State Enhanced Remedy in New Bedford, South Terminal

Massachusetts Department of Environmental Protection

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EXECUTIVE SUMMARY

The Confined Disposal Facility ("CDF") project at the South Terminal in New Bedford has been promulgated in order to develop a multi-purpose marine terminal, a primary purpose of which will be to provide critical infrastructure to serve offshore renewable energy facilities and accommodate international shipping at the new facility. The proposed facility will also be capable of supporting other industries within New Bedford, and will beneficially re-use sand from navigational dredging or the construction of confined aquatic disposal facilities to the extent approved by US EPA.

An assessment of the potential locations for supporting offshore renewable energy facilities and international shipping has resulted in the conclusion that South Terminal in New Bedford, Massachusetts is the only location that is practicable due to a number of constraints, including: horizontal clearance, jack-up barge access, overhead clearance, total wharf and yard upland area, berthing space, site control/availability, and proximity. Due to the lack of other practicable alternatives, and the avoidance and minimization of impacts to resource areas to the maximum extent practicable, the South Terminal CDF is the Least Environmentally Damaging Practicable Alternative that will meet the primary Project Purpose.

The following assessments have been completed to quantify the resource area impacts that are anticipated from completion of the South Terminal CDF project: a shellfish survey, an essential fish habitat assessment, a functions and values assessment, a neighborhood analysis, an analysis of NOx generation from construction activities, a delineation of wetlands onsite, an avian wildlife assessment, an analysis of secondary impacts from construction and operation of the facility, an analysis of the presence of similar habitats within New Bedford Harbor, and an assessment of potential mitigation options.

Historically, much of the land that will be incorporated into the proposed Facility is former heavy industrial property, the site of an extensive former mill complex. The Potomska Mills, which once stretched from the current intertidal to beyond the western proposed site boundary, was present on the site from the late 1800's until about 1936 (when it was demolished), and encompassed an area of approximately 19 acres, more than half of which was within the footprint of the proposed South Terminal CDF Facility.

Impacts to soil have been detected in the upland portion of the proposed South Terminal CDF Facility. There are three primary areas on the Site that require remediation to (a) remove source areas of contamination as required by the Massachusetts Contingency Plan, 310 CMR 40.0000 ("MCP") administered by the Department, (b) remove constituent concentrations in soil that may pose an unacceptable risk, and (c) address TSCA-requirements for PCB-remediation waste. Additional details regarding upland sampling and analysis and proposed remediation are included in Section 5.5.

The resource areas anticipated to be impacted by completion of this project are as follows: 1.43 acres of intertidal area, 4.06 acres of shallow, near-shore sub-tidal area, and 0.18 acres of salt marsh will be filled by construction of the CDF. 7.71 acres of shallow, near-shore, sub-tidal area will be dredged from -1 to -13 MLLW to -14 MLLW. 3.68 acres of shallow, near-shore, sub-tidal area will be dredged from -1 to -6 MLLW to -30 to -32 MLLW. 7.01 acres of deeper sub-tidal area will be dredged from -20 to -25 MLLW to -30 MLLW.

To mitigate for impacts to the existing Gifford Street Mooring Basin and Channel, 8.01 acres of shallow, near-shore, sub-tidal area will be dredged from -5 MLLW to between -6 and -7 MLLW. Additionally, an 8.67 acre CAD Cell will be constructed in the area north of Pope's Island for disposal of contaminated sediment. Finally, approximately 19.15 acres of

maintenance dredging within the Federal Navigation Project will be dredged from between -26 MLLW to -29 MLLW to -30 MLLW. The impacts anticipated from the South Terminal CDF represent a small portion of the existing larger resource areas nearby that provide similar functions and values.

Impacts to resources have been avoided and minimized to the maximum extent practicable. To mitigate for the unavoidable impacts, the following mitigation is proposed: Creation of 17.73 acres of Winter Flounder spawning habitat, creation/enhancement of 3.47 acres of inter-tidal area and enhancement of 10.91 acres of near-shore, shallow, sub-tidal areas located in the outer harbor, immediately southwest of the Hurricane Barrier, creation/enhancement of up to approximately 1.9 acres of a combination of successional marsh areas (mudflat, low marsh, high marsh, and transitional area), completion of a Tern Monitoring program to provide additional information on the utilization of New Bedford Harbor by terns, and a combination of transplanting and/or seeding of shellfish (however, no shellfish will be transplanted from Fish Closure Area 1 to areas outside of Fish Closure Area 1).

State Enhanced Remedy in New Bedford, South Terminal

The Commonwealth of Massachusetts submits the following materials in support of its request that the US Environmental Protection Agency (EPA) approve a CDF at the location known as the South Terminal as a component of the State Enhanced Remedy (SER) in New Bedford harbor[1]. (see **Figure 1**, Site Locus). The goal of the proposed action is to develop a multi-purpose marine terminal to provide critical infrastructure to serve offshore renewable energy facilities and accommodate international vessels at the new facility. Additional, secondary goals include beneficially re-using sand from navigational dredging for construction of the proposed multi-purpose marine terminal and, if approved by the EPA, facilitating the beneficial re-use of sand from the construction of future Confined Aquatic Disposal Cells within New Bedford Harbor.

Organization

The materials are organized to be consistent with EPA guidance, as follows:

1. Introduction
2. Project Purpose
3. Criteria for determining a suitable location for a the multi-purpose terminal
4. Discussion of the Scope of the South Terminal Project and a Discussion of why South Terminal is the least environmentally damaging practicable alternative that meets the Project Purpose
5. Information Characterizing the Existing Site Conditions is Presented

[1] The EPA may consider these materials as a scope of work within the meaning of the Memorandum of Understanding between EPA and DEP dated January, 2005.

6. Discussion of the Impacts Associated with the Proposed Project
7. Avoidance and minimization measures are discussed and a Conceptual Mitigation Plan is proposed for unavoidable impacts.

1. INTRODUCTION

The Commonwealth, through the Massachusetts Department of Environmental Protection (the Department), requested that the Environmental Protection Agency ("EPA") include an expansion of the State Enhanced Remedy ("SER") of the New Bedford Harbor to allow the construction of three confined disposal facilities (CDFs) in a forthcoming Explanation of Significant Differences ("ESD") that EPA is planning to issue for the New Bedford Harbor Superfund Site[2]. In response to the Department's initial request, EPA verbally notified the Department that EPA considers the proposed South Terminal CDF to be covered by the initial Record of Decision[3] and that it could be included in the SER without need for inclusion in the ESD. However, EPA has noted that the proposed project must still meet all substantive requirements and evaluations that would normally be conducted for this proposal as part of the regulatory review and permitting process.[4] The EPA has provided guidance regarding the information required to conduct this review. The overall purpose of this report, which was initially submitted in August of 2010[5], and has been revised multiple times via additional submissions to USEPA between August 2010 and March 2011 (with USEPA's most recent comments on the project submitted to the Commonwealth in June of 2011), is provided in a revised format which includes the most recent information regarding the project, to provide EPA with the information that it has requested to complete its review. The report shows that the South Terminal is the least environmentally damaging practicable alternative. The report also

[2] Letter dated January 20, 2010 to Mr. Curtis Spalding, Regional Administrator, EPA Region 1, from Mr. Gary Moran, Deputy Commissioner, MADEP.
[3] Record of Decision, EPA Region 1, September, 1998
[4] Letter dated February 11, 2010, from Mr. Curtis Spalding, Regional Administrator, EPA Region 1, to Mr. Gary Moran, Deputy Commissioner, MADEP.
[5] Report dated August 25, 2010, titled "State Enhanced Remedy in New Bedford, South Terminal", MADEP.

provides detail on the other anticipated uses of the terminal. Other sections of the report show that the impacts of the project have been identified, and have been mitigated.

2. PROJECT PURPOSE

2.1. Project Purpose

The purpose of the project is to develop a multi-purpose marine terminal, as a component of the approved State Enhanced Remedy for New Bedford Harbor, a primary purpose of which will be to provide critical infrastructure to serve offshore renewable energy facilities and accommodate international shipping at the new facility. *The Project is also capable of beneficially re-using sand from navigational dredging or the construction of confined aquatic disposal facilities to the extent approved by US EPA.*

The Project Purpose has been defined to meet the primary objective of creating port infrastructure with the capacity to support the development, operation and maintenance of offshore renewable energy facilities, place the project in the context of the state enhanced remedy, and acknowledge the on-going Superfund remediation of the Harbor as context for potential future benefits associated with the facility.

2.2. Multi-purpose Terminal Capable of Supporting Offshore Renewable Energy Projects

Plans for the development of major offshore wind energy generation are under development in most of the Atlantic coastal states. Projects are expected to be under development in Massachusetts and Rhode Island in the near term, and the states have identified areas in federal waters off their coasts for further evaluation for development in the mid-term, and both states (and many of the Atlantic coastal states) are working closely with the Minerals

Management Service to initiate the offshore leasing process. A key component of developing offshore wind energy generation is the shore-side infrastructure necessary to support construction, assembly and transshipment of foundation and turbine components. Without a well-positioned, marine-industrial terminal to receive store, stage, assemble, and maintain wind turbine components and their supporting infrastructure, the development of off-shore wind facilities cannot be accomplished. As described in detail below, such facilities have specific operational requirements associated primarily with the scale of the turbine and foundation components: factors such as proximity to the offshore facilities, horizontal and vertical clearances, laydown area, and access to deep water navigation constitute 'hard criteria' site requirements. This would also be the case for tidal or wave energy projects should those technologies become viable in the long term.

The City also proposes to use the terminal for other cargoes, which may include container, break bulk, and bulk cargo shipping. Additionally, the terminal would facilitate implementation of America's Marine Highway (Short-Sea Shipping) and would also serve as a location to temporarily store sand generated during CAD Cell construction, so as to facilitate reuse of the material.

The anticipated future uses (container shipping, break-bulk cargo shipping, bulk cargo shipping, short-seas shipping and CAD Cell sand storage) each require approximately the same type of facilities: deep water berthing, quae-side loading and unloading area, and upland storage and staging area. Major demands for berthing and upland storage and staging space will be temporary, and will fluctuate based upon the size of the shipments anticipated to arrive or leave. Break-bulk cargo, containers, trucks, or bulk cargo may require temporary storage prior to loading and transport of vessels; however, only a small portion of the site (1-2 acres) would be

required for any one method of transportation with any regularity; cargo would primarily require the temporary usage of berthing space, which can be sequenced efficiently with other uses at the facility. Reserving a portion of the site for both shipping and the storage of CAD Cell sand, while utilizing the site periodically to support offshore renewable energy projects will therefore not be difficult.

The intent is to use the terminal for the purpose of offshore renewable energy development until late 2012 or early 2013 (the anticipated completion date of the first offshore renewable energy construction project) and, subsequent to that date, utilizing the facility for, other cargoes (until such time as another alternative energy support project requires the use of the site, at which point, use of the site would be shared between alternative energy support and other cargoes, including international shipping). Thus, the terminal would be constructed to the specifications required for wind energy development but would be designed so as to accommodate a range of future uses described above.

Additionally, the proposed terminal represents an opportunity to beneficially reuse and/or manage material dredged from the harbor as part of the State Enhanced Remedy and ongoing EPA Superfund harbor cleanup activities as described below.

Although the terminal is intended to serve as an international port, a significant objective is to provide support for offshore renewable energy development. Hence, when considering whether alternative locations are practicable, we primarily assessed the ability of each location to serve this significant objective.

2.3. Harbor Remediation

Polychlorinated Biphenyl (PCB) contaminated oils and byproducts have historically made their way into the Harbor through sewer lines and other outfalls, contaminating the sediments on the bottom of the Harbor. By the 1970s, sediment sampling and testing conducted by environmental officials revealed that significant concentrations of metals and PCBs existed in the Harbor bottom sediments. In September 1998, the United States Environmental Protection Agency (EPA) issued a Record of Decision (ROD) that set forth the selected remedial action for the Upper and Lower Harbors of the New Bedford Harbor Superfund Site in New Bedford, Massachusetts, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, 42 U.S.C. Sections 9601 et. seq. and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as amended, 40 C.F.R. Part 300.

The cleanup standards varied depending upon the location of the contamination: 50 parts per million (ppm or mg/kg) was designated for deeper water areas, where direct contact was not likely; 10 ppm was designated for mudflat and shallow water areas accessible at low tide; 25 ppm was designated for beach combing shoreline areas; and 1 ppm was designated for residential shoreline areas. This designation effectively split the Harbor into two categories: those areas with sediments exceeding the cleanup standards where contaminated sediments would be removed by the EPA; and those sediments with PCB concentrations below the cleanup standards that would be left in place.

The use of Confined Aquatic Disposal (CAD) has been considered and approved by EPA as an alternative to the current remediation strategy to remove PCB contaminated sediment (processing and upland disposal). CAD construction requires appropriate materials management of the PCB contaminated top layer of silt (Top of CAD), the layer of uncontaminated sand and

gravel removed to create the CAD (clean excavate) and the clean sand to cap the completed CAD and restore the benthic habitat. In order to implement the use of CAD cells, EPA has promulgated an Explanation of Significant Differences (ESD) for the ROD; the proposed terminal could reuse clean sand generated during EPA CAD Cell construction.

2.4. Navigational Dredged Material Management

EPA approved a State Enhancement to the Remedy pursuant to the ROD under which navigational channels can be maintained and improved in order to allow the Harbor to continue to serve its industrial, commercial and recreational functions. Three phases of dredging have already been completed. At the conclusion of Phase 1 (which was not done under the SER process) approximately 75,000 yards of contaminated sediment was dredged from the area to the south of the State Pier and the fairways leading there-to. The material was dewatered and stabilized with a lime and cement mixture, and was placed on the CSX Rail Site next to New Bedford Harbor.

Prior to the start of the Phase II Dredge Project, the use of Confined Aquatic Disposal (CAD) cells was determined to be the preferred dredged materials management option under the State Enhanced Remedy. The Phase II Dredge Project included the design and construction of a transitional Confined Aquatic Disposal (CAD) Cell located within the Borrow Pit as well as the design and construction of CAD Cell #1, located adjacent to the Borrow Pit. The NBHDC completed Phase II harbor maintenance dredging in January 2006, removing more than 156,000 cubic yards (cy) of material from sites in New Bedford and Fairhaven.

Phase III Dredge Project began in September 2006 and included a new CAD Cell to accommodate the dredged material – CAD Cell #2. The New Bedford Harbor Phase III Dredge

Project was completed in four parts: the removal of the top of CAD Cell #2 (with the placement of the material within CAD Cell #1), the dredging of clean sediment from within CAD Cell #2 (with disposal of some material at the Cape Cod Bay Disposal Site and some material used as a pilot cap for the Borrow Pit CAD Cell), the dredging of areas north of the Coggeshall Street Bridge (Phase III Navigational Dredge – Part B), and the dredging of areas south of the Coggeshall Street Bridge (Phase III Navigational Dredge – Part A).

Phase IV is under-development, and its scope and timing is being evaluated contingent on funding and the availability of CAD capacity.

In total, it is anticipated that individual components of a comprehensive navigational dredging plan will be implemented over the next two decades and generate a total need for 1.8 million cy of disposal and/or management capacity, which will typically be generated in smaller increments of between 75,000 and 150,000 cubic yards. Effective beneficial reuse of clean sand from CAD Cells requires an appropriate staging location, as the demand for the material is time-dependent and typically does not sequence well with CAD Cell construction (for example, beach nourishment projects typically cannot be completed when beaches are in use; similarly, de-icing of roadways with sand could not take place during the summer). The South Terminal can reasonably be expected to stage up to 40,000 cubic yards of clean sand per acre of facility utilized; it is anticipated that between 1-3 acres of the site would be used to temporarily store up to 120,000 cubic yards of clean sand per CAD Cell being constructed. Time periods between CAD Cell construction cycles would be utilized to distribute the clean sand to beneficial re-use projects. New Bedford Harbor is a vital economic and recreational asset. The Port serves as the City's greatest natural resource and most critical asset to stimulate investment, attract new industry, create jobs and sustain and grow the local economy. Over 4,400 people are employed

by the commercial port. Effective reuse of clean sand from CAD Cell construction will facilitate the Navigational Dredging process, which is essential to the near and long term viability of the Harbor.

We recognize that the Harbor Remediation and Navigational Dredged Materials Management potential future uses are not dispositive factors in determining whether the proposed terminal represents the least environmentally damaging alternative, but also believe that the potential future environmental and economic benefits of the terminal to future navigation and Superfund dredging are significant and should continue to be acknowledged.

2.5. Linkages of South Terminal CDF to the State Enhancement

The area in front of existing South Terminal, and the area around the Gifford Street Boat Ramp and (what is known as) the Gifford Street Mooring Area, are part of planned State Enhanced Remedy (SER) dredging (see **Appendix 1** which includes figures from the New Bedford Harbor Plan [2009] indicating the areas in need of dredging and already contemplated under the SER process). As set forth in the Record of Decision in 1998 and in the phases of navigational dredging following the decision, navigational dredging is recognized as a state enhancement to the CERCLA remediation, because this dredging removes and safely disposes of PCB's that would otherwise stay in the harbor.

The dredging that will occur in this area, and the creation of the CDF, enhances the remedy in precisely the same fashion. The dredging that will be needed in order to make the South Terminal Extension serviceable wholly overlaps with the area that has already been planned to be dredged, and would be dredged with or without the South Terminal CDF, under the SER process (a map which shows proposed Phase IV dredge areas, and overlays the portion

of dredging proposed within the 2010 New Bedford/Fairhaven Harbor Plan in the vicinity of the proposed South Terminal CDF is also included within **Appendix 1**). SER dredging of a part of the channel in front of existing South Terminal, as well as the Gifford Street Boat Ramp channel, was recently completed (in October of 2009) under Phase III of the SER Navigational Dredge Project in New Bedford Harbor. Additional dredging was originally scheduled (for Phase III) both for the Gifford Street Boat Ramp Channel and the Gifford Street Mooring Basin; however, a shortfall in funding for the Phase III project forced the NBHDC and the Commonwealth of Massachusetts to reduce the Phase III dredge footprint in this area.

It has always been the intent of the NBHDC and MADEP to finish the planned SER dredging of the Gifford Street and South Terminal areas in a future phase of SER dredging (ideally all of it in Phase IV, if sufficient funding could be acquired). The footprint for the dredging that would need to be conducted to allow appropriate vessel berthing and access to the proposed South Terminal Extension overlaps with the South Terminal and Gifford Street Boat Ramp and Mooring Basin dredging that is already and otherwise contemplated for this area.

Based upon this information, then, the South Terminal CDF is linked to the SER in the following potential ways:

- **Navigational Dredging** – Facilitation of navigational dredging, and resulting removal of contaminated sediments from the bottom of the Harbor in locations where USEPA will not be completing remediation, is the prime reason for the creation of the State Enhanced Remedy. As noted above, the dredging for the South Terminal CDF overlies navigational dredging planned by the New Bedford Harbor Development Commission. The dredge footprint for the South Terminal CDF overlies two proposed dredge areas that

are included within Phase IV Navigational Dredging for the State Enhanced Remedy, and are also highlighted within the 2009 New Bedford/Fairhaven Harbor Plan:

- **South Terminal Dredging** – The northern portion of the South Terminal CDF dredging overlies the basin for the existing South Terminal bulkhead. The South Terminal basin extends the length of the existing South Terminal bulkhead, and extends approximately 300 feet to the west of the bulkhead. Navigational dredging for the South Terminal basin is required to maintain the -20 MLLW to -25 MLLW approved basin depth at this location. This area is scheduled to be dredged in Phase IV regardless of whether the South Terminal CDF is constructed. This area is highlighted within the New Bedford/Fairhaven Harbor Plan.
- **Gifford Street Boat Ramp and Mooring Area Dredging** – The southern, and some eastern, portions of the South Terminal CDF dredging overlies areas that are anticipated to be dredged during Phase IV Navigational Dredging to deepen the existing Gifford Street Mooring area. This area of the harbor has accumulated sediments over time and is currently too shallow to be utilized for mooring vessels. This area is highlighted within the New Bedford/Fairhaven Harbor Plan. Therefore, part of Phase IV Navigational Dredging was to conduct maintenance dredging within the Gifford Street Mooring area.

- **Disposal of Contaminated Navigational Dredging Material Within CAD Cells** – The primary methodology for disposal of contaminated material generated during navigational dredging is disposal of that material within CAD Cells located within the Dredge Materials Management Plan, a designated area north of Pope's Island within New

Bedford Harbor. Disposal of contaminated navigational dredging material removed from the dredge footprint associated with the extension of South Terminal (as part of the South Terminal CDF Project) within CAD Cells is anticipated, as disposing of these materials by other means is likely to be costly and problematic from an engineering standpoint.

- **Utilization of Clean (Parent) Material From Navigational Dredging –** Clean (parent) material will be generated during navigational dredging. This material exists, in places, below the contaminated sediments within the footprint of the navigational dredging that will be conducted as part of the Phase IV Navigational Dredge Project. This material will be placed within the South Terminal CDF, instead of placing it into a CAD Cell (which is not necessary as the material is not contaminated and would be taking space that could otherwise be utilized to sequester other contaminated material).

Navigational dredging will be coordinated with construction of a CAD Cell such that the time frame for both activities will align properly. Where possible, clean material from Navigational Dredging or from CAD Cell construction will be beneficially utilized within proposed mitigation measures (outlined later within this document) or to cap existing CAD Cells. We also confirm that the CDF will be constructed from clean sand from navigational dredging.

The Commonwealth submits that this project facilitates navigational dredging, which in turn enhances the CERCLA remediation in precisely the ways envisioned by the original ROD. Therefore, the EPA may properly approve this project as part of the State Enhanced Remedy.

