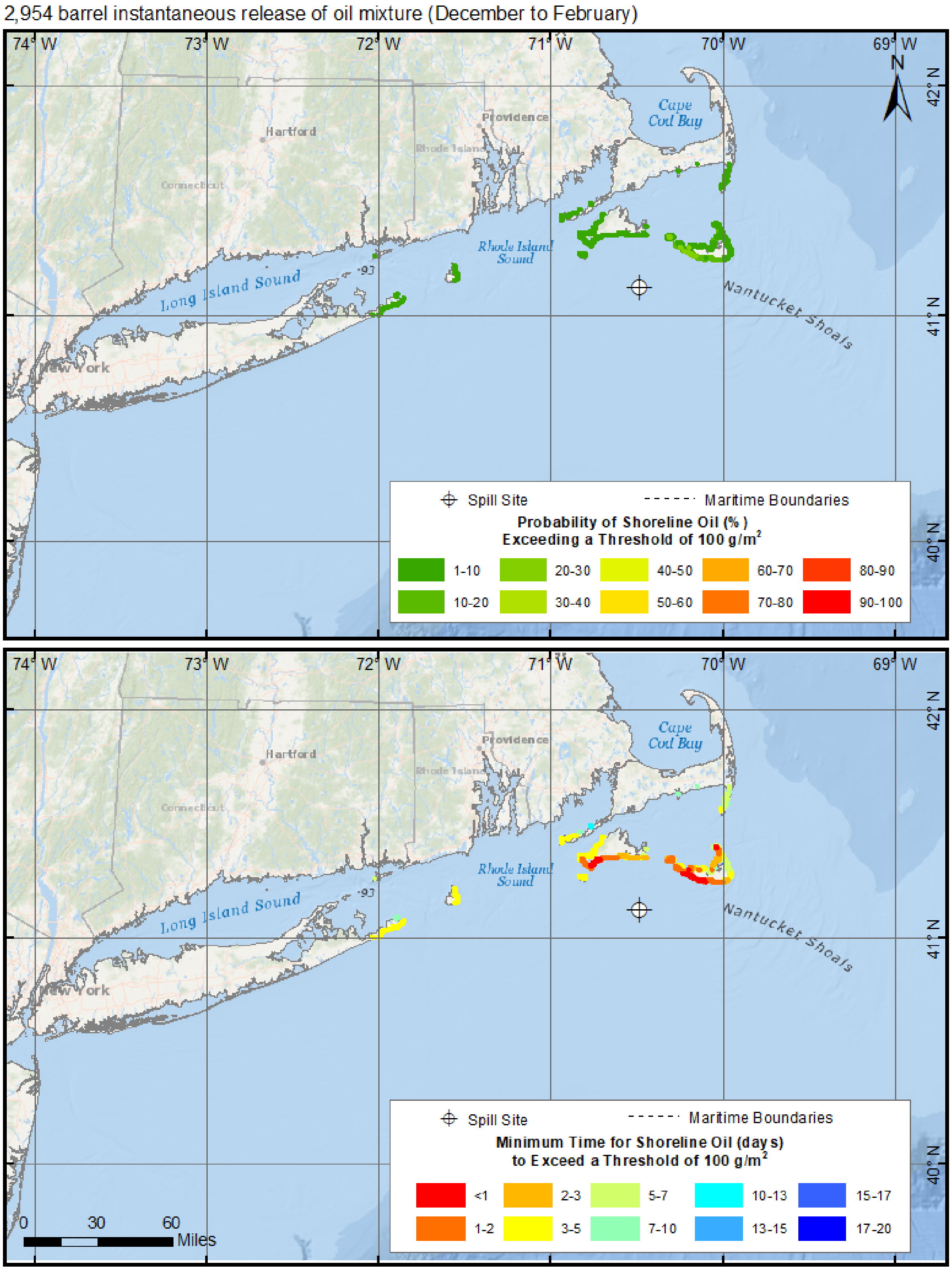


Figure 44. Top Panel - Probability of shoreline oiling above a minimum thickness of 100 µm (100 g/m² on average over the grid cell) during winter months for an instantaneous release from the 800 MW ESP location. Bottom Panel – Minimum time for shoreline oil thickness to exceed 100 g/m².

4.3. Conclusions

This oil spill modeling study assesses the trajectory and weathering of a catastrophic release of all oil contents from the topple of an ESP located closest to shore within the WDA for two different scenarios: a 400 MW ESP and an 800 MW ESP, where the 800 MW ESP has a more conservative (higher) discharge volume. Both of these scenarios simulate worst case discharges involving a relatively small and finite release of oil, with an extremely small probability of such a catastrophic event occurring. In addition to the low probability of such an event, the oil spill scenarios modeled in this study assume that no oil spill response or mitigation would occur. This is also a very conservative assumption because as discussed in further detail in Section 2.3.4 of the OSRP (COP Appendix I-A), response equipment employed on water would be used to prevent the spread of the spill, contain the oil to as small an area as possible, and protect sensitive areas before they are impacted.