3. CRITERIA FOR DETERMINING LOCATIONS WITHIN THE REGION FOR A FACILITY THAT MEETS THE PROJECT PURPOSE

3.1. Initial Screening

In order to evaluate the practicable locations for this terminal within Massachusetts, an independent consulting firm (Tetra-Tech EC, Inc.) was commissioned by the Massachusetts Clean Energy Center to perform a study, which was entitled "Port and Infrastructure Analysis for Off-Shore Wind Energy Development" (attached as **Appendix 2**). Ports reviewed by Tetra-Tech include Gloucester, Salem, Boston, Quincy, Fall River, and New Bedford. In addition, ports in Maine, New Hampshire, Rhode Island, Connecticut, New York, New Jersey and Pennsylvania were more generally characterized for the capacity to support some level of construction and/or operations and maintenance services for offshore wind energy facilities.

Based on specifications developed in consultation with port managers, the marine construction industry, and offshore wind energy developers, port facilities were screened for their consistency with the following 'hard criteria' – i.e., those basic requirements without which a facility could not support a renewable energy terminal. Specifications included:

- Sheltered harbor (protected from bad weather by means of a barrier);
- Unobstructed vertical (overhead) clearance;
- Minimum horizontal clearance greater than 40 m (approximately 150 feet);
- Minimum low tide navigational channel depth of 7.3 m (24 feet);
- 24/ hour/day and 7 days/week operational availability;
- Exclusive use of the staging facility;
- Minimum berth length of 138 m (approximately 450 feet);
- Minimum berth water depth of 7.3 m (24 feet);

- Lay down storage and assembly backland area larger than 4 hectares (10 acres); and
- Proximity to likely offshore wind farm site.

Based upon the screening contained within the report, the following locations were selected for in more depth analysis of their practicability within this document:

- Port of Davisville, Quonset, Rhode Island;
- Fall River State Pier, Fall River, Massachusetts;
- Dry Dock #4, Boston, Massachusetts;
- North Terminal, New Bedford, Massachusetts;
- Pope's Island, New Bedford, Massachusetts;
- New Bedford State Pier, New Bedford, Massachusetts
- South Terminal, New Bedford, Massachusetts.

3.2. Refinement of the Screening Criteria

The criteria used within the Tetra Tech study have been further refined, and in some cases significantly modified, based upon numerous discussions with off-shore wind-energy manufacturers. On Thursday, April 8, 2010, representatives from the Power Systems Division, Wind Power Division, and Power Generation Division of Siemens met with New Bedford personnel to discuss the requirements of an offshore renewable energy support facility, based upon their experiences installing wind turbines in Europe (see summary memo attached as **Appendix 3**). Since the April 8 meeting, there have been additional discussions with Siemens about its specific needs. In a letter dated August 25, 2010, Siemens has further clarified its requirements. The following information can be gleaned from the April 8 meeting, further discussion with Siemens, and the August 25, 2010 letter, which is attached as **Appendix 4**:

- There are a few types of vessels that would be used to transport wind turbine components from the manufacturer to the support facility. However, the approximate range in sizes of an international vessel is between 140 - 150 meters (460 – 490 feet) in length, 30 - 35 meters (98 - 115 feet) in width and requires 7 – 9 meters (23 – 29.5 feet) of draft.
- The international vessel can only carry components for 6 turbines at one time. Therefore, for constructing an offshore wind energy facility for 130 turbines, 22 separate shipments from international vessels would need to be received at the support facility. The international vessel will require 3-4 days of docking for unloading each trip.
- Offshore renewable energy facility installation ships would consist of jack-up barges that would be approximately 91 meters (300 feet) in width and 30 meters (100 feet) in width.
- In order to keep the installation vessels (which, as stated earlier, are associated with offshore renewable energy facility) stable during dockside loading, the barges would deploy their spuds to "jack-up" the vessel for stability. This is to prevent the vessel from tipping over from uneven loading. Due to the loads anticipated to be borne by the spuds, it is necessary to ensure that the harbor floor at the quae-side is of a stable material. An unstable harbor bottom could cause the spuds to sink unevenly, which could tip the vessel and sink it. Harbor bottoms consisting of a thick layer of silt or clay could also cause the spuds to sink too deeply as it is loaded, and prevent the spuds from being withdrawn, which will trap the vessel at the facility. An example of a location where jack-up barges would likely be unstable, as well as additional explanations of the potential for this type of instability, is discussed in more detail in Section 3.3.2.
- In order to efficiently run construction of the offshore renewable energy facility, multiple installation vessels must be utilized. At a minimum, one installation vessel will be at the

construction site, one installation vessel will be loading at quay-side, and one installation vessel will be returning from the construction site. During much of construction, at least two installation vessels will be at quay-side either being loaded or arriving from the construction site and awaiting loading. Therefore, it is required that berthing space for the international vessel and two installation vessels be available.

- The anticipated loading requirements for the entire facility will be 20 tonnes/square meter (4,000 pounds/square foot), due to the use of 600 ton crawler cranes (an example of which is a Lieberr 750 Crane) anticipated to be utilized throughout the facility to transport, stack, load, and unload renewable energy facility components.
- Due to the anticipated loading requirements, an asphalt or concrete surface would not work. The heavy cranes would demolish such a surface in very short order. Therefore, the preferred surface is crushed stone.
- If possible, it is preferred to have a facility closer to 35-40 acres in size (the specific request was for 150,000 square meters for an ideal facility); however, 28 acres is the minimum amount of space required for the staging, preconstruction, and storage of renewable energy components for the construction of a 130 wind turbine offshore renewable energy facility. This is illustrated by a diagram prepared by Siemens, which shows how Siemens would use a 28.25 acre space situated at a proposed South Terminal CDF in New Bedford, Massachusetts.
- The heavy cranes must be able to reach within a meter of the target loading area on the installation vessels.

- Interest was expressed for an area (outside of the 28 acre facility) for parking for up to 200 people. A 28 acre facility would not be large enough to accommodate parking as well as storage, assembly, etc.
- A high priority is to find a location within which vessels can dock and exit the harbor without waiting for other vessels.
- Vertical restrictions for the installation vessels are also problematic in the long run. As the industry moves toward full assembly on shore, and the use of ever larger turbines, there will be a need for 250 feet or more of vertical clearance.

Note that the additional information gathered during the various meetings with Siemens has been utilized to further refine, and in some cases significantly modify, the criteria utilized to determine the practicability of potential locations for an offshore renewable energy support facility. For example, the Tetra-Tech study assumed that the minimum offshore renewable energy support facility size should be 10 acres; as is shown above, the meeting with Siemens personnel has shown that 28 acres is the minimum required size (and a much larger facility is preferred).

We submit that the most credible and probative information comes from Siemens, as it is an actual firm that constructs offshore wind facilities and has specifically examined how one offshore wind project could be constructed within specific timelines. The timelines include ensuring that the nation's first offshore wind facility is in operation by January 1, 2014. That date is critical for the facility to receive either the investment tax credit or the production tax credit offered by the federal government. Both of these tax incentives only apply to facilities that are operational by that date. We understand that the construction time period for this facility

(transmission cable and the turbines) is 2 years, and this terminal would not be ready until late summer or early fall of next year, so that all of the turbines will need to be installed within approximately a one year period to meet the January 1, 2014 deadline. The Commonwealth places a high priority on having a terminal in place to allow this facility to meet this deadline, as a large portion of the benefits of the tax incentives flow back to the commonwealth's ratepayers and ameliorate the cost of the electricity generated by the project.

Based on both the Tetra-Tech study and the updated and modified information from Siemens, we set forth below a number of minimum criteria that are necessary for any off-shore wind energy support terminal. Many of these criteria are ubiquitous between locations; for the purposes of determining practicability, only the most crucial and differentiating criteria are listed below:

Horizontal Clearance: In order for the facility to be practicable, nothing can restrict the horizontal (lateral) clearance for vessels moving to and from the facility to less than 130 feet. We based this horizontal clearance criteria on the range of anticipated widths of international vessels (98-115 feet) plus anticipated space requirements on either side of the vessel ranging from 10-15 feet. This width is necessary to accommodate potential drift of vessels from wind and currents as they move past the horizontal restriction.

Jack-Up Barge Access: As stated earlier, berthing space at the facility needs to accommodate both one international vessel and two installation vessels, which consist of jack-up barges. As stated earlier, discussions with offshore wind energy personnel indicated that the jack-up barges used for wind turbine construction are approximately 300 feet long and 100 feet wide. The

vessels float like a normal barge, and have three to four spuds that are raised while the vessel is in motion. Recent offshore wind energy construction in Germany has shown that the installation vessels have spuds up to 78.85 meters in length (259 feet), which are lowered to the ocean bottom when the vessel is loaded or is in operation during construction, at which time, hydraulic winches raise the barge itself out of the water onto the spuds (see **Appendix 5**). In order for the jack-up barges to be able to access the facility, therefore, the ocean bottom in front of the bulkhead must be of a uniform, hard consistency. An example of a location where jack-up barges would likely be unstable, as well as additional explanations of the potential for this type of instability is discussed in more detail in Section 3.3.2.

Overhead Clearance: In the long run, in order for the facility to be practicable for full assembly on land and the use of larger turbines, no overhead restrictions lower than 250 feet can be present either at the facility, or in the approach to the facility by water. This includes bridges, electric lines or other utilities, or restrictions due to other potential uses surrounding the facility (such as airspace restrictions). The restrictions apply both to the cranes (which, as stated earlier, have booms that reach up to 475 feet) as well as the spuds of the installation vessels (which, as stated earlier, are as long as 259 feet).

Total Wharf and Yard Upland Area: The minimum total wharf and yard upland area for the facility to be practicable is 28 acres. The 28 acres is needed within one contiguous parcel, or multiple adjacent parcels (that are also adjacent to the harbor). Due to the size of the wind energy components (particularly wind blades which are 180 feet in length), it is infeasible to transport those pieces to other remote supporting locations via rail or road due to the limitations

on turning radius of the vehicles (truck or rail) that would be utilized to transport the wind blades for most conventional roads or railways. To fulfill these tasks it is important that landside facilities have adequate acreage, warehouse space, onsite equipment, and high load bearing capacity, all adjacent to the water.

Berthing Space: The marine terminal will receive, store, assemble and ship off-shore wind energy components. The terminal will receive components via international vessel, the size of which is approximately 480 feet in length, 100 feet in width. The components will be constructed via jack-up barge. Jack-up barges will typically be approximately 300 feet in length and 100 feet wide, and will transport pre-assembled wind turbine components to the wind farm construction site. At a minimum, the off-shore wind energy facility must be capable of berthing the international vessel and at least two jack-up barges (installation vessels). The two jack-up barges could not be placed side by side, with one seaward of the other, because the heavy cranes could not load the turbines over the landward barge. Two jack up barges are necessary as there will be multiple international vessel berths taking place over the course of construction of an off-shore wind farm construction project. While the international vessels are being unloaded, the construction must move forward. To ensure that construction proceeds smoothly, berthing must be available for two jack-up barge vessels (one being loaded, and one awaiting loading). Therefore, for a facility to be considered for off-shore wind energy support, it must have at least 1,200 linear feet of bulkhead space (480 feet for the international vessel and 600 feet for 2 jack-up barges, and approximately 60 linear feet between them).

Site Control/Site Availability: In order for the facility to be practicable, it must be free (or easily obtainable) to be utilized for an off-shore wind energy support facility within the timeframes mentioned above (i.e., not later than late summer 2012). Thus, we examined whether potential locations are: 1). owned by a party that is currently utilizing the area and does not wish to sell or relocate, 2). currently leased by another party and breaking that lease is impracticable, or 3). already servicing a number of different essential services that would be difficult or impossible to replace elsewhere. Additionally, in order for the facility to be practicable, other simultaneous uses at the location (if any) must be compatible with off-shore wind support equipment. For example, due to the type of equipment necessary to transport and load/off-load wind turbine parts (600 ton crawler cranes), off-shore wind facility support requires a surface (crushed stone) that is non-compatible with other marine industrial activities (container shipping, roll-on/roll-off shipping, or parking of vehicles require relatively level asphalt or concrete surfaces).

Proximity: In order for the facility to be practicable, it must be within a reasonable distance to the proposed locations for future off-shore wind facilities. Some of the reasons for this can be quantified in raw economic terms, while others add elements of risk, which are more difficult to fix definite costs to. Some factors that must be considered are: the cost of transport, the direct and potential environmental impacts, potential cost-increasing construction delays, and loss due to weather conditions. These factors are accounted for by project developers, who (upon being interviewed) have expressed the importance of locating the shore side support facility close to the proposed development site, and note that this is an important consideration when determining the viability of a particular offshore renewable energy project. Separate conversations with Cape

Wind and Deepwater Wind (two separate companies involved in offshore renewable energy development) have indicated that some locations are simply too far away to be a practicable location for an off-shore renewable energy support facility. An example of a location where proximity would become a driving factor as to the feasibility of a particular location, as well as additional explanations of the potential for this type of instability, is discussed in more detail in Section 3.3.2.

Ability to beneficially re-use sand: In addition to the above factors, which focus on the requirements for the terminal to support off-shore wind, an additional project purpose is to beneficially re-use sand from navigational dredging and potentially from superfund remediation, as well as to temporarily store clean sand from future CAD Cells in order to facilitate its future beneficial re-use. While this screening factor was not a dispositive one, it was considered in the evaluation, and this factor weighed against the three alternative sites outside of New Bedford.

3.3. Locations Outside of the New Bedford Superfund Site

The following locations are outside of the New Bedford Superfund Site, and therefore cannot store or dispose of sand generated from CAD Cell construction; in addition, the sites are impracticable for the primary use, as detailed below:

3.3.1. PORT OF DAVISVILLE, QUONSET BUSINESS PARK, QUONSET, RI

From the outset, the Commonwealth realizes that Cape Wind has secured a federal permit to utilize the Port of Davisville as a staging area for construction. However, notwithstanding the

permit that has been issued, the Commonwealth has reviewed the logistical and operational issues involved in utilizing the currently permitted facility to meet the needs of the Commonwealth associated with satisfying its Project Purpose. As a result of its review, the Commonwealth notes the following operational and logistical challenges this site presents to satisfy the Project Purpose of the Commonwealth.

Site Control/Site Availability: Site availability is the primary issue with utilizing the Port of Davisville for an off-shore wind energy support facility. As a general matter, the Commonwealth, in conjunction with the City of New Bedford, is seeking to own or operate a marine terminal to serve a primary purpose of support for the offshore renewable energy.

More specifically, in order for the facility in question to meet the Project Purpose of the Commonwealth, either total site control must be granted, or existing uses must be compatible with off-shore wind energy support. The entire Quonset Business Park is reportedly 3,160 acres; however, the vast majority of the area of the Park is located far inland from port facilities. Port facilities at which an off-shore wind energy support facility could be constructed are located at the Port of Davisville, a much smaller part of the overall facility.

The Port of Davisville is already committed to utilizing its facilities to support water-dependent industries that are incompatible with off-shore wind energy support. According to a March 16, 2009 article within the Providence Business News, Quonset's Port of Davisville ranks as the fifth busiest auto importer in North America. J. Michael Saul, Economic Development Corporation (EDC) Interim Executive Director and Chairman of the Quonset Development Corporation Board is quoted within the article as stating that he anticipates "further increases" in the

"growing auto import business" at the Port. Aerial photos as well as photographs of the Port facility (see **Appendix 6**) show that the two main piers (Pier 1 and Pier 2) and a large section of upland area are fully utilized for the automobile import operation. The Piers (and the majority of the rest of the Port of Davisville), are filled with automobiles that are periodically staged during unloading and loading for international transportation.

An off-shore wind energy support facility will require the use of enormous 600 ton crawler cranes that would destroy asphalt or concrete surfaces as they load, unload, and transport extremely heavy wind energy components around the facility. Pier 1 in particular (the southern pier) is a pile supported, concrete slab structure that would be incapable of supporting the anticipated loading due to offshore renewable energy support activities. The ideal surface for offshore renewable energy support is crushed stone (that can be easily filled as differential settlement occurs from the extreme loads from the cranes and components). An uneven crushed stone surface is not compatible with loading, unloading, or staging new automobiles for international import. It is extremely unlikely that the Port of Davisville would cancel its commitment to auto importers.

The area immediately to the south of Pier 1 has approximately 1,000 linear feet of bulkhead and approximately 27.5 acres of area. This area is hereinafter referred to as the "Magnolia Street Area". However, the Magnolia Street Area has as little as zero feet of water depth for most of its length, and does not have appropriate load bearing capacity. Thus, it could only be used as a staging area in conjunction with Pier 2, which is not available for the reasons set forth above. In any event, the commonwealth inquired into the current use and ownership of that area, and has

confirmed that 14.5 of the 27.5 acres is under agreement and the holder of the option on that space is not interested in granting a long term lease to the Commonwealth. A map noting the location of the Magnolia Street Area and the portion of the Magnolia Street Area under agreement is attached as **Appendix 6**.

In addition to Pier 1 and Pier 2, and Magnolia Street Area, there is unimproved land between the Quonset Point Airport and the area immediately to the south of Pier 1; this area is referred to as the "Broadway Street Area", and is also shown on the aerial photos within **Appendix 6**. The Broadway Street Area is approximately 45 acres in size, and is adjacent to the shoreline; however, the area has as little as zero feet of water depth for its entire length, and does not have appropriate load bearing capacity. Thus, it could only be used as a staging area in conjunction with Pier 2, which is not available for the reasons set forth above. The development of the Broadway Street Area would also have disproportionate environmental impacts as outlined below:

Disproportionate Environmental Impacts Compared to Other Alternatives: The creation of a terminal at the Broadway Street area was deemed to have significantly higher environmental impacts than other alternatives. The most practicable and likely the least environmentally damaging method for improving the Broadway Street area would be to extend the existing bulkhead to the south for approximately 1,200 linear feet. The northern 800 linear feet of shoreline at the Broadway Street Area are dominated by an approximately 6 acre salt marsh, which would be destroyed should the terminal be built in this location, the location of which can be seen on the attached aerial photos.

An extension of the bulkhead, to create 1,200 linear feet of berthing space, would fill approximately 15.7 acres of intertidal and shallow sub-tidal area, which is approximately three times the area that is proposed to be filled associated with an extension of South Terminal.

In order to create a boat basin to service the new facility, approximately 9 acres of shallow sub-tidal area would need to be dredged from between -1 and -6 MLLW to between -20 and -30 MLLW.

A turning basin would need to be dredged to allow deeper vessels to maneuver into the facility. This turning basin would need to be approximately 1.5 times the size of the typical international vessel (460 to 490 linear feet long, as stated within the August 25, 2010 submission to USEPA) that would service the facility. The estimated size of this turning basin is approximately 9.75 acres, which would dredge shallow sub-tidal areas to a depth of approximately -30 MLLW.

A channel would need to be dredged that would reach the existing channel that services Pier 1 and Pier 2. The estimated distance between the existing channel and the proposed terminal is approximately 4,000 linear feet. Subtracting the size of the boat basin (300 linear feet) and the approximately size of the turning basin (approximately 700 feet) results in approximately 3,000 linear feet of channel that would need to be dredged to -30 MLLW. It is currently anticipated that approximately 14 acres would need to be dredged to create such a channel. Should the facility be shifted to the south to avoid impacts to the salt marsh, the length of the channel would need to be extended, and the area impacted by dredging would increase.

In order to create the boat basin, turning basin, and channel, approximately 32.75 acres of dredging would need to take place, virtually all of which would involve dredging of shallow, near-shore, sub-tidal areas to a depth of -30 MLLW. Although the total acreage of dredging is roughly equal to the total acreage of dredging necessary for the South Terminal CDF boat basin and channel construction, virtually all of the dredging would involve deepening of near-shore, shallow, sub-tidal areas, which is approximately three times the area of near-shore, shallow, sub-tidal areas that would need to be dredged for the proposed South Terminal extension.

Overhead Clearance: The center-line of the Quonset Point airport's main runway is located approximately 3,200 linear feet (less than one mile) from the southern boundary of the Magnolia Street Area. As stated earlier, in order for the facility to be practicable for full assembly on land and the use of larger turbines, no overhead restrictions lower than 250 feet can be present either at the facility, or in the approach to the facility by water. As outlined within the Dry Dock #4 "Overhead Clearance" section within the August 25, 2010 submittal to USEPA, it was clear that the use of Dry Dock #4 (located less than one mile from Logan International Airport) for offshore renewable energy support would represent a Determination of Hazard or a Determination of Presumed Hazard to air traffic, based upon the FAA's previous history of determinations within Massachusetts. It is currently unclear if the use of Pier 1, Pier 2, or the Magnolia Street Area would pose a severe restriction to air traffic as all three areas have been considered to be utilized by offshore renewable energy interests; however, it is extremely likely that use of areas within the Broadway Street Area (which would bring the cranes within 2,000 linear feet of the main runway at Quonset Point) would represent a Determination of Hazard or a Determination of Presumed Hazard to air traffic, and clearly would if the site were adjusted to

the south to avoid impact to the salt marsh (which would bring the cranes within 1,200 linear feet or closer of the main runway at Quonset Point).

Ability to beneficially re-use sand: Utilization of the Port of Davisville as a staging point for reuse of CAD Material is infeasible as the location would be beyond the control of the Commonwealth of Massachusetts, would require multiple handling, and would require transportation a great distance from the generation point (CAD Cells within New Bedford Harbor).

3.3.2. DRY DOCK #4, BOSTON, MASSACHUSETTS

Dry Dock #4 (which is located in the Marine Industrial Park in South Boston) has been determined to be an impracticable location for an off-shore wind energy facility for a number of reasons, enumerated below:

Total Wharf and Yard Upland Area: The immediate backland at Dry Dock #4 is approximately 13 to 14 acres, which does not meet the landside criterion. The parcel is bound to the south by Northern Avenue, which is a very active roadway and would severely hinder transportation of renewable energy components to an adjacent upland location. Northern Avenue is not constructed to accommodate the turning radius required for transportation of large wind blades to more remote locations. Immediately across the street is the Mass Bay Brewing Company. There is no direct land connection to the north or to the west of the property. To the east of the property is the Harpoon Brewery. In order to develop this area into an off-shore wind energy facility, specific owners would have to agree to sell their facilities, such that several

adjacent areas could be utilized to create the new facility. In particular, the Harpoon Brewery facility would need to sell its land to be able to add land to the facility to generate 28 acres. The Harpoon Brewery has operated out of this location for many years, and is a well known landmark in South Boston. It is logistically infeasible to believe that this property could be purchased (and the operators evicted or relocated) in a relatively short period of time such that an off-shore wind energy support facility could be constructed here. The process of freeing the land would take many years.

Jack-Up Barge Access: Due to the geologic nature of the sediments within, and underlying, Boston Harbor, it is infeasible to utilize jack-up barges in the manner that is necessary to support off-shore wind facility construction. The material underlying Boston Harbor consists of fine-grained organic material, underlain by Boston Blue Clay. The presence of Boston Blue Clay below Boston Harbor as well a large portion of the City of Boston and adjacent towns is well documented. As stated within *Remaking Boston: An Environmental History of the City and It's Surroundings,* edited by Anthony N. Penna and Conrad Edick Wright, "Boston Blue Clay…was deposited about fourteen thousand years ago. The clay settled out from a mixture of seawater and glacial meltwater and covers much of the landscape in the Boston region. Up to seventy-five feet thick in the Boston area, it has filled in many low-lying areas. The clay extends inland to an elevation of sixty-five feet, and it can be found as far west as Watertown, which indicates the extent of (historic) inundation at its greatest point. In Boston there is clay throughout the city, in the harbor, and at least nine miles offshore." As stated earlier, unstable harbor bottoms would allow the spuds of the jack-up barges to sink within the substrate. Potential side-effects of the spuds sinking include listing of vessels that are unevenly loaded as well as the potential that the

spuds could not be extracted. It is unreasonable to expect that any other methodology could be utilized to secure the jack-up barges when the loads are placed upon the barges (anticipated be hundreds of tons of material). The stability necessary for the jack-up barges requires the use of the spuds during loading.

The following reference provides additional information regarding the potential issues associated with utilizing jack-up barges on unstable substrates: Design Guides for Offshore Structures, Stability and Operation of Jack Ups, P. La Tirant and Ch. Perol, Editions Technip, Paris, France, 1993. This book focuses on offshore jack-up barge design and planning for oil drilling purposes. Oil drilling jack-up barges are significantly larger, have larger, truss-type support spuds, and are typically lighter for their size than the jack-up barges anticipated to be utilized to support the offshore renewable energy industry. The jack-up barges anticipated to be utilized for installation of offshore renewable energy facilities will be smaller, very heavily loaded, and have smaller spuds (i.e. more concentrated point loads) than those described within this reference; however, the design assumptions for oil-drilling jack-up barges are similar to those anticipated to be utilized at the proposed facility. The reference states that, although the penetration of the spuds "never exceeds a few meters in stiff soils, so that the uncertainty in the actual penetration has no effect on the choice of the jackup (leg length)", in softer soils (such as Boston Blue Clay) "penetration can be as high as 20, 30, or 40 meters in soft soils, sometimes with a high uncertainty to be taken into account in choosing the leg length of the jackup". This difference in uncertainty can result in significant settlement of jack-up barges, including uneven settlement that can result in failure of the barge. According to the reference, "The causes of accidents of

jackups in afloat, in preload, and in operation are many. Noble Denton classes (Sharples et al., 1990) jackup accidents into ten categories (listed in order of magnitude):

- Soils and foundations;
- Tow (including dry transportation);
- Blow-out and fire;
- Collision;
- Structural design;
- Action of storms or hurricanes;
- Fatigue of structural components;
- Jacking on installation or demobilization;
- Accidents due to war;
- Other (miscellaneous or unidentified).

The first three categories listed (foundations, towing, and blow-outs) by themselves account for two-thirds of the accidents observed." Other potential accident causes notwithstanding, clearly the substrate located below the spuds is crucial for proper functioning of the jack-up barges. The reference goes further, in stating that jack-up barge accidents resulting from uncertain substrates result "most often from rapid punch-through of one (or more) spud during pre-loading" and "from various causes of foundation soil failure during operation". Finally, the reference states that "the consequences of accidents or incidents due to the foundations range from minor (or no) damage to one leg to the total loss of the jackup." Therefore, the presence of Boston Blue Clay (a relatively soft and potentially unsteady surface) below the jack-up barges has the potential for

minor to extremely damaging accidents. Thus, the presence of the Boston Blue Clay results in the inability to utilize jack-up barges in Boston Harbor, making it infeasible to site the facility at Dry Dock #4 in Boston Harbor.

Overhead Clearance: The entire Port of Boston is affected by air traffic at Logan Airport. While maritime operations are not restricted, according to the Coast Pilot, all vessels with air draft greater than approximately 25.9 m (85 feet) must advise air traffic control of their presence (U.S. Department of Commerce, National Oceanic and Atmospheric Administration and National Ocean Service 2009).

A long-term Federal Aviation Administration approval and/or permit would be required in order to operate the facility at Dry Dock #4. A review of previous FAA decisions associated with Wind Power projects located within 10 miles of Massachusetts Airports, conducted in January of 2007 is attached as **Appendix 7**. Wind turbines ultimately constructed at the Deer Island Wastewater Treatment Plant (located approximately 2 miles from Logan and approximately 2,000 to 4,000 feet to the northeast and/or east of two regularly used take-off and landing routes) were originally designed to be 394 feet high. A Determination of Presumed Hazard by the FAA required redesign of the turbines to a height of 190 feet. Wind turbines originally designed to be installed in Lynn (located approximately 5.7 miles from Logan) were originally designed to be 397 feet high. A Determination of Presumed Hazard by the FAA required redesign of the turbines to a height of 254 feet.

Dry Dock #4 is located less than 1 mile from Logan Airport and is located only 2,000 to 3,000 thousand feet to the northwest of one of the main landing strips for the airport. Installation vessels would be unable to exit and enter Boston Harbor except by directly crossing the airspace associated with that same landing strip. As stated earlier, in order for the facility to be practicable for full assembly on land and the use of larger turbines, no overhead restrictions lower than 250 feet can be present either at the facility, or in the approach to the facility by water. It is clear that the use of Dry Dock #4 for offshore renewable energy support would represent a Determination of Hazard or a Determination of Presumed Hazard to air traffic, based upon the FAA's previous history of determinations, as outlined above.

Proximity: The Port of Boston is located a significant distance from the anticipated construction locations for Off-Shore Wind facilities, which will make it logistically infeasible to site an off-shore wind support facility. Boston is located 130 nautical miles from Nantucket Sound (a potential location for the Cape Wind Off-Shore Wind development) as opposed to 75 miles for Fall River, 70 miles for Quonset and 45 miles for New Bedford. Boston is located 295 miles from the proposed Deepwater Wind construction location off of the coast of Rhode Island, as opposed to 45 miles for Fall River, 50 miles for New Bedford, and 35 miles for Quonset. An analysis of the feasibility of utilizing Dry Dock #4 can be found within **Appendix 8**. The conclusions of this analysis were that it is infeasible that Dry Dock #4 can be utilized as an off-shore wind energy support facility due to its proximity to the anticipated future locations of off-shore wind developments.

Ability to beneficially re-use sand: Utilization of Dry Dock #4 as a staging point for reuse of CAD Material is infeasible as the location would require multiple handling, and would require transportation a great distance from the generation point (CAD Cells within New Bedford Harbor).

3.3.3. FALL RIVER STATE PIER, FALL RIVER, MASSACHUSETTS

Fall River State Pier has been determined to be an impracticable location for an off-shore wind energy facility for a number of reasons, enumerated below:

Total Wharf and Yard Upland Area: The total wharf and yard upland area at Fall River State Pier is approximately 9 acres, which does not meet the landside criterion for creation of an off-shore wind energy support facility. The Braga Bridge (135 foot clearance) is located directly above approximately 20% of Fall River State Pier, making a large portion of the area of the pier inaccessible to the large cranes required for operation of an offshore renewable energy support facility. Water Street is located directly to the east and southeast of the facility, which is a very active roadway and would severely hinder transportation of renewable energy components to an adjacent upland location. Water Street is not constructed to accommodate the turning radius required for transportation of large wind blades to more remote locations. Immediately across the street is an active railyard. Additionally, the properties to the east, southeast, and south are currently owned and occupied by other port users (see Site Control/Site Availability section below).

Overhead Clearance: Vertical clearance is the most significant constraint for the Port of Fall River. The Braga Bridge, Mt. Hope Bridge, and Jamestown Verrazzano Bridges each impose a height restriction of approximately 41 m (135 feet). The Braga Bridge is located directly above approximately 20% of Fall River State Pier, making a large portion of the area of the pier inaccessible to the large cranes required for operation of an offshore renewable energy support facility.

Site Control/Site Availability: While the Fall River State Pier is currently owned by the Commonwealth of Massachusetts, the current operation accommodates multiple different users of the pier. These uses include: an off-loading location for break-bulk cargo and container ship cargo, a roll-on roll-off terminal, as a storage location for cargo, and as a berthing and terminal location for cruise ships. Relocation of these existing users is extremely infeasible as there is no other public location in Fall River for these services to be relocated to.

These existing users represent a significant public benefit to the City of Fall River and southern New England. The Massachusetts Waterways Regulations (Chapter 91) require that any displaced water-dependent use be relocated as cited below:

> 310 CMR 9.36(4): The project shall not displace any water-dependent use that has occurred on the site within five years prior to the date of license application, except upon a clear showing by the applicant that said use:
>
> (a) did not take place on a reasonably continuous basis, for a substantial period of time; or
> (b) has been or will be discontinued at the site by the user, for reasons unrelated to the proposed project or as a result of voluntary arrangements with the applicant.
>
> Absent the above showings, the project shall include arrangements determined to be reasonable by the Department for the water-dependent use to be continued at its existing facility, or at a facility at an alternative location having physical attributes, including

proximity to the water, and associated business conditions which equal or surpass those of the original facility and as may be identified in a municipal harbor plan, if any. Permanent relocation to an off-site facility may occur in order to accommodate a public service project for which relocation arrangements are governed by law, or if the Department determines that it is not appropriate for the water-dependent use to continue on the site. Otherwise, only temporary relocation may occur as necessary for project construction.

If an off-shore wind energy facility is sited at State Pier in Fall River, it would consume all available space at State Pier. A new public terminal would need to be constructed to harbor these users would need to be constructed if they were displaced to make way for an off-shore wind energy terminal.

Additionally, in order to increase the existing area at the facility, adjacent properties would need to be obtained. The properties in the area of Fall River State Pier are summarized in more detail below:

Fall River State Pier and Adjacent Properties

Parcel ID	Owner Name	Site/Use	Acreage
N-13-0020	COMMONWEALTH OF MASSACHUSETTS	FALL RIVER STATE PIER	7.18
N-13-0021	COMMONWEALTH OF MASSACHUSETTS	STEAMSHIP DOCK	2.02
N-16-0011	NASSER REAL ESTATE TRUST	WATERFRONT CAFÉ	0.744
N-15-0002	BORDEN & REMINGTON F R LLC	MILL COMPLEX (TEXTILE RUBBER AND CHEMICAL MANUFACTURING)	29.22
N-16-0030 and T-03-0019	NEW YORK CENTRAL LINES, LLC	RAIL YARD	2.013
N-13-0003	COMMONWEALTH OF MASSACHUSETTS	PARKLAND	2.06
N-16-001	AZAR JEANNE ETALI	RESTAURANT/BAR	0.396
N-16-0001	FALL RIVER INC MARINE MUSEUM	MARINE MUSEUM OF FALL RIVER	0.438

Additional supporting information is included within **Appendix 9**. In order to develop this area into an off-shore wind energy facility, specific owners would have to agree to sell their facilities, such that several adjacent areas could be utilized to create the new facility. In particular, the only property that is large enough to cede land to the new facility is the Borden & Remington Rubber and Chemical Manufacturing facility located to the south of Fall River State Pier (although at least one other property would have to sell its land in order for a connecting roadway to be constructed).

It is logistically infeasible to believe that these properties could be purchased (and the operators evicted or relocated) in a relatively short period of time such that an off-shore wind energy support facility could be constructed here. The process of freeing the land would take many years. Additionally, it may be impossible to find another location for the existing water-dependent uses.

Ability to beneficially re-use sand: Utilization of the State Pier in Fall River as a staging point for reuse of CAD Material is infeasible as the location would require multiple handling, and would require transportation a great distance from the generation point (CAD Cells within New Bedford Harbor).

3.4. LOCATIONS WITHIN THE NEW BEDFORD SUPERFUND SITE

The following locations are within the New Bedford Superfund Site, and therefore can store or dispose of sand generated from CAD Cell construction; however, the sites are impracticable for

the primary purpose of offshore renewable energy support due to other criteria, as detailed below:

3.4.1. UNION WHARF AND FAIRHAVEN SHIPYARD, FAIRHAVEN, MASSACHUSETTS

The New Bedford/Fairhaven Harbor Plan indicates the potential construction of two CDFs on the Fairhaven portion of the Harbor. The potential sites are at Union Wharf and Fairhaven Shipyard. However, both locations have been determined to be impracticable for an off-shore renewable energy support facility for a number of reasons, enumerated below:

Site Control/Site Availability:

While Union Wharf is currently owned by the Town of Fairhaven, the Town operates the Wharf in a manner that accommodates multiple different uses of the Wharf. These uses include: berthing for large commercial off-shore fishing vessels, near-shore lobster boats, commercial boat repair, and fish processing and packing. The Town of Fairhaven is currently proceeding with plans to refurbish and expand Union Wharf; however the expansion is to accommodate the existing users of the Wharf, not to support an off-shore renewable energy support facility. Below is the current list of property owners at Union Wharf and Fairhaven Shipyard:

Union Wharf Properties

Parcel ID	Owner Name	Address	Acreage
07-009	FAIRHAVEN TOWN OF C/O SEAFOOD SERVICES INC	UNION WHARF	1.518
07-008	ISAKSEN GAIL & MAX T	10 UNION WHARF	0.077

0-7009A	ISAKSEN GAIL	12 UNION WHARF	0.138
07-007	UNION WHARF REALTY, LLC	2 UNION WHARF	0.021
07-PRT9	FAIRHAVEN TOWN OF	2 UNION WHARF	0.214
07-011	CASEY BOAT REALTY, LLC	7 UNION WHARF	1.7409

Fairhaven Ship Yards (North) is currently occupies the Center Street Wharf areas. The parcels which form the Wharf are as follows:

CENTER STREET Wharf Properties

Parcel ID	Owner Name	Address	Acreage
09-059	OLD SOUTH WHARF REALTY LLC	WATER STREET	0.226
09-065	OLD SOUTH WHARF REALTY LLC	WATER STREET	0.217
09-066	OLD SOUTH WHARF REALTY LLC	WATER STREET	0.095
07-001	OLD SOUTH WHARF REALTY LLC	24 WATER STREET	4.900

These existing users of represent a significant public benefit to the Town of Fairhaven and southern New England. If an off-shore wind energy facility is sited at Union Wharf and Fairhaven Shipyards, it would consume all available space in the area. In accordance with The Massachusetts Waterways Regulations (Chapter 91), any displaced water-dependent use would need to be relocated as stipulated within 310 CMR 9.36(4). It is unlikely that these facilities would be able to be relocated within the Port of New Bedford/Fairhaven without the creation of a new marine terminal. A new public terminal would need to be constructed to harbor these users if they were displaced to make way for an off-shore wind energy terminal.

Total Wharf and Yard Upland Area: As outlined above, the existing total wharf and yard upland area at Union Wharf and Fairhaven Shipyard is approximately 9.14 acres. Although the parcels are contiguous, due to the lack of total wharf and yard upland area, a CDF would need to be constructed. The CDF would be constructed between the two existing docks at Union Wharf and Fairhaven Shipyard. The available area for filling between the two docks is 2.87 acres. Expansion of the facility to the east would be impracticable as the proposed facility would be bounded by Water Street on that side. After construction of the CDF, the total wharf and yard upland area would increase to approximately 12.01 acres, which does not meet the landside criteria for the creation of an off-shore renewable energy support facility (28 acres, as stated earlier).

Expansion of the facility to the west would impinge upon the Federal Navigation Project, which runs immediately to the west of both Union Wharf and Fairhaven Shipyard. It is impracticable to expand the CDF to the north or south, due to the presence of private, water-dependent industries located to the north (Harbor Blue Seafoods) and the south (WJA Properties). These industries currently support commercial fishing in New Bedford Harbor, which is currently under significant pressure due to a lack of berthing space. In accordance with The Massachusetts Waterways Regulations (Chapter 91), any displaced water-dependent use would need to be relocated as stipulated within 310 CMR 9.36(4). It is unlikely that these facilities would be able to be relocated within the Port of New Bedford/Fairhaven without the creation of a new marine terminal.

After construction of the CDF, the total wharf and yard upland area would increase to approximately 12.01 acres, which does not meet the landside criteria for the creation of an off-shore renewable energy support facility (28 acres, as stated earlier). Although Union Wharf and Fairhaven Shipyard are located within a water-dependent industrial area on Fairhaven Harbor, residential neighborhoods are located immediately to the east of the area. Additionally, local roads adjacent to the two sites are not configured to allow for the movement of large renewable energy components. Therefore, due to the lack of wharf space onsite, and the lack of suitable upland areas nearby the site (and the unsuitability of adjacent roadways to transport components to upland locations, if any), there location is infeasible due to a lack of sufficient total wharf and yard upland area.

Berthing Area: The proposed CDF would have a total berth length of approximately 780 feet, far less than the 1,200 linear feet required for an off-shore renewable energy support facility. Therefore, the location is infeasible due to a lack of sufficient berthing space.

Fairhaven Public Acceptance: From 2008 to 2010, Fairhaven has undertaken a public process in evaluating the best location for harbor operations while promulgating the New Bedford/Fairhaven Harbor Plan. During the harbor planning process, although Union Wharf and Fairhaven Shipyard were proposed as a potential Confined Disposal Facilities (in support of navigational dredging), no public support for a large marine terminal was garnered for either facility (unlike at South Terminal). CDFs in these areas were anticipated to supplement the land of existing owners or leasees. Therefore, Union Wharf and Fairhaven Shipyards are not accepted

locations for an off-shore renewable energy facility in the eyes of the public of the Town of Fairhaven.

3.4.2. NORTH TERMINAL AND POPE'S ISLAND, NEW BEDFORD, MASSACHUSETTS

North Terminal and Pope's Island could also be expanded by CDFs in order to support off-shore wind developments; however, both locations have been determined to be impracticable locations for an off-shore wind energy support facility for a number of reasons, enumerated below:

Horizontal Clearance: The horizontal clearance along the access pathway along the water to both the North Terminal and Pope's Island facilities is restricted by the Route 6 New Bedford-Fairhaven Bridge. The Route 6 New Bedford–Fairhaven Bridge is approximately 92 feet wide, far short of the minimum 130 feet that is required. Efforts have been made by the City of New Bedford and the Town of Fairhaven over the last decade to reconstruct this bridge in such a manner as to increase the horizontal clearance and allow for smoother operation of the bridge (the current construction causes significant delays for vessels traveling north of the bridge and traffic crossing the bridge); however, the efforts over the last decade have not yet borne fruit (the project is still in the conceptual phase and neither permitting, nor design is complete). As a result, it will likely be many years before this project is complete and the horizontal clearance issue can be overcome.

Site Control/Site Availability: Both North Terminal and Pope's Island are not currently under the control of an entity that can develop an off-shore wind energy support facility, because the

existing property is either owned by an outside source or is currently under a long term lease. All of the properties that could conceivably allow the creation of an off-shore wind energy support facility are currently in use by either a water-dependent or non-water dependent user.

Pope's Island: The following is a list of the current owners of properties located to the north of Route 6 in New Bedford:

Pope's Island Properties North of Route 6

Parcel ID	Owner Name	Address	Acreage
60 18	POPES ISLAND HARBOR DEV CORP	243 255 POPES ISLAND	1.485
60 12	POPES ISLAND HARBOR DEV CORP	173 235 POPES ISLAND	10.57
60 26	POPES HAVEN MARINA INC	161 POPES ISLAND	0.652
60 13	NERI REALTY CO LLC	137 143 POPES ISLAND	3.011
60 19	MITCHELL MARK S "TRUSTEE"	83 POPES ISLAND	1.559
60 22	PANAGAKOS MICHAEL	53 POPES ISLAND	0.775
60 20	POPES ISLAND REALTY ASSOCIATION	23 POPES ISLAND	1.98

In order to develop this area into an off-shore wind energy facility, a number of these owners would have to agree to sell their facilities. Many of the owners of these properties currently are in long-term leases with the operators at their facilities. The operators are business owners of water-dependent businesses (in many cases) that include shipyards, marinas, boat repair facilities, and marine supply businesses. In accordance with The Massachusetts Waterways Regulations (Chapter 91), any displaced water-dependent use would need to be relocated as stipulated within 310 CMR 9.36(4). It is unlikely that these facilities would be able to be relocated within the Port of New Bedford without the creation of a new marine terminal. It is

logistically infeasible to believe that these properties could be purchased (and the operators evicted or relocated) in a relatively short period of time such that an off-shore wind energy support facility could be constructed here. The process of freeing the land would take many years.