Based on the environmental datasets analyzed as input for the oil spill modeling, the following conclusions can be drawn:

- Winds in the region are moderate, generally blowing from the northwest (winter) or southwest sector (summer) with monthly average wind speeds ranging from 6 to 10 m/s. The strongest winds are found in December and January with the weakest in August.
- Currents at the spill site are up to approximately 30 cm/s speed on average, and their direction changes in the representative seasons.
- In the area of interest, winds are usually more influential than the associated currents in regards to surface transport; however the winds in this region are often much more variable. During the month of July when wind intensity decreases, surface current may control the movement of floating slicks.
- Though there are strong seasonal trends in winds, it is important to note that the direction and magnitude of winds can change from day to day, and the wind roses presented below show monthly averages.

Based on the results of the stochastic spill trajectory analysis assessing potential spills of all oil contents of one ESP located closest to shore, the following conclusions can be made:

- The sea surface area exposed to oil exceeding the 10 g/m^2 threshold is contained within approximately 20-25 miles of the 400 MW ESP spill location and 30-50 miles of the 800 MW ESP spill location for all four seasons, with the area for the winter simulation being relatively smaller than the other three seasons.
- In all seasons, there is a 1-40% probability of oil above a minimum thickness of 100 µm (100 g/m^2 on average over the grid cell) reaching the shorelines of Martha's Vineyard and Nantucket within 1-3 days of the release. There is a lower probability (<10%) of oil above the threshold reaching the shorelines of Rhode Island and Massachusetts >3 days following the release. There is the relatively small (<10%) potential for shoreline contamination to occur above 100 g/m^2 on parts of Long Island and Connecticut;

however, the timing for this to happen is much longer (>10 days) in most cases, and would likely be largely mitigated with response measures.

5. References

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Appendix A – Oil Spill Modeling System - Description

OILMAP/SIMAP Introduction

OILMAP and SIMAP are part of RPS' comprehensive oil spill modeling system comprised of several interactive modules to reproduce the transport and fate of oil releases in different environments: land, water, and atmosphere. The impact assessment module – SIMAP – was derived from the physical fates and biological effects submodels in the Natural Resource Damage Assessment Models for Coastal and Marine and Great Lakes Environments (NRDAM/CME and NRDAM/GLE), which were developed for the U.S. Department of the Interior (USDOI) as the basis of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) Natural Resource Damage Assessment (NRDA) regulations for Type A assessments (French et al., 1996; Reed et al., 1996). The physical fates model has been validated with more than 20 case histories, including the *Exxon Valdez* and other large spills (French McCay, 2003, 2004; French McCay and Rowe, 2004), and test spills designed to verify the model's transport algorithms (French et al., 1997). The wildlife mortality model has also been validated with more th an 20 case histories, including the *Exxon Valdez*, that verify the values are reasonable (French and Rines, 1997; French McCay 2003, 2004; French McCay and Rowe, 2004). The technical documentation for SIMAP is in French McCay (2003, 2004, 2009).

Applications for OILMAP/SIMAP include impact assessment; hindcast/forecast of spill response; Natural Resource Damage Assessment (NRDA); contingency planning; ecological risk assessment; cost-benefit analysis, and drills and education. The model may be run for a hindcast/forecast of a specific release, or be used in stochastic mode to evaluate the probable distribution of contamination.

OILMAP/SIMAP contains several major components:

- The physical fates model estimates surface distribution and subsurface concentrations of the spilled oil and its components over time.
- The biological effects model estimates impacts resulting from a spill scenario on fish, invertebrates, wildlife, and for each of a series of habitats (environments) affected by the spill.
- The probability of impact from an oil discharge is quantified using the three-dimensional stochastic model.
- Currents that transport contaminant(s) and organisms are entered using the graphical user interface or generated using a (separate) hydrodynamic model. Alternatively, existing current data sets may be imported.
- Environmental, chemical, and biological databases supply required information to the model for computation of fates and effects.

- The user supplies information about the spill (time, place, oil type, and amount spilled) and some limited environmental conditions at the time (such as temperature and wind data).

As with RPS' other modeling systems, OILMAP/SIMAP is easily applied to a wide variety of conditions. It is set up and runs within RPS' standard Geographic Information System (GIS) or ESRI's ArcView GIS, and can be applied to any aquatic environment (fresh or salt) in the world. It uses any of a variety of hydrodynamic data file formats (1-, 2- and 3-dimensional; time varying or constant) and allows 2-D vertically-averaged current files to be created within the program system when modeled currents are not available. Outputs include easily interpreted visual displays of dissolved and particulate concentrations and trajectories over time, as appropriate to the properties of the chemical being simulated. An optional biological exposure model is available to evaluate areas and volumes exposed above concentrations of concern and to predict the impacts on exposed fish and wildlife.

OILMAP/SIMAP specifically simulates the following processes:

- initial plume dynamics;
- slick spreading, transport, and entrainment of floating oil;
- evaporation and volatilization (to atmosphere);
- transport and dispersion of entrained oil and dissolved aromatics in the water column;
- dissolution and adsorption of entrained oil and dissolved aromatics to suspended sediments;
- sedimentation and re-suspension;
- natural degradation
- shoreline entrainment, and
- boom and dispersant effectiveness.