North Terminal: Although the New Bedford Harbor Development Commission currently owns the land associated with a potential North Terminal off-shore wind energy support facility, the Commission is currently in long-term lease agreements with all of the operators that currently exist in the area. The following is a list of the current lessees of properties located at North Terminal in New Bedford:

North Terminal Property Tenants

Parcel ID	TENANT	PROPERTY ADDRESS	Acreage
72 291	ROBERT C. COOK (NB WELDING)	272 HERMAN MELVILLE BLVD.	1.033
72 248	MARINE HYDRAULICS (DAVID CHAMBERS)	256 HERMAN MELVILLE BLVD.	1.986
72 292	ROBERT C. COOK	286 HERMAN MELVILLE BLVD.	0.966
72 297	MARVIN L. DOLINSKY	300 HERMAN MELVILLE BLVD.	1.485
72 299	ACUSHNET RIVER SHIPYARD	302 HERMAN MELVILLE BLVD.	1.531
72 293	TISBURY TOWING AND TRANSPORTATION	352 HERMAN MELVILLE BLVD.	3.479

The leases that these tenants have with the Commission are 99 years in length. A sample copy of a lease is attached as **Appendix 10**. The leases do not offer an option for the Commission to unilaterally cancel the agreement, and, therefore, in order to develop this area into an off-shore wind energy facility, these operators would have to agree to break their leases with the Commission. The operators are business owners of water-dependent businesses (in many cases) that include shipyards, boat repair facilities, and marine bulk transport businesses. In accordance with The Massachusetts Waterways Regulations (Chapter 91), any displaced water-dependent use would need to be relocated as stipulated within 310 CMR 9.36(4). It is unlikely that these facilities would be able to be relocated within the Port of New Bedford without the creation of a new marine terminal. It is logistically infeasible to believe that the lease agreements could be broken (and the operators evicted) in a relatively short period of time such that an off-shore wind energy support facility could be constructed here. The process of freeing the land would take many years.

Total Wharf and Yard Upland Area: As outlined above, the existing total wharf and yard upland area at North Terminal is approximately 10.5 acres, which does not meet the landside criterion for creation of an off-shore wind energy support facility. Additionally, the parcels that are available are not contiguous. In order to construct the facility at this location, a CDF would have to be constructed to connect the facilities together and create an additional 9.5 acres of usable land, which would be created by filling intertidal and sub-tidal areas (significantly more than the 5.67 acres that needs to be filled to construct the South Terminal CDF).

An offshore renewable energy facility could be constructed by utilizing the land on the northern portion of Pope's Island (approximately 20 acres) and constructing a CDF to provide an additional 8 acres of usable land. In order to create this extra usable land, at least 8 acres of intertidal and near-shore sub-tidal area would need to be filled.

New Bedford Public Acceptance: From 2008 to 2010, New Bedford has undertaken a public process in evaluating the best location for harbor operations while promulgating its New Bedford/Fairhaven Harbor Plan. During the harbor planning process, although both North Terminal and Pope's Island were proposed as potential Confined Disposal Facilities (in support of navigational dredging), neither facility was evaluated as a stand-alone marine terminal. No public support for a large marine terminal was garnered for either facility (unlike at South Terminal). CDFs in these areas were anticipated to supplement the land of existing lessees of the Commission. Therefore, North Terminal and Pope's Island are not accepted locations for an off-shore wind energy facility in the eyes of the public of the City of New Bedford.

3.4.3. STATE PIER, NEW BEDFORD, MASSACHUSETTS

State Pier has been determined to be an impracticable location for an off-shore wind energy facility for a number of reasons, enumerated below:

Total Wharf and Yard Upland Area: The immediate backland at State Pier is approximately 7 to 8 acres, which does not meet the landside criterion. The land use adjacent (to the north, south, and west) of State Pier cannot accommodate an off-shore wind energy support facility.

MacArthur Drive is located directly to the west of the facility, which is a very active roadway and would severely hinder transportation of renewable energy components to an adjacent upland location. MacArthur Drive is not constructed to accommodate the turning radius required for transportation of large wind blades to more remote locations. Immediately across to the north is Fisherman's Wharf, which is currently dedicated to supporting commercial fishing activity. Immediately to the south is Steamship Pier, Homer's Wharf and Leonard's Wharf, which are similarly dedicated to supporting commercial fishing activity. Similar to the activities on State Pier, 10 CMR 9.36(4) would require the relocation of commercial fishing activities should either of the facilities to the north or south be utilized. Commercial fishing berthing is already sorely lacking within New Bedford Harbor. It would be extremely difficult to locate additional commercial fishing berthing within New Bedford Harbor without constructing a new Marine Terminal at another location, therefore, it is infeasible to expand the site in any way to bring the usable area closer to the area required for an off-shore wind energy support facility (28 acres, as stated earlier). The site is bounded on the west by Herman Melville Avenue and Route 18; monopiles and wind blades would have to move from State Pier to another, more remote location along roadways or rail lines that are not designed to accommodate the required turning radius.

Site Control/Site Availability: While the New Bedford State Pier is currently owned by the Commonwealth of Massachusetts, the commonwealth operates the pier in a manner that accommodates multiple different users of the pier. These uses include: a fast ferry terminal for transportation to Martha's Vineyard, an off-loading location for break-bulk cargo, as a storage location for refrigerated cargo, as a berthing and terminal location for cruise ships, as a berthing and terminal location for pleasure cruise boats, as a berthing location for ferry service to

Cuttyhunk Island, as a staging location for emergency services vessels, and as a seasonal berthing location for the Ernestina.

The facility can support freighter service and store over 135 containers. American Cruise Lines operates out of the facility with a minimum of 20 ports of call on an annual basis and up to 89 passengers per trip. Ferry services also operate out of the State Pier, including passenger and cargo service to Cuttyhunk Island and passenger service to Martha's Vineyard. Ferry service brings over 115,000 passengers through the port annually. The Quick Start Ferry facility on the State Pier allows intermodal transfers of waterborne freight and freight carried by truck and rail. Relocation of these existing users is extremely infeasible as there is no other public location in New Bedford for these services to be relocated to.

These existing users represent a significant public benefit to the City of New Bedford and southern New England. If an off-shore wind energy facility is sited at State Pier in New Bedford, it would consume all available space at State Pier. In accordance with The Massachusetts Waterways Regulations (Chapter 91), any displaced water-dependent use would need to be relocated as stipulated within 310 CMR 9.36(4). It is unlikely that these facilities would be able to be relocated within the Port of New Bedford without the creation of a new marine terminal. A new public terminal would need to be constructed to harbor these users would need to be constructed if they were displaced to make way for an off-shore wind energy terminal.

New Bedford Public Acceptance: From 2008 to 2010, New Bedford has undertaken a public process in evaluating the best location for harbor operations while promulgating its New Bedford/Fairhaven Harbor Plan. During the harbor planning process State Pier in New Bedford was not evaluated as a stand-alone marine terminal, it was assumed that the facility would continue to serve as a multi-use facility. An excerpt from the New Bedford Harbor Plan, outlining the proposed future uses of the New Bedford State Pier is included as **Appendix 11**. No public support for a large marine terminal was garnered for the facility (unlike at South Terminal). Therefore, State Pier in New Bedford is not an accepted location for an off-shore wind energy facility in the eyes of the public of the City of New Bedford.

4. WHY SOUTH TERMINAL CDF IS THE LEAST ENVIRONMENTALLY DAMAGING PRACTICABLE ALTERNATIVE THAT MEETS THE PROJECT PURPOSE

4.1. Proposed Project Description

4.1.1. Filled Facility

The proposed South Terminal CDF is a filled structure adjacent to the shoreline, bounded by sheet piling, capped by crushed stone. **Figures 2 and 3** note the anticipated orientation of construction for the facility as well as the plots of land anticipated to be incorporated into the facility. It is currently anticipated that approximately 150,000 cubic yards of clean sand from navigational dredging would be incorporated into the construction of the facility. Approximately 1,200 linear feet of berthing space will be available at the facility. The size of the facility as envisioned will be 28.25 acres.

The main portion of the facility consists of the following properties:

- Map Number 31 Lot Number 263 (private owner);
- Map Number 31 Lot Number 288 (private owner);
- Map Number 25A Lot Number 53 (Commonwealth Owned);
- Map Number 25A Lot Number 49 (Commonwealth Owned); and
- Map Number 25A Lot Number 48 (City of New Bedford Owned).,

In order to meet the area requirements for off-shore renewable energy support, the use of 8 acres located within separate parcels to the south of the main operating area is required. This additional area will be supplied within four adjacent, ancillary properties, located to the south of the facility. The properties are:

- Map Number 25A, Lot Number 48 (City of New Bedford Owned);
- Map Number 21, Lot Number 30 (private owner);
- Map Number 25A, Lot Number 47 (private owner);
- Map Number 25A, Lot Number 45 (private owner);
- Map Number 25A, Lot Number 5 (private owner);
- Map Number 25A, Lot Number 7 (City of New Bedford Owned); and
- Map Number 21, Lot Number 45 (City of New Bedford Owned).

The City of New Bedford has already discussed the use of property Map Number 21, Lot Number 30 with the private owner, and has a conceptual agreement to utilize the property temporarily for this project (a letter of support from the owner Map Number 21, Lot Number 30 is attached as **Appendix 12**. The location of these properties is shown on **Figure 3**.

The parcels that form the south terminal are numbered Map Number 31 Lot Number 263, Map Number 31 Lot Number 288, Map Number 25A Lot Number 53, Map Number 25A Lot Number 49, Map Number 25A Lot Number 48, Map Number 25A Lot Number 7, and Map Number 21 Lot Number 45. All of these parcels are either owned by the City or the Commonwealth except Map Number 31 Lot Number 263 and Map Number 31 Lot Number 288. The Commonwealth is engaged in discussions with the private landowner of Map Number 31 Lot Number 263 and Map Number 31 Lot Number 288, and anticipates being successful and securing the necessary property rights to expeditiously construct the terminal. The

Commonwealth is also actively engaged in securing an easement across Map Number 21 Lot Number 30, which will be necessary to access Map Number 21 Lot Number 45, as well as an easement across parcels Map Number 25A Lot Number 47, Map Number 25A Lot Number 45, and Map Number 25A Lot Number 5, which will be utilized as a land-connection between the northern and southern parcels. The Commonwealth anticipates being able to secure the easement rights for those four properties expeditiously to construct the terminal.

The southern 8 acres provided by the ancillary properties would be used specifically for wind blade lay-down only, a relatively space-intensive use that does not require heavy-loading capacity. Therefore, the ancillary properties would not be subject to the intense usage and high load-bearing requirements of the remainder of the facility. As the ancillary properties are all outside of federal resource jurisdictional area, no additional resource impacts are anticipated due to inclusion of these properties.

Very little site work will be required in order to utilize the properties. Some construction site work at Map Number 21, Lot Number 45 will be required (and perhaps some minor grading work at Map Number 21, Lot Number 30) to prepare the site for wind blade lay-down as the property previously contained a mill building that was demolished within the last 2-3 years, and currently contains rubble and portions of the building foundation (up to 8 feet in depth) that currently present a hazard to the general public, and will need to be either removed, covered and/or graded. Grading at this facility is anticipated to utilize a large portion of clean material generated from the navigational dredging (up to 34,000 cubic yards). Please note that no portion of this property contains Federal resource areas.

The total estimated size of the facility, including the ancillary southern properties, is currently anticipated to be approximately 28.25 acres.

4.1.2. South Terminal CDF Dredge Footprint

To determine the minimum possible dimensions for the dredge footprint that would be both capable of serving offshore renewable energy facilities and capable of supporting a future international multi-purpose marine terminal, the following sources of information were consulted:

- Information was gathered from Power Systems Division, Wind Power Division, and Power Generation Division of Siemens;
- Individuals involved in the shipping industry,
- Individuals with insight into the anticipated size of cargo vessels that are likely to utilize the South Terminal CDF in the future, and
- Individuals with specific knowledge regarding vessel transport and mooring within New Bedford Harbor.

Information from Siemens

As previously described , on Thursday, April 8, 2010, representatives from the Power Systems Division, Wind Power Division, and Power Generation Division of Siemens met with New Bedford personnel to discuss the requirements of an offshore renewable energy support facility, based upon their experiences installing wind turbines in Europe (see summary memo attached as **Appendix 3**). Since the April 8 meeting, there have been additional discussions with Siemens concerning specific needs for the facility. In a letter dated August 25, 2010, Siemens has further clarified facility requirements. The following information can be gleaned from the

April 8 meeting, further discussion with Siemens, and the August 25, 2010 letter, which is attached as **Appendix 4**:

- There are a few types of vessels that would be used to transport wind turbine components from the manufacturer to the support facility. However, the approximate range in sizes of an international vessel is between 140 - 150 meters (460 – 490 feet) in length, 30 - 35 meters (98 - 115 feet) in width and requires 7 – 9 meters (23 – 29.5 feet) of draft.
- The international vessel can only carry components for 6 turbines at one time. Therefore, for constructing an offshore wind energy facility for 130 turbines, 22 separate shipments from international vessels would need to be received at the support facility. The international vessel will require 3-4 days of docking for unloading each trip.
- Offshore renewable energy facility installation ships would consist of jack-up barges that would be approximately 91 meters (300 feet) in width and 30 meters (100 feet) in width.

Draft Dredge Footprint

Utilizing the information regarding vessel sizes received from Siemens, the Commonwealth produced a Draft Dredge Footprint in August of 2010 and promulgated the footprint for review by other organizations that would likely be involved in operation and use of the new facility (see **Appendix 13** for a copy of the August 2010 Draft Dredge Footprint). Through the fall and winter of 2010, and through the spring of 2011, the Commonwealth of Massachusetts conducted research into the feasibility and viability of the use of the draft dredge footprint. As part of this exercise, the Commonwealth contacted:

- Individuals involved in the shipping industry,

- Individuals with insight into the anticipated size of cargo vessels that are likely to utilize the South Terminal CDF in the future, and
- Individuals with specific knowledge regarding vessel transport and mooring within New Bedford Harbor.

Information from the Shipping Industry

The shipping industry representatives (officials from North American Port Infrastructure, LLC, HDR ONE COMPANY, and Maritime International Incorporated) reviewed the Draft Dredge Footprint and indicated that alterations to the configuration and size of the footprint were desirable. Some of the input received included the following:

- The deep-draft section of the proposed terminal (originally 500 feet in length to accommodate the international vessels anticipated to service the offshore renewable energy industry) would accommodate a more diverse set of vessels if it were extended to 600 feet in length or longer.
- The channel leading to the terminal (originally 150 feet in width) would be easier to navigate, were it widened.
- The channel leading to the terminal would be easier to navigate if it accommodated tug traffic more easily.
- The channel leading to the terminal may be easier to navigate if it were re-oriented. No specific proposal was given regarding the channel's reorientation, however, it was suggested that discussions with the Northeast Marine Pilots Association would be helpful in this regard.

A summary of the input provided by the shipping industry representatives is attached as **Appendix 14**.

Marine Pilot's Input

According to representatives from the Northeast Marine Pilots Association (the Pilots), 100% of foreign flag vessels and 100% of United States-flag vessels engaged in international trade are required to take a state pilot when entering state waters. Pilots operate under the mandate of the state and on behalf of the public interest. The pilot is a local representative who protects the local waters by helping to ensure that vessels arriving from sea are properly equipped and operated safely. The Northeast Marine Pilots Association represents New Bedford Harbor. Therefore, representatives of the Pilots have a high degree of expertise associated with determining appropriate conditions for vessels, and also are familiar with a wide range of types of vessels that may enter the Port of New Bedford (or other northeastern ports) either currently, or in the future.

The Pilots reviewed the Draft Dredge Footprint and indicated that improvements to the footprint were desirable. Some of the input received included the following:

- *Change in Alignment of the Channel Needed*: The Pilots indicated that a direct pathway to approach the South Terminal CDF is needed to facilitate access to the new terminal. The simplest pathway is typically preferred, in that it reduces the chances for mistakes to result in accidental grounding of vessels. A re-alignment of the orientation of the proposed channel to target the turning basin in the vicinity of the New Bedford State Pier is the best way to facilitate vessel traffic.

- *Change in Width of the Channel Needed*: The Pilots indicated that the channel leading to the terminal (originally 150 feet in width) would need to be wider. The Pilots preferred that the channel be as wide as possible.
- *Addition of Tug Channel Needed:* The Pilots indicated that all (including those associated with the offshore renewable energy industry) vessels that are planned to be berthed at the South Terminal CDF will require tug assistance to stay within the channel. Tugs need to be oriented perpendicular to the vessel's direction in order to keep them from drifting out of the channel (this way the tugs can pull and push the vessel toward the center of the channel as necessary). The Pilots suggested a 100 foot wide tug channel.

A summary of the input provided by the Marine Pilots is attached as **Appendix 15**.

New Bedford Tug Operator's Input

According to representatives from the local tug operator's industry within the Port of New Bedford, 100% of large vessels within New Bedford Harbor require tug assistance when entering or leaving the Port. 100% of the large vessels and 100% of the barges that will berth at the proposed facility will require tug assistance. Tug boats help in guiding the vessels within channels, turning vessels, pushing vessels up to their berths, and helping vessels away from dock. The tug operators typically assist all of the larger vessels that come into the Port of New Bedford, but also assist with vessels in other local ports, such as the Port of Providence and the Port of Fall River; therefore, the tug operators have a high degree of expertise associated with determining appropriate conditions for vessels, and also are familiar with a wide range of types of vessels that may enter the Port of New Bedford either currently, or in the future.

The tug operators reviewed the Draft Dredge Footprint and indicated that improvements to the footprint were desirable. Some of the input received included the following:

- *Change in Alignment of the Channel Needed*: The tug operators agreed with input supplied by the Marine Pilots indicating that a direct pathway to approach the South Terminal CDF is needed to facilitate access to the new terminal and that a re-alignment of the orientation of the proposed channel to target the turning basin in the vicinity of the New Bedford State Pier is the best way to facilitate vessel traffic.
- *Change in Width of the Channel Needed*: The tug operators agreed with the Marine Pilots that the channel leading to the terminal (originally 150 feet in width) would need to be wider and that the channel be as wide as possible.
- *Addition of Tug Channel Needed:* The tug operators also agreed with the Marine Pilots that cargo vessels that a tug channel would be needed to allow tug assistance to vessels.
- *Tug Channel/Shallow Draft Area:* The tug operators stated that they felt that it was very likely that one of the local tug companies would be guiding future cargo vessels. Therefore, it was unlikely that -20 MLLW would be required for the tug channel or for the shallow draft area. The maximum draft of the local tugs was 13 feet; therefore, -14 MLLW was considered to be an acceptable minimum dredge depth for the tug channel/shallow draft area.

A summary of the input provided by the tug operators is attached as **Appendix 16**.

Description of Final South Terminal CDF Dredge Footprint

The area to the east of the CDF will be dredged from its current depth of between -1 and -6 MLLW to between -14 and -32 MLLW to accommodate various sizes of vessels (the deep-

draft section of the bulkhead will accommodate vessels approximately 600 feet in length). These vessels are both representative of the offshore renewable energy industry (international vessel and installation vessel), anticipated future cargo vessels, and tug vessels that will be needed to assist larger vessels that will berth at the new South Terminal CDF. To accommodate these vessels, portions of the existing South Terminal Basin would be dredged from its existing depth of -20 to -25 MLLW to a depth of -30 MLLW in order to construct a channel connecting the new South Terminal CDF boat basin to the federal turning basin north of South Terminal. The current dredge footprint anticipates:

- A boat basin that ranges in depth from between -14 MLLW (to accommodate installation vessels and tugs) to -32 MLLW (to accommodate international vessels and future cargo vessels).
- Maintenance of a turning basin located in front of New Bedford State Pier and maintenance of a portion of the existing Federal Turning Basin in order to allow access to the South Terminal Channel.
- A 175 foot wide channel dredged to -30 MLLW to allow access to the facility. The channel is oriented such that there is a direct line from the proposed turning basin (which is located in front of New Bedford State Pier) to the facility. A portion of the channel is located within the Federal Turning Basin associated with the Federal Navigation Project.

  Note: This dredging should technically be unnecessary, since it lies within the Federal Navigation Project; however, since the Federal Navigation Project has not been maintained in many decades, maintenance dredging may be necessary to ensure an appropriate water depth for vessels. (Please note that the

US Army Corps of Engineers plans to conduct maintenance dredging of New Bedford Harbor in the near future; however, it may not be complete when construction of the South Terminal CDF begins).

- A 100 foot wide tug channel adjacent to the vessel channel. This will allow tugs to guide the larger vessels as they approach the terminal, and help them in docking procedures.

A drawing showing the reconfigured dredge footprint is attached as **Appendix 17**. A drawing showing the South Terminal Channel, the extension of the pathway of the vessels to the turning point in front of New Bedford State Pier, and a circular area within which vessels would turn is also included within **Appendix 17**. The dotted lines indicate the Federal Channel, and the Federal Turning Basins and Anchorages.

The net environmental impacts associated with the dredge footprint and proposed compensatory mitigation are discussed in Section 7.2 of this document.

4.1.3. CAD Cell Construction

Construction of a CAD Cell will be necessary in order to sequester surficial sediment impacted by PCBs that will be dredged associated with the South Terminal Dredge Footprint. The Commonwealth has collected a number of samples of sediment in order to characterize dredge material prior to construction of the South Terminal CDF facility. A summary of the results of the analytical samples collected to date is included within **Section 5.0** of this document.

Three CAD Cells (the Borrow Pit CAD Cell, CAD Cell #1 and CAD Cell #2) have since been constructed to date within New Bedford Harbor, within an area bounded on the south by the Route 6 Bridge and on the north by the Route 195 Bridge. The locations of the three CAD Cells

are shown on a Figure within **Appendix 18**. The location of the CAD Cell anticipated to be constructed associated with the South Terminal CDF is currently anticipated to be directly north of CAD Cell #2 (see **Appendix 18**). It is currently envisioned that construction of the future CAD Cell would follow the permitting and construction processes of the prior three CAD Cells. The CAD Cell would be dredged to approximately -45 MLLW, filled with contaminated sediment, and then capped. The areas to be dredged range in depth from -4 MLLW to -9 MLLW.

4.1.4. Mitigation Dredging: Gifford Street Channel

The construction of the South Terminal CDF will block a portion of the existing channel that accesses the Gifford Street Boat Ramp. In order to eliminate this impact, dredging will be conducted to re-align the channel such that it is no longer blocked by the facility. The target dredge depth for the Gifford Street Channel is -7 MLLW, and the areas to be dredged range in depth from -4 MLLW to -8 MLLW. The proposed Gifford Street Channel Mitigation dredging is shown within **Appendix 19**.

4.1.5. Mitigation Dredging: Gifford Street Mooring Area

The construction of the South Terminal CDF will displace some of the recreational boating moorings that are currently within the area of the proposed dredge footprint. In order to mitigate for the loss of this mooring area, the Commonwealth proposes to dredge two areas within the Gifford Street Mooring Basin that are currently too shallow for moorings. Deepening

these areas will mitigate for the moorings that will be lost associated with the construction of the new South Terminal CDF dredging. The target dredge depth for the Mooring Mitigation Areas is -6 MLLW and the areas to be dredged range in depth from -4 MLLW to -6 MLLW. The proposed Mooring Mitigation dredging is shown within **Appendix 20**.

4.2. Anticipated Future Uses of South Terminal CDF

Use of the South Terminal CDF for off-shore wind energy support terminal is anticipated to start as early as November 2012 (immediately subsequent to construction of the terminal). Operation of the facility for off-shore wind energy support for the first major off-shore wind energy project is anticipated to last until February of 2014. We understand that the South Terminal CDF must be in place no later than fall 2012, so that the first major offshore wind energy project can be operational in time to qualify for sizable federal tax incentives that significantly lower the cost of the electricity for Massachusetts ratepayers.

Although off-shore wind energy support operations will utilize the entire facility until February of 2014, subsequent to that date, the facility is anticipated to be utilized in a number of non-off-shore wind energy related means, including: as a terminal for container shipping, a terminal for break-bulk cargo shipping, a terminal bulk cargo shipping, and as a location to store sand generated via CAD Cell construction, so as to facilitate reuse of the material. Some transition measures will be required at the site to facilitate international and regional shipping; however, the measures will be relatively cheap to implement, and will not prevent off-shore wind-energy support to continue once another off-shore wind energy project is in the construction phase. Although the anticipated surface that will be in place to accommodate off-shore wind energy

support (a relatively uneven crushed stone surface) may make use of the facility for shipping operations difficult, re-grading of the site with additional gravel would quickly solve this problem and would be a relatively low cost upgrade to the facility.

The use of the facility with respect to non-off-shore wind energy related shipping activities was investigated by FXM Associates within a Technical Memorandum entitled, "Port of New Bedford South Terminal Business Plan", dated December 22, 2009, attached as Appendix K of the "Port and Infrastructure Analysis for Off-Shore Wind Energy Development" report prepared by Tetra-Tech EC, Inc. (attached to this document as **Appendix 21**).

Having researched the economic basis for use of the South Terminal CDF facility, FXM Associates concludes within its Business Plan that "A new multi-use port facility at South Terminal can capture container, break bulk, and bulk cargoes not now handled in New Bedford or other Massachusetts ports, and can generate economic development benefits and net operating income to the HDC *with* or *without* offshore wind energy development projects."

International marine cargo through the Port of New Bedford consists mostly of perishable food, including seafood and fresh fruit. Break-bulk frozen seafood from Norway is discharged from ships for distribution throughout New England, cranberries are exported, South American fruit is imported seasonally, and locally caught fish is frozen in New Bedford plants and 80% containerized for export to Europe and the Far East. International marine cargo through the Port of New Bedford is anticipated to grow in the near term by 3% (fish and frozen product) and 5% (container services) annually. A study completed by FXM Associates conducted in September

2004, entitled "Potential Economic Effects of Dredging New Bedford Harbor" stated that a significant impetus for this growth was derived from the success local fish processors have had in sourcing fish from other regions around the world, including supplies that arrive by cargo vessels.

Existing break-bulk cargo and refrigerated cargo is currently accommodated at State Pier, Maritime Terminal and Bridge Terminal; however, the Route 6 Bridge restriction (limiting vessel width to no greater that approximately 90 feet) and the depth restrictions (current maximum depth is approximately -23 feet MLLW) at the two terminals prevents vessels of a certain size from accessing Marine Terminal and Bridge Terminal, and keeps vessels that can access the terminals from being fully loaded at these locations. Maritime International estimates a significant annualized loss of income from less than fully loaded vessel, and that any availability at the South Terminal CDF would be quickly utilized to expand its break-bulk operations. The increased capacity would allow a significant increase in international cargo vessels with break-bulk cargo to utilize the Port.

South Terminal would also be ideal for shipment of bulk cargo, such as sand, gravel, or other bulk material. Multiple terminals within New Bedford already service bulk cargo. The R.M. Packer facility ships sand, gravel, fuel, modular homes, and "heavy lift" items. Island Barge transports construction materials and scrap to and from Nantucket. D.W. White recently suspended bulk shipment operations from its location at Pope's Island, from which it transported salt, gypsum, cement, and scrap lumber, due to inefficiencies caused by lack of minimum storage space as well as lack of an appropriate bulkhead with sufficient draft for loading and unloading

of bulk cargoes. Access to an available South Terminal CDF would allow larger barges, and potential increased shipments for these organizations.

FXM Associates states within its Business Plan that "The handling of cargoes not related to an offshore renewable wind energy installation (OREI) – including container, break bulk and bulk cargoes projected for South Terminal – is estimated to expand business output in *Bristol County* by $15.7 million annually, providing 130 permanent jobs and $5.9 million in new household income each year. These economic impacts include total direct, indirect, and induced economic effects within Bristol County estimated to occur annually following facility construction and do not include support of offshore wind energy projects."

The Port of New Bedford is also in negotiations to set up South Terminal as a major shipping location within America's Marine Highway (Short-Sea Shipping). Short-sea shipping operations are the diversion of wheeled cargo (truck traffic) from congested highways to the open sea – as well as on inland waterways to absorb a significant part of the future projected growth in highway freight traffic, reduce air pollution, traffic congestion, and shipping costs.

The Port of New Bedford has been working directly with the U.S. Department of Transportation's Maritime Administration to implement short-seas shipping (dubbed by USDOT "America's Marine Highway). Information from the US DOT website on America's Marine Highway, which outlines the program, is attached as **Appendix 22**. The US DOT information outlines the creation of the "M-95 Corridor", which would send goods by barge up and down the east coast. Information on the "East Coast Marine Highway Initiative" and the "New Jersey

Marine Highway Initiative" show the US DOT's plans to create these marine highways. The Port of New Bedford is highlighted in each of these initiatives.

A study on short-sea shipping was prepared by Reeve & Associates in March, 2006 (attached as **Appendix 23**), which assessed the viability of implementation of short-sea shipping for the Ports of New Bedford and Fall River. The report stated that the establishment of only two short-sea shipping lines (a daily short-haul to New Jersey and a twice weekly long-haul to Jacksonville, Florida or Wilmington, North Carolina) would generate an estimated total direct income of $45 million dollars per year, would also generate indirect income of $72 million dollars per year, would generate 300 direct jobs in the short-seas industry, would generate an additional 500 jobs that provide goods and services to short-sea employees and companies. The Reeve & Associates report concluded that "New Bedford's current cargo facilities in terms of berth and yard capacity need to be improved to effectively support a short-sea service." The South Terminal CDF is precisely the type of improvement that will facilitate implementation of short-seas shipping in New Bedford.

The New Bedford Harbor Development Commission is already soliciting vendors for use of the facility once the first off-shore wind energy facility is complete (one of the many brochures currently being utilized for marketing of the new facility after off-shore wind energy use is complete is attached as **Appendix 24**. The minutes from one meeting with a prospective shipping company (Jersey Harborside) are also attached as **Appendix 24**. Additional meetings with other vendors have also produced tangible results. Several meetings have been held by the Port of New Bedford with American Feeder Lines (AFL), a company producing U.S. Flagged

vessels that will be utilized to implement short-seas shipping. AFL has included the Port of New Bedford in its proposed shipping route in anticipation of utilizing the South Terminal CDF as its shipping connection (see Appendix 24).

The South Terminal CDF will also serve to store sand generated during CAD Cell construction, in order to phase and sequence reuse of the sand at other locations. Although no space will be available for CAD Cell sand staging or storage during construction of the first off-shore wind energy facility, space will be set aside within the facility after the anticipated February 2014 completion date. A portion of the facility (anticipated to be unused by the various cargo operations that are anticipated to populate the site once off-shore wind energy support is complete) will be set aside for storage of sand from CAD Cell construction. The space will be utilized for storage of sand from navigational dredging and/or Superfund-related dredging, that may be reused in beach nourishment, upland near-shore reuse, CAD Cell capping, or sediment capping operations.

The anticipated future uses (container shipping, break-bulk cargo shipping, bulk cargo shipping, short-seas shipping and CAD Cell sand storage) each require approximately the same type of facilities: deep water berthing, quae-side loading and unloading area, and upland storage and staging area. Major demands for berthing and upland storage and staging space will be temporary, and will fluctuate based upon the size of the shipments anticipated to arrive or leave. Break-bulk cargo, containers, trucks, or bulk cargo may require temporary storage prior to loading and transport of vessels; however, only a small portion of the site (1-2 acres) would be

required for any one method of transportation with any regularity. Reserving a portion of the site for the storage of CAD Cell sand will therefore not be difficult.

Refrigerated cargo does require refrigerated storage areas; however, refrigerated storage areas are available in other areas of the harbor, and cargo would be transported to refrigerated storage locations after offloading at the facility. Break-bulk cargo will need shelter from the elements; but will be shipped to a warehouse after unloading at the facility. Bulk cargo will need space onsite for temporary storage prior to loading, but will be staged and delivered to limit its footprint at the site. Truck staging will be required for short-seas shipping; but the trucks will only be onsite immediately before and after a short-seas vessel arrives or leaves.

4.3. Least Environmentally Damaging Practicable Alternative

4.3.1. Only Practicable Location

South Terminal in New Bedford has been determined to be the only practicable location for siting of an offshore renewable energy support facility. All other locations have been reviewed and have been found to not be practicable for reasons outlined within the previous section(s). South Terminal meets each of the evaluation criteria as summarized below:

- The entrance to the Hurricane Barrier of New Bedford Harbor is 150 feet across and is authorized to -30 MLLW and therefore presents no Horizontal Clearance restriction. **Appendix 25** contains a memorandum outlining information obtained from the U.S. Coast Guard, Port of New Bedford Security Team Head and the U.S. Army Corps of Engineers regarding the size of vessels able to enter the Port of New Bedford through the Hurricane Barrier (these documents outline that there are no restrictions on vessels

passing through the Hurricane Barrier, other than the innate physical limitations [150 foot width and 30-35 foot draft, depending upon the tide level].

- The geologic material located within the subsurface of New Bedford Harbor is sufficient to allow Jack-Up Barges to access and stabilize themselves without sinking into the substrate. Thirty-two over-water borings conducted during the pre-design investigation of the South Terminal CDF have indicated that the subsurface material (either sand with low fines content or glacial till or rock) located at the base of the proposed dredge footprint is very competent. Boring logs for the subsurface investigations (included within **Appendix 26**) show that the predominant substrate (below organic maintenance material that has accumulated over the years) is a combination of very compact sand, silt and gravel (glacial till) or compact fine sand with low fines content, or rock, all three of which are competent enough to support jack-up barge operations.
- There are no Overhead Clearance issues associated with accessing the South Terminal location. **Appendix 27** contains a memorandum outlining the results of a conversation with New Bedford Airport personnel, indicating that the area within which height restrictions are enforced ends south of Pope's Island, and that the South Terminal area is not bounded by such restrictions.
- The proposed terminal to be constructed will consist of approximately 28.25 acres, which is sufficient to support off-shore renewable energy construction projects. All of these parcels are either owned by the City of New Bedford or the Commonwealth except for two parcels, and the Commonwealth anticipates being successful and securing the necessary property rights to expeditiously construct the terminal. An additional four

parcels will require easements; however, the Commonwealth anticipates being successful and securing the necessary property rights to utilize these parcels.

- The proposed terminal will have approximately 1,200 linear feet of berthing space, which is sufficient to support one international vessel and two installation vessels simultaneously, as required.
- The majority of the area in which the proposed facility is anticipated to be constructed is currently unoccupied and within the control of either the City or the commonwealth, and the commonwealth and/or the City of New Bedford has the ability to take ownership of the portions of the site that are in private ownership. New Bedford is located nearby proposed offshore renewable energy project construction locations.
- During the harbor planning process (for the 2010 New Bedford/Fairhaven Harbor Plan), South Terminal was specifically identified as a location that the community would support for a future large marine terminal.
- Finally, South Terminal is very close to the anticipated location of CAD Cell construction; therefore, it is able to accept material from future CAD Cells both during construction, and for staging in the future to allow reuse of the clean sand material.

4.3.2. Only Practicable Design

While the South Terminal CDF is intended to serve multiple purposes, one of its proposed future uses (support of offshore wind energy facility construction), requires an extra-ordinary capacity to support heavy loads. It is this required loading capacity that restricts the type of design possible for construction of the facility. In particular, the only practicable design for the terminal is a filled structure.

Introduction

Wind turbine components are extremely heavy pieces of equipment. The combined loading of the turbines and the enormous cranes required to transport these pieces result in loadings that are much higher than any conventional marine terminal. Due to the anticipated loads to be endured by the facility, which includes the heavy individual turbine components, extremely large cranes necessary to transport the components, and extreme vibration loads that a pile-supported structure is poorly designed to resist, the analysis has determined that the only reasonable alternative to support these loads is for the facility to be designed as a filled structure. The balance of the document outlines the nature of the facility, the distinct differences between the proposed facility and other shore-line facilities, and the nature of the loadings that are driving the need for a filled structure at the site.

Typical Loading for Cargo Terminal

It is important to evaluate the need for a commercial marine terminable that is capable of handling very heavy loads in the context of what is typically required for a standard cargo terminal. When comparing the requirements of the South Terminal CDF to the standard cargo terminal, it becomes apparent how different the requirements will be for the South Terminal CDF, from what is typically required. For comparison, a typical shore-side cargo port facility is designed to accept the maximum loadings from containers (either a twenty-foot long container or a forty-foot long container). The maximum weight for a 20-foot cargo container is 24,000 kg (24 metric tons) and for a 40-foot cargo container is 30,500 kg (30.5 metric tons) – (**Appendix 28**).

To handle the loads from containers (or other types of cargo), shore-side facilities typically are constructed to handle 500 to 1,000 pounds per square foot (vs. 12,161 pounds per square foot).

Attached is information from the Port of Long Beach (one of the primary cargo ports for the United States) as **Appendix 29**. Section 3.3.1 of **Appendix 29** indicates that the Live Loading for the Port of Long Beach is 1,000 pounds per square foot. Similarly, information obtained from Bourne Consulting Engineering (**Appendix 30**) shows that recent terminals constructed in Eastport, Maine were designed to accommodate 1,000 pounds per square foot, which included design to support a 100 (Imperial/U.S.) ton mobile crane (vs. a 600 metric ton crane). Additional information within **Appendix 30** indicates cranes at two facilities (one on Staten Island in New York City and one in Chelsea, Massachusetts) both utilize 235 (Imperial/U.S.) ton cranes (vs. a 600 metric ton crane) to facilitate offloading of cargo.

Wind Turbine Components

In contrast to typical loadings for cargo terminals, offshore wind installations require the staging and manipulation of large, unwieldy, and extremely heavy equipment. Wind turbines are comprised of several base component parts for shipment: wind blades, nacelles, tower sections, electrical components, foundation components and hubs. Depending upon the type of wind installation, the foundation requires a number of potential foundation considerations. It is the size and weight of this equipment that makes an offshore wind staging facility distinctly different than other shoreline facilities, such as container terminals.

The Commonwealth anticipates that the facility will initially be used for staging of the installation of Siemens 3.6 MW turbines at an off-shore wind construction facility. The

following is a summary of important information associated with the portions of this wind turbine**:**

Part	**Length**	**Width/Diameter**	**Number/Turbine**	**Weight Per Piece**
Wind Blade	191 feet	13.7 feet	3	18 metric tons
Nacelle	46 feet	13 feet	1	125 metric tons
Hub	13 feet	11 feet	1	100 metric tons
Tower Length	107 feet	14 feet	3	100 metric tons
Monopile	115 feet	18 feet	1	400 metric tons

A brochure for this type of wind turbine is attached as **Appendix 31.** Typically, the nacelle and hub are joined together, making the total weight of the combined unit approximately 225 metric tons (although verbal communication with Siemens has indicated that the total weight is, in actuality, 240 metric tons). Tower sections are planned to be set vertically onsite, to save space on the barge when transported to the installation location, which results in a concentration of the loading into a relatively small area.

A Siemens 3.6 MW turbine represents a type of turbine that is utilized in many locations offshore of European countries. However, as noted in a printout from the website of the German Energy Agency (**Appendix 32**), this turbine represents only one of many types of offshore wind turbines, and by no means the largest. It is very likely that future offshore wind installations will involve larger and larger turbines, some of which are noted in **Appendix 32**. For example, the nacelle-hub combination associated with an Enercon E-126 7.5 MW Offshore turbine weighs 650 metric tons, over twice the size of the Siemens 3.6 MW turbine.

Crane Sizes and Capacities

To transport these components around the facility, very large cranes will be needed. One type of crane that has been used at offshore wind staging facilities in Europe is the DEMAG CC 2800-1, a 600 metric ton crane (see **Appendix 33**), although this is by no means the largest crane utilized to move wind turbine parts. In fact, it is far more likely that a much larger crane will be utilized at the South Terminal facility, the size of which will likely range between 1,000 to 1,300 metric ton cranes. While analysis of a 1,000 or 1,300 metric ton crane would show a more extreme example, the available information for the CC 2800-1 is more straightforward (i.e. in English rather than metric units); and the analysis of the CC 2800-1 is conservative and consistent with previous information received from Siemens (within which a 600 metric ton crane was anticipated to be utilized).

As shown within **Appendix 33**, the total weight of the DEMAG CC 2800-1 is approximately 794,000 pounds. According to the documentation, the crane (without any loading) distributes a ground pressure of approximately 20 pounds per square inch, or approximately 2,880 pounds per square foot. When lifting a 400 metric ton object (such as the monopile foundation unit), the total weight of the unit more than doubles to 1,676,400 pounds, with a resulting ground pressure of 42 pounds per square inch or 6,080 pounds per square foot.

This estimate assumes that the crane is lifting items immediately in front of it, which is valid for much of the facility, but not on the waterfront, where the crane will need to load barges that will be transporting components to the offshore wind construction site. When loading vessels, the crane will need to reach far from its base to place the materials onto the barge. When the heavy weight of the object is distributed very far from the center of gravity of the crane, the crane will tip forward slightly, and distribute its load unevenly on the front tracks.

When rotating, the loads will also concentrate over one crawler track more than the other. Assuming that the front tracks (representing 50% of the total tracks) will bear the majority of the weight load, the loading needed to support the crane increases by a factor of two to 12,160 pounds per square foot. Additional increases are expected when the weight is shifted to the front of just one of these crawlers (for instance, when the load is rotated such that the boom of the crane is directly over the front of one of the crawlers).

Heavy load estimates between 6,000 pounds per square foot and 18,000 pounds per square foot are not inconsistent with the loading numbers included in the designs of several European ports that have supported offshore wind installations. Attached as **Appendix 34**, is information for Cuxport, Germany whose heavy load area supports 90 metric tons per square meter (18,434 pounds per square foot), Aarlborg, Denmark, whose heavy load area supports 42 metric tons per square meter (8,602 pounds per square foot), and Hartlepool/Able Seaton Port, whose heavy load area supports 75 metric tons per square meter (15,361 pounds per square foot).

Vibration Impacts

Although not normally a major consideration when designing a marine terminal, vibrational impacts for the South Terminal CDF are anticipated to significantly affect the design of the terminal. Multiple heavy cranes moving with very heavy loads on the site induces subsurface vibrations that have a significant effect on stability and long-term lifetime of subsurface structures installed to support the overall loading. Vibrational impacts can severely impact structures that rely heavily on a fixed number of connection points, such as a pile-supported structure. The vibrations can work to disrupt these connections and result in early failure of the structure. Other potential impacts include anticipated cracking or spalling of

concrete decking from vibrations, which can expose the structure to increased corrosion in the long term. Significant factors of safety need to be included to protect against vibration loadings from shaking a structure apart during use. This impact would be more pronounced on facility designs that rely on specific connection points; therefore, a pile-supported structure, if utilized would need to be over-designed in order to minimize the potential impact of vibrational energy on the long-term stability of the structure.

Assessment of Pile-Supported Structure As a Practicable Alternative

Clearly, the loading requirements at an Offshore Wind Energy support facility are extremely demanding. The 600 metric ton crawler crane described earlier is an enormous piece of equipment that delivers extremely large point loads onto the underlying structure. In addition, as described earlier, the crane creates vibrational loads that are extremely difficult to predict and control.