The physical and biological models require environmental, oil and biological data as inputs. One of RPS' strengths is the ability to synthesize data from disparate sources. The data come from many sources including government and private data services, field studies and research. Modeling techniques are used to fill in "holes" in the observational data, thus allowing complete specification of needed data. The environmental database is geographical, including data of the following types: coastline, bathymetry, shoreline type, ecological habitat type, and temporally varying ice coverage and temperature. This information is stored in the simplified geographic information system. The chemical database includes physical-chemical parameters for a wide variety of oils and petroleum products. Data have been compiled by RPS from existing, but diffuse, sources.

An oil spill is simulated using site-specific wind, current, and other environmental data gathered from existing information, on-line services, and/or field studies. Shoreline and habitat types, as well as bathymetry, are mapped and gridded for use as model input. The physical, chemical, and toxicological properties of the spilled oil are provided by the oil database or updated to the specific conditions of the release. The model estimates the fate of the oil over time. The model outputs are time-varying concentrations and mass per unit area on surfaces (i.e., water surface, shoreline, sediments), which quantifies exposure to aquatic biota and habitats. Atmospheric loading in space and time is also computed, and provides input to air dispersion models.

Decay / Degradation Processes

Degradation, also known as decay, is the result of several processes in the water column and sea surface. Decay represents both biodegradation and photolysis. Photolysis is a chemical breakdown process energized by ultraviolet light from the sun as it penetrates the oceans sea surface layer. Biodegradation occurs when microbes metabolize oil as a carbon source, producing carbon dioxide and water as by-products. The biodegradable portion of various crude oils can vary, ranging from 11% to 90% (NRC, 1985, 1989). Not all types of organisms utilize the same oil components, nor are all types of organisms present in all locations.

In the RPS oil spill model, degradation is applied to all oil components present in the sea surface, shoreline, and in the water column. The degradation rate captures all degradation processes (e.g. photolysis and biodegradation) and is calculated for each environmental compartment. Degradation rates are constant throughout the simulation and based on empirical evidence. Oil degradation rates in OILMAP's oil database are based on French et al., 1996. The following table lists the different degradation rates used in this modeling study for each compartment, expressed in day^{-1}. It should be noted that these rates are being re-evaluated based on new findings in particular for the water column; however the rates used in this study can be considered conservative (i.e. slightly underestimating decay in the water column).

Table A-1. Oil Decay rates used in OILMAP for each marine compartment and oil components (THC range).

Environmental Compartment	Oil exposed to air (surface (0-1m), shoreline)	Oil in water column	Oil in sediments
Daily Decay Rate (1/day)	0.001	0.240 – THC1 (1-180 C) 0.078 – THC2 (180-265 C) 0.042 – THC3 (265-380C) 0.01 – Residual oil	0.001

Model Uncertainty / Limitations

The model has been developed over many years to include as much information as possible to simulate the fates and effects of oil spills. However, as in all science, there are significant gaps in knowledge and the ability to simulate the detailed behavior of organisms and ecosystems. Typically assumptions based on available scientific information and professional judgment are made in the development of the model, which represent our best assessment of the processes and potential mechanisms for effects (consequences) that would result from oil spills.

The major sources of uncertainty in the oil fates and biological effects model are:

- Oil contains thousands of chemicals of varying physical and chemical properties that determine their fate in the environment. In addition, those chemicals (their properties) change over time. The model must treat the oil as a mixture of a limited number of hydrocarbon components, grouping chemicals by physical-chemical properties.
- The fates model contains a series of algorithms that are simplifications of complex physical-chemical processes. These processes are understood to varying degrees, but can dramatically vary depending on the environmental conditions (e.g. cold vs warm waters).
- Organisms are assumed uniformly distributed in affected habitats they occupy for the duration of the spill simulation. The accuracy of this assumption varies between organisms, but the objective is to assess potential effects for an average-expected condition, which is what this assumption most closely resembles.
- Biological effects are quantified based on acute exposure and toxicity of contaminant concentrations as a function of degree and duration of exposure. The SIMAP model used is not designed to address long-term, chronic exposure to pollutants.
- The model treats each spill as an isolated pollution event and does not account for any potential cumulative effects.
- Various physical / environmental parameters including river flow, depth / sea bottom roughness, total suspended solids concentration, etc. were not sampled extensively at each location of the extended domain (hundreds of square kilometers). What limited data that did exist was applied to each location, leading to a certain degree of homogenization of the environmental (marine/coastal) conditions.

In addition, in any given oil spill, the fates and effects will be highly related to the specific environmental conditions, the precise locations of organisms, and a myriad of details related to the event. Thus, the results are a function of the scenarios simulated and the accuracy of the input data used. The goal of this study was not to capture every detail that could potentially occur, but to describe the range of possible consequences so that an informed analysis could be made as to the likely effects of spills under various scenarios. The model inputs are designed to provide representative conditions to such an analysis. Thus, the modeling is used to provide quantitative guidance in the analysis of the spill scenarios being considered.

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