Although a full design of a pile-supported structure was not undertaken, the following is the basis of some preliminary conceptual design parameters that justify the abandonment of the pile-supported option as a practicable alternative:

- To protect the area within which the cranes will work, and to allow for anticipated settlement due to the heavy loadings, the offshore wind industry typically demands that the surface upon which the work is completed be a crushed-stone type surface, since the cranes tend to destroy asphalt or concrete surfaces as they work. Therefore, to protect the structure, up to three (3) feet of fill and crushed stone would need to be placed on top of the decking to protect it from damage.

- The heavy loadings combined with the thick layer of fill required to protect the decking would result in an enormous load that would need to be borne by a pile-supported structure. To protect against punching shear from pilings, the pile caps would need to be 5 (five) to 7 (seven) feet in thickness, and supporting cross-member beams 3 (three) to 4 (four) feet in thickness would also be needed. A concrete deck would need to be placed atop the beams, with a minimum thickness of up to three (3) feet.
- The total structure would need to be at least 17 feet thick (3 feet of fill plus 7 feet of caps, 4 feet of beams, and 3 feet of decking).
- The final elevation of the South Terminal extension is currently anticipated to be at an elevation of approximately +12 feet above Mean Lower Low Water. The average existing depth to mudline in the vicinity of the bulkhead alignment is approximately -1 MLLW. Therefore, there is approximately 13 feet of room between the existing mudline and the proposed final deck elevation.
- The combined deck thickness and fill needed to support the loadings would result in approximately seventeen (17) feet of fill and concrete to be placed on top of pilings. As stated earlier, 17 feet is four feet more than the available depth present at the bulkhead alignment (however, the mudline elevations increase as you move inland, resulting in less available depth). It is extremely problematic to frame and cast concrete caps and beams below Mean High Water, and even more so below Mean Low Water, which would be the case in this situation, resulting in an unacceptable risk for error in assembly of a pile-supported structure.

- The average weight of sand or gravel is approximately 125 pounds per cubic foot. The average weight of concrete is approximately 148 pounds per cubic foot. With three feet of fill (125 lbs/cubic foot X 3 feet = 375 pounds per square foot) plus 14 feet of concrete (148 lbs/cubic foot X 14 feet = 2,072 pounds per square foot) plus the anticipated load of crane and component (12,140 pounds per square foot, outlined earlier), the total load (375 + 2072 + 12,140) equals 14,587 pounds per square foot (or 7.3 Imperial/U.S. tons per square foot).
- **Appendix 35** is an excerpt from "Design of Marine Facilities for the Berthing, Mooring, and Repair of Vessels" by John W. Gaythwaite (ASCE, 2004). The document lists multiple types of pilings that are typically utilized in marine construction are listed, including timber piles, H-piles, concrete filled steel pipe, pre-cast concrete, and concrete cylinder.
    - The loadings for each range significantly depends upon the diameter and/or size of the members. However, for a concrete cylinder pipe (the pile with the highest loading capacity), the maximum load is listed at 240 Imperial/U.S. tons for a 54" (4.5 foot) diameter pipe (15.9 square feet in cross-sectional area).
    - At 7.3 Imperial/U.S. tons per square foot of loading of the decking, the 240 Imperial/U.S. ton column could support 32.4 square feet of decking, which is a circle with a diameter of 6.4 feet.
    - Thus, a column 4.5 feet in diameter (2.25 foot radius) could support an area 6.4 feet in diameter (3.2 foot radius).

- Therefore, there would only be approximately 2 feet of free area [(3.2 feet – 2.25 feet = 0.95 feet) X (2 Columns) = 1.90 feet] between the outer edges of columns in each direction, which is a very narrow opening.

- Therefore, the pile-supported option would not only fill the available depth with fill and concrete, but any area supported by pilings above the mudline (which, from a preliminary analysis, appears unlikely) would be mostly consumed with the pilings themselves. The area would be similar to a "forest" of columns that would be the equivalent of a filled structure. This initial assessment indicated that a pile-supported option is not a practicable alternative, as it would have the same ultimate effect as a filled structure.
- As stated earlier, the Commonwealth has offered a conservative analysis of the structural loads required for the facility. In so doing, the Commonwealth did not consider the following issues:
    - The above-noted analysis does not take into account other loads (that would typically be addressed during detailed design) such as lateral loading from ships, vibrational loadings, additional dead loads not considered here or a factor of safety (which would typically range from 1.5 to 2).
    - The above analysis assumes a 600 metric ton crane, when a 1,000 to 1,300 metric ton crane is more likely to be needed at the facility. A 1,000 to 1,300 metric ton crane would have heavier loads, and would therefore require a stronger support system than envisioned above.

- The analysis above assumes that only a 3.6 MW turbine needs to be transported. It is anticipated that 5.0 MW to 7.0 MW installations need to be supported in the future and it would be short-sighted to design a facility that could not also accommodate these types of future uses. 5.0 MW to 7.0 MW turbines will be heavier, will require larger cranes, and will distribute larger loads than those evaluated within this section.

In light of the foregoing considerations, the Commonwealth strongly questions whether a pile-supported structure presents a viable option; and continues to believe that a filled structure presents the best means of accommodating the larger loads from lateral loading, vibrational loading, 1,000 to 1,300 metric ton cranes and 5.0 to 7.0 MW turbines.

4.3.3. Least Environmentally Damaging Practicable Alternative

South Terminal in New Bedford has been determined to be the only practicable location for siting of an offshore renewable energy support facility. All other locations have been reviewed and have been found to not be practicable for reasons outlined within the previous section(s). South Terminal meets each of the evaluation criteria. Additionally, the only practicable design of South Terminal in New Bedford has been determined to be a filled structure, as a pile-supported structure has been determined to not be a practicable alternative, as it would have the same ultimate environmental effect as a filled structure. The loadings exerted by cargo and cranes at the South Terminal CDF will far exceed the typical capacity of cargo terminals located within the United States, many of which could reasonably be designed as a

pile-supported structure. The heavy loads will require construction that is specific to this particular terminal due to its specific configuration. The information outlined within this section outlines that a pile-supported option is not a reasonable alternative at South Terminal, based upon the loadings anticipated at the facility; therefore, a filled structure at South Terminal in New Bedford is the Least Environmentally Damaging Practicable Alternative That Meets the Project Purpose.

5. CHARACTERIZATION OF PROPOSED PROJECT AREA

5.1. Sediment Sampling

Sediment samples were collected via the advancement of vibracores and Russian Peat Cores within both the proposed dredge footprint and the proposed facility footprint. A Russian Peat Corer is a hand-operated, mechanical sampling device that utilizes a side-filling mechanism to collect uncompressed samples from wetlands and estuaries. The chambered-type corer collects samples which are not compressed or shortened during recovery, unlike samples taken with end-filling core samplers. The corer is deployed (in the closed position) to the desired depth. The corer is rotated clockwise 180° so that the sharpened edge of the chamber cuts a sediment core which is contained by the cover plate. During retrieval, the cover plate's counterclockwise rotation extrudes the undisturbed sample.

The vibracores were advanced to refusal, and the recovered material was sampled at one-foot intervals for PCBs (PCB Congeners by Modified EPA Method 8270C), Copper, Chromium, and Zinc (EPA Method 6020A). The Russian Peat Corer mechanism was utilized to collect samples at one-foot intervals until refusal, except where a vibracore sample was scheduled (however, in some cases vibracores and Peat Cores were collected side-by-side to confirm the results of each).

The sampling was lead in the field by an experienced sediment sampler. This Field Operations Lead (FOL) had discretion (within the parameters of this sampling plan) to make decisions in the field concerning the sampling program. Sampling was conducted from a research vessel equipped with an “A-frame” and appropriate sampling and positioning equipment. As-

built sample locations were documented using a Global Positioning System (GPS). Once the sampling vessel is in position, the as-built coordinates and water depth were logged.

Sampling of vibracores was performed as previously stipulated. Surface samples from within the dredge areas or the filled facility footprint were collected and analyzed for PCBs (22 NOAA Congeners by Modified EPA Method 8270C) at each sample location. Surface samples (samples collected from 0 to 1 foot) from fifteen (15) of the Russian Peat Corer locations (five locations within the area to be filled and ten locations from within the dredge footprint) were also analyzed for 13 Priority Pollutant Metals (EPA Method 6020A/7471), SVOCs (EPA Method 8270C), and Total Petroleum Hydrocarbons (EPA Method 8015). Where the metals analyses indicated a concentration above the "20 times rule" TCLP analysis was performed on that metal.

Sampling equipment was cleaned following standard decontamination procedures prior to individual sample collection. Sediment samples were logged and visually characterized prior to being transferred to laboratory-supplied pre-cleaned and pre-preserved jars. Samples were stored at 4 degrees Celsius in sample coolers on the vessel prior to shipment to the laboratory.

Samples for chemical analysis were stored on ice from the time of sample collection until they were delivered to the laboratory. Samples were collected and placed in the appropriate container for each analytical method and sealed with the lid. The sealed container was then labeled with indelible ink, with the sample location, depth interval and time of collection. Sample containers were then wrapped in protective shipping material (such as bubble wrap) and be placed in a cooler with ice. Ice was placed in and around the samples to ensure uniform and quick chilling. Chemical ice was not used.

The locations of the vibracore and Russian Peat Corer samples are indicated on a figure contained within **Appendix 36**. An additional figure within **Appendix 36** notes the PCB

concentrations for samples analyzed at each location. A summary of the data is attached as tables within **Appendix 36**. The peat core and vibracore logs are attached within **Appendix 36**. The analytical data for sediment sample results is also attached within **Appendix 36**.

A representative portion of over-water sample collection was observed by Tribal Representatives.

5.2. Federal Channel Sampling and Analysis

Although dredging within the Federal Channel should technically be unnecessary; since the Federal Navigation Project has not been maintained in many decades, maintenance dredging may be necessary to ensure an appropriate water depth for vessels. The US Army Corps of Engineers plans to conduct maintenance dredging of New Bedford Harbor in the near future and has already completed an expansive characterization of the sediments within the Federal Channel. A 2007 report produced by USACE, containing the results of USACE sampling within the Federal Channel to characterize sediments in preparation for the Federal Navigation Project maintenance dredge is attached as **Appendix 37**.

5.3. Water Column Sampling

In order to determine what risk to the environment may be posed by sediments suspended in the water column during construction activities, twelve water column samples were collected at the site in four locations. During dredging, pile-driving, and filling activities it is expected that there will be a localized increase in the volume of suspended sediment in the water column. Water column samples were collected to assess potential contamination in the water column that may affect the water quality at the site from these activities. Water samples were analyzed for

turbidity (utilizing a real-time turbidity meter) and PCBs (22 NOAA Congeners by Modified EPA Method 8270C), 13 Priority Pollutant Metals (EPA Method 6020A/7471), SVOCs (EPA Method 8270C), and Total Petroleum Hydrocarbons (EPA Method 8015) (utilizing an analytical laboratory).

Water samples were collected within proposed dredge area from approximately two (2) feet below the water surface, the approximate midpoint of the water column, and approximately two (2) feet off the bottom (i.e., two feet above the sediment) to provide a representative sample of pre-dredge conditions at the site. A Kemmerer sampler was used to collect the water samples. Efforts were made to ensure that there was not contamination from surface sheens or other sources while the sample was being collected or the device was being lowered into the water. The collection point was recorded and noted using a portable GPS device. The water was placed directly from the sampling device into clean laboratory supplied glassware, sealed and placed in a cooler and transported to the laboratory.

The locations of the water column sample locations are indicated on a figure contained within **Appendix 36**. A summary of the turbidity measurements as well as the analytical data is attached as tables within **Appendix 36**. The analytical data for sediment sample results is also attached within **Appendix 36**.

5.4. Upland Geophysical Investigation

A geophysical investigation is a non-intrusive means of quickly gathering subsurface information, over a large area, on subsurface anomalies/structures that may contain and or be indicative of contamination, including asbestos-covered piping and other building debris possibly containing asbestos that may not be located within the former building footprint or other

targeted locations for investigation as well as remnants of buried tanks and fill areas containing potentially unsuitable materials.

A geophysical investigation was performed on the upland areas of the South Terminal CDF. The geophysical survey was conducted on the entire property using Time Domain Electromagnetics (TDEM) followed by Ground Penetrating Radar (GPR). GPR was used in conjunction with TDEM data to better characterize electromagnetic anomalies. The purpose of the investigation was to provide information on the character and conditions of the subsurface within the boundaries of the proposed project.

The investigation was intended to aid in determining whether any infrastructure which may have serviced the mill remains below the ground surface. Geophysical methods may reveal the presence of underground storage tanks, metallic pipelines, and extent of buried debris, foundations, and voids. As previous investigations at the site had identified bulk ACM, which could be associated with building demolition debris, it was anticipated that buried debris would be the likeliest location for the presence of any additional ACM onsite. The geophysical survey information was used with complementary geotechnical data in characterizing the subsurface site conditions.

A summary report of the Geophysical Investigation is attached as **Appendix 38**.

5.5. Upland Sampling and Assessment

Nineteen (19) test pits and eight (8) soil borings, finished as monitoring wells, were completed during an initial investigation at the Site. A second round of investigation included the advancement of thirty-eight (38) test pits. A third round of investigation included the advancement of fifteen (15) test pits. Laboratory testing results for soil samples collected during

this initial phase of work identified varying levels of contamination. Polycyclic Aromatic Hydrocarbons (PAHs), PCBs, Total Petroleum Hydrocarbons (TPH), Extractable Petroleum Hydrocarbons (EPH; C11-C22 Aromatics carbon fraction) and lead were detected at one or more locations at concentrations above their respective Massachusetts Contingency Plan (MCP) Reportable Concentrations (RCs) for Soil Category S-2.

In particular, elevated levels of heavier-end PAHs and TPH were detected in a soil sample collected from Test Pit 6 (TP-6), a potential location for what may have been a former gas holder at the historic Potomska Mills complex (identified from historic fire insurance maps and the results of the geophysics investigations), which used to operate within the upland areas. In addition, an elevated concentration of EPH C11-C22 Aromatic carbon fraction was detected in a duplicate soil sample from TP-6. The Relative Percent Difference (RPD) between the duplicate sample and the soil sample it was split from was very high, reflecting the heterogeneity of the sample.

Elevated levels of PCBs (Aroclor 1254) were also detected in TP-4 and TP-2, and to a lesser extent at TP-3, TP-9, TP13 and TP17. Samples were collected from shallow fill materials (upper five feet). Except for TP-13 and TP-17, debris, likely remnants of the former Potomska Mills complex, which was historically present on the upland properties, were observed in the test pits where elevated constituents were detected. The elevated lead concentration was detected in a sample collected from a coal ash layer in TP-5.

The PCB type detected in soil at the Site during initial field activities was identified by the laboratory as Aroclor 1254; however, the laboratory noted on multiple samples that a mixture of PCBs was present, and that identification of Aroclor 1254 was often a simplification of the results. Additional analyses of samples collected during subsequent investigations indicated the

presence of Aroclors 1260 and 1016/1242 (the investigations are discussed in more detail below). The elevated PCB concentrations were detected in shallow samples collected in the upper five feet of fill materials with the highest levels being detected in fill materials containing brick that may be remnants of former Potomska Mill buildings.

The Site history suggests that the PCBs predate 1978, when TSCA was promulgated. PCBs have been detected below existing grade and are associated with areas where building debris, likely remnants of the former Potomska Mill buildings, are present. Historical information indicates that most of the upland area has been vacant, with no industrial activities, since the demolition of the former Mill complex in the 1930's and 1940's. Also, the observed distribution (typically below grade) and distribution across the Site is not suggestive of dumping.

Elevated concentrations of petroleum-related constituents were detected in samples that exhibited a creosote-like odor. These samples also exhibited heavier-end PAHs which may be indicative of a heavier fuel consistent with the fuels contained in gas holders. Bulk asbestos was not observed in test pits or borings advanced to date.

Test pits, soil borings and monitoring well locations, are shown on figures attached within Appendix **39.** The laboratory testing program and testing results for soil and groundwater samples are summarized on Tables 1 through 12, also included within **Appendix 39**. The laboratory data was compared to the applicable MCP reporting criteria (MCP Reportable Concentrations for Soil Category S-2 and Groundwater Category GW-2), and to the more conservative MCP Method 1 Standards (GW-3/S-1 and GW-3).

FIELD PROGRAM

Test Pit, Soil Borings and Monitoring Well Installations

As previously mentioned, during the initial investigative activities, 19 test pits (TP-1A through TP-17) were excavated between April 25, 2011 and April 27, 2011. The initial phase also included eight (8) soil borings completed as monitoring wells that were advanced between May 2, 2011 and May 13, 2011. Thirteen additional borings were completed for geotechnical purposes. Additional investigative activities included the advancement of 38 test pits that were excavated between July 18, 2011 and July 25, 2011. The 38 test pit excavations were advanced in the areas of TP-1, TP-2, TP-3, TP-4, TP-6, TP-9, TP-13 and TP-17. A final round of 15 test pits was advanced on August 11, 2011. These test pits were advanced in the area of TP-4, TP-2 and TP-6. The second and third round of test pits were performed to confirm prior observations and to delineate the extent of PCB, PAH and/or TPH/EPH impacts in fill materials in these areas. Test pit logs and soil boring/monitoring well logs are included in **Appendix 39.**

Test pits were advanced using a Case 590, Komatsu PC90 or a Caterpillar B315 excavator. Due to the proximity of some of the test pits to wetland resources, hay bales were used to reduce erosion and grass seed was spread and covered with hay to promote re-growth of grass. Soil borings were advanced using a drill rig mounted on an all-terrain vehicle using drive-and-wash drilling methods. Two-inch PVC monitoring wells were set to span the water table observed during drilling. Monitoring wells were located immediately adjacent to (on the downgradient side) of test pits where evidence of potential contamination was observed during the test pit program. Each monitoring well was secured by locking steel casing set in a concrete pad. Test pits and soil boring/monitoring well installations were monitored by an Apex engineer. Test pits, soil borings and monitoring well locations are shown on a figure contained within **Appendix 39**.

During the advancement of TP-1A through TP17, soil samples were collected for field screening using DEP's jar headspace screening method. The material removed from the test pits, side-walls of the test pits, and the bottom of test pits were observed for visual and olfactory evidence of contamination, and for possible materials that appear to be ACM. Evidence of ACM was not observed at any of the test pit locations across the Site. Soil samples were screened for total VOCs using a photo-ionization detector (PID). Samples exhibiting PID readings and/or visual and/or olfactory evidence of contamination were collected for laboratory analysis. If potential contamination is not observed, a sample was collected from immediately above the saturated zone or from fill materials. Each test pit was backfilled with the excavated soils in the general sequence the soils were removed. Each test pit location was recorded at the time of excavation using a handheld Global Positioning System (GPS) instrument with coordinates in NAD 83 State Plane, Massachusetts Mainland Zone.

During the advancement of the second and third round of test pits, each series starting with a TP-1, TP-2, TP-3, TP-4, TP-6, TP-9, TP-13, TP-17 or TP-13/17 prefix, the test pits were extended laterally and/or moved outward away from the original test pits when observations indicated similar subsurface conditions to the initial test pits and/or if evidence of contamination was observed (i.e., extended in an effort to reach a "clean" edge). Soil sample collection differed from the first round and was designed to delineate, laterally and vertically, the extent of contamination in a given area. At select test pit locations, soil samples were collected from similar depths and soils to prior samples that exhibited elevated constituent concentrations. Additionally, one near surface sample was collected from above the impacted zone and one deeper sample from below the impacted zone to assess the thickness and vertical extent of

contamination. PID field screening, backfilling, and GPS location determinations were consistent with methods used during advancement of the initial test pits.

Soil and Groundwater Sampling and Analyses

Tables 1 and 2 present a summary of analyses performed, per location, for soil and groundwater samples respectively.

Soil

During the initial phase of 17 test pits and 8 soil borings, soil samples were collected and analyzed for the 13 Priority Pollutant Metals (EPA Method 6020A/7471), PCB Aroclors (EPA Method 8082 With Non-Target ECD Peaks Reported), total petroleum hydrocarbons (EPA Method 8015), and semi-volatile organic compounds (SVOCs by Method 8270C). If evidence of potential petroleum-related contamination was observed, soil samples were submitted for extractable petroleum hydrocarbons (Massachusetts Method MAEPH) and/or volatile petroleum hydrocarbons (Massachusetts Method MAVPH) including the target compounds, where applicable. If elevated headspace readings are detected then the soil sample was submitted for VOCs (EPA Method 8260). If metals analyses indicate concentrations above the "20 times rule", TCLP analyses were performed on the detected constituent exhibiting the elevated concentration.

During the second and third round of test pits, the analyses were tailored to address contaminant impacts observed in a given area. For samples collected in the area of TP-2, TP-3, TP-4, and TP6, one sample from each test pit was analyzed for PCBs, SVOCs and EPH. For the nine test pits advanced in the area of TP-13, TP17, and TP-9, samples were collected and analyzed for PCBs. Samples were selected from similar depths and soil/fill types to prior

samples that exhibited elevated constituent concentrations. In addition, one near surface sample ("A" designation on samples) was collected from above the impacted zone and one deeper sample ("B" designation on samples) from below the impacted zone was collected and analyzed for PCBs to assess the thickness and vertical extent of PCB contamination ("M" designation on samples indicated the middle sample collected).

For soil borings, soil samples were collected continuously using a two foot long split spoon sampler. Each sample was logged by an engineer and placed in a clean glass jar. Each sample was then field screened using DEP's jar headspace method. The soil sample selection process was consistent with the approach used for the first phase of test pits. Selected samples from soil borings were submitted and analyzed for the 13 Priority Pollutant Metals (EPA Method 6020A/7471), PCB Aroclors (EPA Method 8082 With Non-Target ECD Peaks Reported), TPH (EPA Method 8015), and SVOCs (Method 8270C). If elevated PID readings and potential petroleum-related impacts to soil were observed during drilling, then soil samples were submitted for EPH (Massachusetts Method MAEPH) and/or VPH (Massachusetts Method MAVPH) including the target compounds, and VOCs (EPA Method 8260). Note that soil samples collected from the geotechnical borings were also PID field screened and observations were made with regard to potential environmental contamination.

Groundwater

Prior to sampling each monitoring well, the well was developed and allowed to reach equilibrium with the surrounding aquifer before sampling. During well development and groundwater sampling, personnel monitored groundwater parameters including turbidity, pH, conductivity and temperature. Each well was allowed to equilibrate for at least one week prior to

sampling. Prior to sampling, the depth to groundwater was recorded. Monitoring wells were sampled using low-flow sampling to minimize turbidity in the samples.

Following sampling activities, the measuring point elevations (top of the highest point of PVC) and the ground surface elevations for each well was surveyed. Elevations are referenced to NAD 83 State Plane, Massachusetts Mainland Zone.

Depending on the contaminants of concern that were indentified during the initial test pits, soil sampling and testing program, monitoring wells were sampled and analyzed for PCB Aroclors (EPA Method 8082 With Non-Target ECD Peaks Reported), 13 Priority Pollutant Metals (EPA Method 6020A/7471), SVOCs (EPA Method 8270C), and Total Petroleum Hydrocarbons (EPA Method 8015). Select groundwater samples, collected at locations adjacent to test pits where elevated PID readings were recorded, were also analyzed for VOCs (via EPA Method 8260).

Sampling Quality Control

Quality Assurance/Quality Control (QA/QC) duplicate samples were collected at the rate of up to one duplicate for every ten samples per sample matrix. Samples were collected and labeled in such a manner as to make them easily associated with the primary samples.

LABORATORY TESTING RESULTS

Soil Testing Results

Laboratory testing for soil samples are summarized on **Tables 3 through 7**. Testing results are compared to the MCP Reportable Concentrations (RCs) for soil category S-2, MCP risk-based standards for categories S-1/GW-3 (most stringent and included for comparison

purposes only), S-3/GW-3 (standards considered applicable for Site after development), and MCP Upper Concentration Limits (UCLs).

PCBs: One hundred fourteen soil samples, collected from test pits and soil borings, were analyzed for PCBs. PCBs were detected in 77 of the 114 samples. Detected PCB concentrations ranged from 0.0059 mg/kg (or ppm) in the sample collected at TP-1 to 989 mg/kg in the middle sample collected from TP4-1-W-M (approximately 3.8 to 4.8 feet). PCBs were detected at concentrations greater than 50 mg/kg in six samples including TP-2 (75 mg/kg; 0 to 3.7 feet), TP-4 (610 mg/kg; 0.5 to 1.2 feet), TP4-W-1 (641 mg/kg; 0 to 3.8 feet), TP4-2W (480 mg/kg; 0.4 to 2.5 feet), and TP4-1NW-A (100 mg/kg; 0 to 1.3 feet). The majority of PCB concentrations were less than 10 mg/kg. Detected PCB concentrations at several locations exceed the MCP RCS-2 criteria of 3 mg/kg and several detections exceeded MCP Method 1 risk-based standards for Soil Categories S-1 and S-3/Groundwater Category GW-3 (S-1/GW-3 and S-3/GW-3). The detections greater than 100 mg/kg exceed the MCP UCL of 100 mg/kg. The higher detections at TP-2, TP-4, TP4-W, TP4-2W, and TP4-1NW-A would be considered a PCB-remediation waste under TSCA (greater than 50 mg/kg). At each location, the vertical extent of PCBs was delineated.

TPH: Twenty-six soil samples were analyzed for TPH. TPH was detected in 19 of 26 samples. Detected TPH concentrations ranged from 45.4 mg/kg at TP-13 (1.2 to 4 feet) to 5,900 mg/kg at TP-6 (3 to 4 feet). The sample from TP-6 displayed a creosote-like odor. The next highest concentration was 2,180 mg/kg at TP-2 (0 to 3.7 feet). The TPH concentration detected at TP-6 exceeds the MCP RCS-2 reporting criteria (3,000 mg/kg) and the concentrations detected at TP-2

and TP-6 exceed the most stringent MCP risk-based for S-1/GW-3 (1,000 mg/kg) standard and at TP-6 the S-3/GW-3 (5,000 mg/kg) standard.

EPH: Fifty-four soil samples were analyzed for EPH. EPH was detected in 45 of 54 samples. Detected EPH compounds include several ranges of carbon fractions (C9-C18 Aliphatics, C19-C36 Aliphatics, and C11-C22 Aromatics). Adjusted C11-C22 Aromatics ranged from 7.22 mg/kg at TP-7-NW-B to 17,800 mg/kg at TP-6-1-N-H. The C11-C22 Aromatics concentration detected at TP-6-1-N-H exceeds the MCP RCS-2 reporting criteria (3,000 mg/kg) as well the MCP Upper Concentration Limit (UCL) (10,000 mg/kg), which is a level of contamination which may pose a significant risk of harm to public welfare and the environment in the future.

VPH: Five soil samples were analyzed for VPH. VPH was detected in five samples. VPH carbon fraction C9-C12 Aliphatics and C9-C10 Aromatics were detected at concentrations below applicable reporting criteria and Method 1 standards. Samples were selected for VPH based on elevated PID readings and observed creosote and/or petroleum-like odors.

VOCs: Sixteen soil samples were analyzed for VOCs. VOCs were detected in 10 of 16 samples. With the exception of tetracholorethene being detected at a low level just above the method reporting limit, several petroleum-related VOCs were detected at low concentrations below their applicable MCP reporting criteria and MCP Method 1 risk-based standards.

SVOCs: Seventy-two soil samples were analyzed for SVOCs. SVOCs were detected in 58 of 72 samples. Several SVOCs that are referred to as PAHs were detected in fill materials at the Site.

Heavier end PAHs, (e.g., benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene) and two petroleum- related SVOCs (naphthalene and 2-methylenaphthalene) were detected at elevated levels primarily in the area of TP-6 were creosote-like odors were observed in the fill materials and at TP-2 where building debris and asphaltic like materials were observed. Several detected SVOCs, primarily in the areas of TP-6 and TP-2, exceeded MCP RCS-2 reporting criteria and MCP Method 1 risk-based standards.

13 Priority Pollutant Metals: Nineteen soil samples were analyzed for the 13 Priority Pollutant Metals. With the exception of TP5 and TP17 where lead was detected at 580 mg/kg (1.2 to 2 feet) and 561 mg/kg (2 to 4 feet), respectively, detected metals concentrations were low and below their applicable MCP regulatory standards. The lead detects in TP5 and TP17 exceed the MCP RCS-2 and MCP Method 1 standard of 300 mg/kg. The TP5 and TP17 samples were collected from a layer containing coal and ash, and as such, are exempt from the MCP reporting requirements per the notification exemption contained in Section 40.0317(9) of the MCP. TCLP testing was performed on five soil samples where lead was detected above 100 mg/kg which exceeds the "20 times rule". TCLP analyses results were non-detect in three samples and 0.56 mg/l (ppm) in TP2 and 18 mg/l in TP5 which is above the TCLP limit of 5 mg/l indicating the potential for lead to leach into groundwater. However, lead was not detected in the groundwater sample collected from MW-7, which is located downgradient of TP5.

Groundwater Testing Results

Laboratory testing for groundwater samples are summarized on **Tables 8 through 12**. Testing results are compared to the MCP RCs for groundwater category GW-2, MCP risk-based standards for category GW-3 and MCP Upper Concentration Limits (UCLs).

PCBs: Eight groundwater samples were analyzed for PCBs. PCBs were not detected in any of the groundwater samples. Monitoring wells are located immediately downgradient of areas where PCBs have been detected at elevated levels in soil.

TPH: Eight groundwater samples were analyzed for TPH. TPH was detected in one of nine monitoring wells sampled. TPH was reported at a concentration of 3,350 ug/l (ppb or 3.35 ppm) in MW-6, which is below its applicable MCP criteria and standard.

EPH: Two groundwater samples were collected and analyzed for EPH. The two monitoring wells MW-7 and MW-8 are located immediately downgradient of areas were evidence of petroleum-related contamination was observed in soil. One EPH carbon fraction, C11-C22 Aromatics was detected at concentrations of 2,710 ug/l and 140 ug/l which are below the applicable MCP criteria and standard.

VPH: Two groundwater samples were collected and analyzed for VPH. The two monitoring wells MW-7 and MW-8 are located immediately downgradient of areas were evidence of petroleum-related contamination was observed in soil. One VPH carbon fraction, C9-C10 Aromatics, was reported at a concentration of 3,730 ug/l, which is below its applicable MCP criteria and standard.

VOCs: Eight groundwater samples were collected and analyzed for VOCs. VOCs were detected in two (MW-7 and MW-8) of eight monitoring wells sampled. Monitoring wells MW-7 and MW-8 are located immediately downgradient of areas were evidence of petroleum-related contamination was observed in soil. One VOC, naphthalene, exceeded its MCP RCGW-2 criteria in monitoring well MW-7 (3,900 ug/l versus 1,000 ug/l), but was below its applicable MCP Method 1 GW-3 standard.

SVOCs: Eight groundwater samples were collected and analyzed for SVOCs. SVOCs were detected in two (MW-7 and MW-8) of eight monitoring wells sampled. Monitoring wells MW-7 and MW-8 are located immediately downgradient of areas were evidence of petroleum-related contamination was observed in soil. The detected SVOCs were reported at concentrations below their applicable MCP criteria and standards.

13 Priority Pollutant Metals: Eight groundwater samples were collected and analyzed for the 13 Priority Pollutant metals. Various metals were detected in the Site monitoring wells at low concentrations below their applicable MCP criteria and standards.

SUBSURFACE CONDITIONS

Based on the recently completed test pits and soil borings information coupled with information generated by others, the Site is generally characterized by approximately 3 to 4 feet of granular fill containing anthropogenic materials that appear to be related to the former Mill complex, underlain by sand with varying amounts of silt and/or a brown to black 0.5 to 1-foot

fibrous peat layer, overlying silty sands overlying bedrock. Anthropogenic materials included brick, an approximate 2 to 3-foot ash and clinker layer (generally occurred 1 to 3 feet below existing grade), and remnants of stone foundations.

Based on the environmental data, PCBs are prevalent across the Site and were typically observed in fill materials containing ash and brick debris. PCB concentrations are highest in the areas of TP-2 and TP-4 and decrease markedly away from this area. Petroleum-related impacts, apparently attributable to a former gas holder, are prevalent in the area of TP-6, slightly north of where the former gas holder was anticipated based on historic plans. Elevated levels of heavier-end PAHs were observed at various locations across the Site in samples collected from the ash layer and/or from the petroleum impacted soil that displayed a creosote-like odor.

PROPOSED REMEDIAL APPROACH

There are three primary areas on the Site that are proposed for excavation (see figure outlining those locations within **Appendix 39**), that require remediation to (a) remove source areas of contamination as required by the Massachusetts Contingency Plan, 310 CMR 40.0000 ("MCP") administered by the Department, (b) remove constituent concentrations in soil that may pose an unacceptable risk, and (c) address TSCA-requirements for PCB-remediation waste. The areas requiring remediation are located in the areas of TP-6 and the TP-6 series test pits, TP-2 and TP-4 and the series of test pits associated with these test pits. Petroleum-related contamination has been identified in the TP-6 area, and is likely attributable to a former gas holder, and PCB contamination is located in the area of TP-2 and TP-4 and is likely attributable to former PCB-use in the former Potomska Mills complex. Coincident with the removal of

petroleum and PCB-impacted soils, elevated levels of PAHs will also be removed, primarily in the area of TP-6.

Remedial goals are to achieve a Condition of No Significant Risk under the MCP, and to achieve PCB cleanup levels that address TSCA requirements. PCB concentrations in soil above 25 mg/kg will be excavated and disposed of offsite, in order to satisfy TSCA requirements for Low Occupancy Areas with a Deed Restriction and also in order to achieve a level acceptable under the MCP. The proposed development of the Site includes capping of the Site with a minimum of 24-inches of compacted soil and gravel. This layer is proposed to satisfy cap requirements under 40 CFR 761(a) (7) that call for either 10-inches of compacted soil or 6-inches of concrete or asphalt in areas where residual PCB concentrations range from greater than 50 mg/kg to less than or equal to 100 mg/kg. As previously mentioned, Institutional Controls in the form of a Deed Restriction will be instituted over the site.

The vertical and lateral extent of petroleum-related and PCB impacts to soil has been determined via test pits advanced to date. In general, a silty sand layer underlies the impacted zones and is a "clean" layer and marks the vertical extent of contamination. The thickness of the impacted zones is generally about 2 to 3 feet.

The locations of the test pits are indicated on a figure contained within **Appendix 39**; also on that figure is an outline of the three areas to be addressed via excavation and off-site disposal of soil. Tables summarizing soil and groundwater data collected and to date are attached within **Appendix 39**. Soil boring and groundwater monitoring well borings, as well as test pit logs are attached within **Appendix 39**. The analytical data for soil and groundwater sample results is also attached within **Appendix 39**.

5.6. Background Air Sampling

Background sampling were conducted at one location onsite and consisted of three 24-hour samples collected on days on three consecutive weeks for PCB analysis. Samples were run for 10 PCB Homologues (EPA Method 1668A). Additionally, three 8-hour sampling events were completed with a real-time particulate monitor to monitor background particulate concentrations. The report summarizing the background PCB air sampling, as well as the data from the real-time particulate monitoring is attached as **Appendix 40**.

5.7. Hydraulic Conductivity

In order to assess hydraulic conductivity at the facility for future modeling purposes, several analyses were conducted. Slug tests were performed in each monitoring well to evaluate hydraulic conductivity across the facility. In addition, two samples were collected from the intertidal and two samples were collected from the sub-tidal areas that are anticipated to be filled and two samples of sediment were collected during sediment sampling activities.

Samples of the intertidal and sub-tidal areas (#1 through #4) were collected using a Russian Peat Corer, in order to avoid disturbance to the existing benthic environment. Additionally, two sediment samples were collected and run for hydraulic conductivity untreated (#5 and #6) and separately also treated with 7% concrete (samples mixed with concrete represent the hydraulic conductivity of stabilized sediment). After mixture and curing was complete, a hydraulic conductivity test was conducted on the stabilized sediment (#5A and #6A – please note that the laboratory ran two hydraulic conductivity tests each on #5A and #6A). Either ASTM

2434 or ASTM D 5084 were performed (depending on the sediment character) to determine hydraulic conductivity of sediment samples.

The locations of the hydraulic conductivity sample locations are indicated on a figure contained within **Appendix 41**. The locations of monitoring wells are indicated on a figure contained within **Appendix 39**. The analytical data for sediment sample results are also attached within **Appendix 41**.

Note: Hydraulic conductivity analysis was performed at the request of US EPA; it is the Commonwealth's understanding that US EPA originally requested hydraulic conductivity analysis to better understand the potential fate and transport of potentially contaminated dredge material once it was dewatered and used as fill within the South Terminal CDF (an approach that was previously proposed by the Commonwealth). However, by virtue of the submission of this restated document, the Commonwealth's approach has changed in that the Commonwealth now anticipates contaminated material to be disposed within a CAD Cell, rather than within the South Terminal CDF. Therefore, the Commonwealth does not, at this time, believe that hydraulic conductivity analysis is necessary.

5.8. Archeological Investigations

Under the direction of US EPA, the Massachusetts Board of Underwater Archaeology (MBUAR) and the Commonwealth of Massachusetts State Historic Preservation Officer (SHPO), an archeological investigation was conducted by the Commonwealth of Massachusetts during the summer, fall, and winter of 2010 within the areas projected to be impacted by the South Terminal CDF project. As result of those investigations, two locations were identified by

the archeological team as containing Paleosols – one area of intertidal Paleosol and one area of subtidal Paleosol and one subaqueous shipwreck was located.

Five summary reports outlining the archeological investigations are attached as **Appendix 42**: an upland archeological investigation report, an intertidal archeological investigation report, a subtidal archeological investigation report, a Phase I & IB underwater archeological investigation, and a Phase II investigation of a located shipwreck. Also contained within **Appendix 42** are concurrence letters from SHPO and MBUAR agreeing with the conclusion that the shipwreck does not meet the Criteria of Eligibility for listing in the National Register of Historic Places (36 CFR Part 60), and that the site lacks integrity, and that no further investigation is warranted.

On January 12, 2011, the Commonwealth issued a letter to the SHPO and MBUAR (both letters with their attachments are included within **Appendix 43**) noting that the footprint of the facility would be altered to avoid impact to the mapped intertidal or subtidal Paleosols via either filling or via dredging associated with the proposed project.

The location and boundaries of the Paleosols are shown on a figure included within **Appendix 43** (please note that the figure in question is included twice as it was attached to both letters included within **Appendix 43**). On January 12, 2011, the Commonwealth issued a letter to the SHPO and MBUAR (both letters with their attachments are included within **Appendix 43**) noting that the footprint of the facility would be altered to avoid impact to the mapped Paleosols via either filling or via dredging associated with the proposed project. The figure within **Appendix 43** notes the facility footprint at the start of the archeological investigation (in red) and the facility footprint proposed to avoid impact to the Paleosol areas (in black). The primary difference between the footprint included within the August 25, 2010 submission to USEPA and

the footprint noted on the drawing within **Appendix 43** is a slight re-orientation of the southern face of the facility.

5.9. Communication With Representatives From Wampanoag Tribes

Direct communication with Lois Adams, Branch Chief of Grants, Tribal, Community and Municipal Assistance after the submission of the Commonwealth's January 12, 2011 letter, indicated that representatives from the Aquinnah and Mashpee Wampanoag Tribes wished to meet to discuss plans for the facility. A meeting was held at 2 P.M. on March 15, 2011 at the New Bedford Whaling Museum Visitor's Center, located at 33 Williams Street, in New Bedford Massachusetts. The minutes from that meeting, as prepared by Lois Adams, are attached as **Appendix 44**. At that meeting, representatives from the Aquinnah Tribe (Ms. Bettina Washington) and Mashpee Tribe (Mr. Chuckie Green) presented concerns associated with the proposed construction, and its potential to impact the Paleosol areas:

- The Tribal Representatives were concerned that pre-design investigations or that construction impacts would harm the Paleosol areas.

  Reply: *The Commonwealth outlined that construction methodology would be instituted such that the Paleosol would be protected during construction. Such protections included keeping construction equipment out of the Paleosol area. The Commonwealth presented a printout from the GPS software (included within* ***Appendix 44****) utilized to locate test borings or other investigations and noted that the Paleosol areas were clearly noted, and that field personnel could at all times see where they were in relation to the Paleosol areas in order to avoid impacts to the areas.*

- The Tribal Representatives stated that they had not received all of the documentation associated with the archeological investigations conducted as of the date of the meeting, and requested additional copies.

  Reply: *The Commonwealth forwarded additional copies of all reports to the Tribal Representatives soon after the conclusion of the meeting. Receipts from the tribal representatives, as well as from Ms. Lois Adams at US EPA are attached as* ***Appendix 45****.*

- The Tribal Representatives requested that a core sample from a boring from one archeological report be re-run to determine if there were any potential archeologically significant findings, based on the initial visual description of the boring.

  Reply: *The Commonwealth performed additional analyses on the boring in question, and produced a report outlining its findings (attached as* ***Appendix 46****). The report was forwarded to the Tribal Representatives (receipts for the report are attached as* ***Appendix 47****).*

- The Tribal Representatives requested that (1) it have direct contact with the Commonwealth; (2) cultural monitoring be ongoing during construction when work is completed in the vicinity of the Paleosol; (3) once a scope of work for work in the vicinity of the Paleosol was finalized that the scope of work be forwarded *to the Tribal Representatives for their* review; and protocol and criteria be established outlining procedures shoul*d an object be discovered during constru*ction *activities.*

  Reply: *The Commonwealth agreed to these requests.*

- Although the Aquinnah Wampanoag Tribe representative stated that they reserved the right to comment in the future, neither Tribe has offered any additional comments concerning the Commonwealth's efforts to protect the designated Paleosol area.

Note: Sometime in August of 2011, Lois Adams, Branch Chief of Grants, Tribal, Community and Municipal Assistance, advised the Commonwealth that in light of a conflict of interest, she was compelled to recuse herself from further involvement with this project.

5.10. CAD Cell Permitting Information

The construction and management of CAD Cells within New Bedford Harbor have, to date, been overseen by the New Bedford Harbor Development Commission and the Town of Fairhaven, under the oversight of the State Enhanced Remedy Committee. The permitting authority for siting CAD Cells within New Bedford Harbor was established within the scope of the Dredge Materials Management Planning process (DMMP process) by the Commonwealth of Massachusetts' Office of Coastal Zone Management during a permitting process that began in 1998 and ended in 2003. During that permitting process, a number of relevant investigations, such as Essential Fish Habitat Assessments, archeological assessments, sediment sampling, seismic analyses, and alternatives analyses were completed in support of the permitting process.

The following is a list of relevant links to the permitting documents associated with the DMMP process from the Massachusetts Office of Coastal Zone Management website:

- http://www.mass.gov/czm/dredgereports/1999/dmmp-99-03.pdf
- http://www.mass.gov/czm/dredgereports/1999/dmmp-99-06.pdf
- http://www.mass.gov/czm/nb_dmmp_deir.htm
- http://www.mass.gov/czm/dredgereports/2003/feirnb-f.htm

6. IMPACT ASSESSMENT OF PROPOSED PROJECT

The following section outlines the Commonwealth's assessment of primary and secondary impacts associated with the project, resource area delineation, and impact assessment of the proposed project.

6.1. Flood Plain Impacts

Construction of the South Terminal CDF will result in minor flood storage loss due to filling within the footprint of the facility. USEPA asked us to assess the impact of the loss of flood storage volume, particularly under the circumstance of a major coastal storm when the New Bedford Hurricane Barrier would be closed and heavy rain is expected within the watershed for New Bedford Harbor. This analysis has been completed utilizing a combination of 100-year flood elevations associated with FEMA flood maps as well as an analysis of the impact of filling within New Bedford Harbor conducted by the US Army Corps of Engineers.

The US Army Corps of Engineers assessed the potential impacts that filling and diking may have upon the elevation of flood levels within New Bedford Harbor when the New Bedford Hurricane Barrier is closed and heavy rains are expected within the document entitled "Hydrology of Floods, New Bedford Harbor, Massachusetts" completed by the Hydrologic Engineering Section of the Water Control Branch, Engineering Division of the Department of the Army, Corps of Engineers, New England Division, dated September 1987. This document states that "for every 100 acres of harbor area lost above +2.0 feet NGVD, but below +6.0, either by diking or filling, there will be a resulting rise in project design flood level of about 0.2 feet." 100 acres lost between +2.0 feet and +6.0 feet (4 feet of filling over 100 acres) equates to approximately 400

acre-feet, the flood storage loss of which is estimated to result in a rise in flood level within New Bedford Harbor of 0.2 feet.

The following table outlines the volume of material that will be placed within the footprint of the facility between elevation +2.0 and elevation +6.0 NGVD as follows:

Elevation	Area Within Project Footprint (ft^2)	Average Area (ft^2)	Average Volume (yd^3)
+2.0 NGVD	255475	268235	9934.63
+3.0 NGVD	280995	290990	10777.41
+4.0 NGVD	300985	307308.5	11381.80
+5.0 NGVD	313632	324177	12006.56
+6.0 NGVD	334722	0	0
		TOTAL (yd^3):	**44100.40**

Where:

Area within Project Footprint = Area within the footprint of the facility at the noted elevation.

Average Area = Average between two successive elevations (for example, average between the area of the footprint of the facility at +2.0 NGVD and +3.0 NGVD).

Average Volume = Average Area X 1 Foot (in cubic yards).

The analysis indicates that 44,100 cubic yards of fill equates to approximately 27.33 acre feet of fill material that will be placed between elevation +2.0 and elevation +6.0 NGVD due to the South Terminal CDF project. Therefore, 27.33 acre-feet of flood storage loss equates to a rise in project design flood level of approximately **0.01367 feet**, or **0.164 inches**.

In order to illustrate the impact that a 0.164 inch change in flood elevation would have upon the City of New Bedford, a location was chosen within New Bedford upon which to assess the impact of the vertical change in flood storage elevation (a location at North Terminal along the

New Bedford waterfront). A plan of the location and a cross-section of the area is attached as **Appendix 48**. The FEMA flood map shows that the 100-year flood elevation within New Bedford Harbor is at the elevation of +5 NAVD 88. The location in question was chosen because the area is relatively flat and is near in elevation to the FEMA 100-year flood elevation (between +4 and +6 NAVD 88); therefore, a change in flood elevation is most likely to have the greatest horizontal change in flood water encroachment in this location, and other locations are likely to be impacted less than this location. As can be seen on the cross-section, a vertical change in flood elevation of +0.164 inches, results, in one instance, in a corresponding horizontal flood encroachment of **11.28 inches.** Please note that this represents the horizontal encroachment during a worst-case flooding event, and is analyzed at a representative worst-case location, where the flood elevation occurs within a flat area; other areas within New Bedford Harbor typically display a steeper grade at this flood elevation (and in most cases a much steeper grade). Thus, *other areas within New Bedford Harbor should see significantly less encroachment (if any), either because the 100 year flood elevation is below existing land elevation, or because existing land elevation is steeper than the relatively flat study location. Therefore, the anticipated rise in flood elevation due to filling due to construction of the South Terminal CDF is unlikely to have an adverse impact to the surrounding floodplain.*

6.2. Conformity Analysis for NOx Emissions

Bristol County Massachusetts has been identified as a non-attainment area for ground level ozone as defined by the U.S. Environmental Protection Agency's National Ambient Air Quality Standards (NAAQS). Ground level ozone is formed in a photochemical reaction of volatile

organic compounds (VOCs), carbon monoxide (CO) and nitrogen oxides (NOx). The result of the chemical reaction is tropospheric (ground level) ozone, which is a respiratory irritant. Therefore, limits have been promulgated on the production of nitrogen oxides to control this reaction. The NAAQS does not require detailed air modeling if it is determined that a project is below de minimis levels. The de minimis levels for projects within non-attainment areas for NOx is 100 tons per year and for VOCs is 50 tons per year (see **Appendix 49**).

The conformity analysis has focused upon the construction-level NOx and HC emissions generation, as the site itself is planned to be a staging area for off-shore renewable energy components, which are not anticipated to generate NOx or VOC emissions. To determine the effects of the construction of the South Terminal CDF on the Ambient Air Quality of Bristol County, a matrix of typical heavy construction equipment anticipated to be utilized for the project was prepared. Utilizing USEPA document number NR-009d (Exhaust and Crankcase Emissions Factors for Non-Road Engine Modeling – Compression-Ignition, EPA-420-R-10-018, dated July 2010) a table was prepared utilizing the anticipated equipment and the horsepower and emissions class for each piece of equipment required for construction. This information was utilized to determine an average output of both hydrocarbons (VOCs) and NOx for the equipment.

A table within **Appendix 49** summarizes the construction equipment and the expected emission factor for each piece of equipment. The calculation is for an approximately 15 month long project, with an average of 4 weeks per month, 5 days per week, and 8 hours per day. Utilization factors were added to account for equipment that is present at the site during

construction, but not utilized 8 hours per day. Utilization factors also account for time within which equipment is broken, or unutilized for other reasons. The calculated NOx output is approximately 27.70 tons and approximately 1.3 tons of VOCs; therefore, the project as proposed is anticipated to have emissions below the de minimis levels.

The table indicates that the output of NOx and VOCs are below de minimis levels and should not impact the Ambient Air Quality of the City of New Bedford, the Town Fairhaven and the surrounding Bristol County.

6.3. Neighborhood Analysis

This section outlines the South Terminal CDF's, potential construction and operational phase, truck and noise impacts on New Bedford's residential neighborhoods. The potential impacts would be caused by on site construction activities and routes for truck delivery of construction materials and equipment. For background concentrations of PCBs in air at the site, please see Section 5.6.

The South Terminal CDF site is located within the Designated Port Area for the Port of New Bedford, which has been specifically reserved for water dependent industrial uses by the Commonwealth of Massachusetts. A significant portion of the work conducted within the Designated Port Area is conducted on an as-needed basis, and could occur 24 hours per day, 365 days per year (shipping activities and/or offloading from fishing vessels). The site is at the interface of a Waterfront Industrial and "Industrial B" zoning districts. A "Mixed Used Business District" can be found across Route 18. Several businesses serving the industrial port occupy the

four blocks between Route 18 and the South Terminal CDF area. An estimate of the quantity of increased truck trips is summarized below. The estimate is based on anticipated construction material quantities required for completing construction.

Land clearing, debris removal, crushed stone base delivery, and warehouse const:	5,750 heavy vehicle loads
Bulkhead Construction:	825 heavy vehicle loads
Relieving Platform:	425 heavy vehicle loads
Total:	7,000 heavy vehicle loads

Therefore, there are an estimated 14,000 heavy vehicle trips (in/out) anticipated during construction. Construction would occur over a nine (9) month period. Over the 9 month construction period the average number of trips per weekday would be 39. Typically, those trips would occur between 6AM – 5PM, assuming a 7 AM – 4 PM work day. That further averages out to just over three and a half (3.5) truck trips per hour. Three to four additional trucks each hour represents an insignificant increase in overall traffic for the area within which the South Terminal CDF is proposed for construction.

The area anticipated to have the highest roadway usage due to creation of the new facility is an area located north of Cove Street, east of Route 18 (West Rodney French Boulevard), and South of Conway Street. Within this area, there are a minimum of twelve fish processing facilities already located east of Route 18 and north of Cover Street of the proposed South Terminal CDF that already utilize the side roads within the area for shipping processed fish to its ultimate

destination, which results in a relatively high ambient level of heavy truck traffic within the neighborhood. Additional industry within the neighborhood include several manufacturing facilities, hardware supply companies, an oil terminal, a boat yard and marine service yard, several fishing gear supply companies, a supermarket, a radio station, a retail store, and several restaurants.

The nearest residential neighborhood is in the "Mixed Use Business District" on the opposite side of Route 18 from the South Terminal. There is also a residential neighborhood located to the south of Cove Street. South Terminal is an additional four (4) blocks from the double lane roadway. Reverberant sound from construction activity will be attenuated by distance from the sensitive receptors in the Mixed Use Business District.

The proposed truck route would have vehicles entering the City from Interstate 195 at the Route 18 exit. Route 18 or John Fitzgerald Kennedy Boulevard is a four lane divided highway with direct connection to I-195. This route typically contains heavy truck traffic travelling to various locations within the Designated Port Area. Route 18 has an intersection where the southbound vehicles can turn left on Potomska Street directly into the industrial port. There is roughly a four (4) block distance to the construction area. Likewise, vehicles leaving the construction site can use Potomska Street to take a right onto Route 18 North.

Once construction is complete, usage of adjoining roadways will typically be limited to commuters who will be working at the South Terminal CDF facility, while off-shore renewable energy support is taking place at the facility, due to the likelihood that virtually all of the off-

shore renewable energy components will arrive and leave by ocean-going vessel. When the site is being utilized for terminal operations, the total volume of truck traffic at the site will be similar to that required for construction; however, the truck traffic may be concentrated to specific periods when cargo vessels arrive to unload and/or load.

Due to its increased proximity to the residential neighborhood adjacent to Cove Street, the use of Map Number 21, Lot Number 45 would be utilized with much less frequency than other portions of the terminal. This property (as well as the other, southern ancillary properties) will be utilized primarily for wind blade lay-down. Although 24/7 access is required for the facility, this is anticipated to be required mainly due to issues associated with loading and unloading of vessels and assembly of wind turbines, activities that will not be occurring at the Map Number 21, Lot Number 45; therefore, although some access to the southern portion of that property may occur within a 24/7 timeframe, it will likely be very infrequent. Additionally, due to the anticipated use of the property (lay down of wind blades is anticipated to take place at the far southern end first, and subsequent wind blades are anticipated to be subsequently laid down in a south-to-north fashion as they arrive onsite, and then utilized in a north-to-south fashion), noise caused by operations (when utilized) at this property will be relatively minimal.

The City-Owned parcel (Map Number 25A, Lot Number 48) contains the Gifford Street Boat Ramp. The Gifford Street Boat Ramp is a public boat ramp that has a relatively low usage, due to the presence of two alternate boat ramps within the City. The nearest alternate boat ramp is located on Rodney French Boulevard, approximately 2,500 linear feet to the south, and is much more utilized than Gifford Street. Although, some users of this boat ramp will be

displaced, the disruption is likely to last only one boating season, and the users can be easily relocated to another boat ramp for the one season (this is currently being conducted during repair of another boat ramp, and the disruption has been minimal to the City of New Bedford [i.e., no complaints have been made]). The primary user of the boat ramp is Bayline Boat Yards, which is a boat storage and repair facility located on Gifford Street, adjacent to the boat ramp. Due to the heavy usage of Bayline Boat Yards, an easement agreement will be completed in which Bayline may utilize the boat ramp on an as-needed basis, and the users of the Marine Terminal will work with Bayline to facilitate usage of the boat ramp. A letter expressing its intent to cooperate with Bayline Boat Yard to facilitate access to the Gifford Street Boat Ramp during this project, prepared by the Executive Director of the New Bedford Harbor Development Commission is attached within **Appendix 12**. A letter of support from the owner of Bayline Boat Yard is attached within **Appendix 12**.

6.4. Resource Identification and Direct Impact Assessment

Prior to conducting a resource identification at the site in question, historical records of land use were reviewed. A map prepared by the Massachusetts Office of Coastal Zone Management indicates that the historic high water line at the facility is significantly inland of the current coast line. This map is presented as **Figure 4**.

The project site is located adjacent to New Bedford Harbor in New Bedford, Massachusetts, immediately to the south of the existing South Terminal facility. A Site Locus Map is included with this document as **Figure 1**. The latitude of this site is 41.622936. The longitude of this site is 70.915271. The site is located within the Cape Cod Watershed. The Hydrologic Unit Code for this site is 01090002.

A wetland resource investigation was conducted on April 20, 2010. Elevations of the property were recorded during the land survey and referenced to New Bedford Harbor Mean Lower Low Water datum, and were used to determine the limits of High and Low tides. During the course of this investigation, the presence of historic fill was confirmed in all but one of up to nine separate test pit locations dug to investigate the presence of hydric soils. The fill on the site consisted of angular stone, soil, brick, gravel, asphalt, tar, concrete, steel, automobile and truck tires and inner-tubes, automobile and truck parts, plastic, and glass. In all but one location, man-made materials (brick, asphalt, trash, etc.) were identified within 15 inches of the surface. This was found to be the case even for areas in which hydric soils were noted within the top 10-15 inches of soil and where wetland indicator species (primarily the invasive species *phragmites australis*) were detected. A written description of the results of the investigation are included as **Appendix 50** to this document.

A resource area location map is included as **Figure 5**. The resource area location map notes the location of the historic high water line as a blue stripe running approximately 200 feet inland and parallel to the existing coastline; the area between the historic high water line and the existing high water line consists of filled tidelands. This map also illustrates an area (in brown) within the upland area and within which urban fill has been confirmed (determined via test pit operations as well as visual indications during Apex's site visit). The areas that contained hydric soils within 10-15 inches of the surface and/or contained wetland indicator species are noted on the drawing in green; although, please note that these areas have generally been confirmed to be underlain by urban fill as well, and are primarily populated with invasive species *(phragmites*

australis). This area is an isolated wetland, likely created due to a relative topographical depression. This area is not tidally influenced, and therefore is not a Federal resource area. Please note that no Federal resource areas are present within the southern, ancillary properties, and no expansion of those properties is planned; therefore, no resource area impacts within the southern ancillary properties are noted on **Figure 5**. The New Bedford Conservation Commission chairman has also confirmed that based on his knowledge of site conditions, no state protected wetland resources exist on the southern ancillary properties.

An area to the southwest of the bulkhead extension is paved (white, striped area). It is Apex's understanding that this area is associated with a release under 310 CMR 40.0000 (The Massachusetts Contingency Plan); the remedy for the release at this site is an asphalt cap. Although a full investigation into the vertical and/or horizontal extent of potential contaminants has not been undertaken at the site, it is likely that other areas of the site are also impacted by hazardous materials, due to the presence of large quantities of historic urban fill.

Historically, the majority of the land that will be incorporated into the proposed Facility is former heavy industrial property, the site of an extensive former mill complex. Historical maps, sketches, and photographs indicate that a large textile mill complex known as the *Potomska Mills* occupied approximately 19 acres, or much of the land within the footprint of the proposed facility (see **Figure 6** for historical map with proposed Facility outline). Based on a best-fit overlay of the historical maps onto current conditions noted from recent (2009) aerial photography, the mill complex land appears to have extended inland from the current shoreline to beyond the western-most extents of the proposed Facility, and extended eastward into some

portion of what is now intertidal land. A 1911 "Atlas of the City of New Bedford, Massachusetts" depicts the former mill site covering more than half of the proposed South Terminal Extension Facility main site. Historical information indicates that the Mill began erecting structures on the site around 1871, and that the complex was demolished between 1935 and 1936 (JMA Report: "*Cultural Resources Background Study and Archaeological Sensitivity Assessment – South Terminal Marie Infrastructure Park (Upland Portion)"*, June, 2010). Presently, the land area that covers the former mill complex exhibits areas of hummocky terrain typically indicative of remnant rubble or debris in the subsurface, and portions of the site (particularly the central, northern, and western portions) contain broken pieces of brick and mortar at or just below the ground surface.

It should also be noted that any area under the high water mark within New Bedford Harbor is part of the New Bedford Superfund Site; as such, the area is universally impacted with PCB containing sediments (typically fine-grained organic sediments of varying thicknesses). Although the concentration of PCBs in this fine-grained sediment varies depending upon the location within the Harbor, historic sampling results indicate that the concentration of PCBs within the sediment at the subject site is higher than the upper limit allowed within landfills within the Commonwealth of Massachusetts. As a result of the PCB impacts, areas within New Bedford Harbor are banned from fishing, shellfishing, and lobstering by the United States Environmental Protection Agency (a notice promulgated by USEPA on the bans is included as **Figure 7**).

Although it may be possible to depurate the shellfish of PCB impacts (although it should be noted that opinions vary on whether shellfish depurate PCBs at all), should depuration occur, the PCBs are not anticipated to degrade on their own and depuration of the shellfish within a clean area will only transport the PCBs to the clean location at which the theoretical depuration occurs, thereby transporting Superfund material outside of a Superfund site. Areas at the site (and within New Bedford Harbor as a whole) below the high water mark act as a source of contaminants for the surrounding communities (beginning at Buzzard's Bay), rather than retaining sediment or toxics, as non-impacted wetland areas would be expected to do. Traditional production from within a wetland provides the opposite effect than what is normally anticipated at wetland sites: the production of food or usable products for humans or other living organisms by the wetland areas are harmful, instead of beneficial to humans, wildlife, fish or the environment.

The primary resource areas noted during the field investigation are: intertidal area, shallow, near-shore subtidal area (existing elevation of between -1 and -6 MLLW), deeper subtidal area (existing elevation between -20 and -25 MLLW), and salt marsh area.

Based upon this delineation completed by Apex, the resource areas anticipated to be impacted by completion of this project are as follows:

For areas to be filled for construction of the CDF:

Intertidal area: 1.43 acres.

Shallow, near-shore sub-tidal area:	4.06 acres.
Salt Marsh:	0.18 acres.

Which is a total of approximately 5.67 acres of resource area that will be filled due to completion of this project.

For areas to be dredged to between -14 and -30 MLLW to allow vessel access to the new CDF:

Shallow, near-shore sub-tidal area (to be dredged from between -1 and -6 MLLW to -14 MLLW):	4.43 acres.
Shallow, near-shore sub-tidal area (to be dredged from between -5 and -14 MLLW to -14 MLLW):	4.03 acres.
Shallow, near-shore sub-tidal area (to be dredged from between -1 and -6 MLLW to between -30 and -32 MLLW):	3.68 acres.
Deeper, sub-tidal area (to be dredged from -20 to -25 MLLW to -30 MLLW):	7.01 acres.

Which is a total of approximately 19.15 acres of resource area that will be dredged to create the boat basin in front of the South Terminal CDF and to create the channel for the vessels to access the new facility.

In order to mitigate the Gifford Street Channel re-alignment and to provide mitigation for moorings that will be lost due to construction of the boat basin and the new channel:

Shallow, near-shore sub-tidal area (to be dredged from between

-4 and -6 MLLW to -6 MLLW): 8.01 acres.

In order to construct the new CAD Cell:

Shallow, near-shore sub-tidal area (to be dredged from between

-4 and -6 MLLW to -45 MLLW, and subsequently filled and capped): 8.67 acres.

Potential maintenance dredging of the New Bedford Federal Navigational Project:

Deeper, sub-tidal area

(to be dredged from -26 to -30 MLLW to -30 MLLW): 19.6 acres.

Note that we identify in **Section 6** the functions and values of the areas that will be altered, and we assess avoidance, minimization, and propose mitigation for the estimated losses of these functions and values as explained in **Section 7**, below.

6.4.1. Mudflat

As a result of statements made by USEPA and NOAA-Fisheries during onsite inspection of the proposed location of the South Terminal CDF regarding their observation of intertidal mudflat, a sampling program was completed, with the intention of delineating the extent of mudflat within the intertidal zone at the site. The basis by which the delineation of mudflat was

completed was based upon the definition of mudflat contained within the 40 CFR 230, 404(b)(1), Subpart E (full citation is included within **Appendix 51**):

§ 230.42 Mud flats.

(a) Mud flats are broad flat areas along the sea coast and in coastal rivers to the head of tidal influence and in inland lakes, ponds, and riverine systems. When mud flats are inundated, wind and wave action may resuspend bottom sediments. Coastal mud flats are exposed at extremely low tides and inundated at high tides with the water table at or near the surface of the substrate. The substrate of mud flats contains organic material and particles smaller in size than sand. They are either unvegetated or vegetated only by algal mats.

(b) Possible loss of values: The discharge of dredged or fill material can cause changes in water circulation patterns which may permanently flood or dewater the mud flat or disrupt periodic inundation, resulting in an increase in the rate of erosion or accretion. Such changes can deplete or eliminate mud flat biota, foraging areas, and nursery areas. Changes in inundation patterns can affect the chemical and biological exchange and decomposition process occurring on the mud flat and change the deposition of suspended material affecting the productivity of the area. Changes may reduce the mud flat's capacity to dissipate storm surge runoff.

The cited definition of mudflat states that "the substrate of mud flats contains organic material and particles smaller in size than sand." Given that a grain size analysis of samples collected within the intertidal zone is capable of determining the presence of sand and particles finer than sand, conducting grain size analysis on samples collected within the intertidal zone appeared to be a reasonable method for delineating mudflat onsite.

Samples were collected on a grid within the intertidal zone (mostly biased toward Mean Lower Low Water, as conversations with NOAA-Fisheries personnel had indicated that mudflat would more likely be closer to Mean Lower Low Water). Survey equipment was utilized in order to locate Mean Lower Low Water, to ensure that the samples were being collected at an elevation low enough to ensure that the lowest reach of the intertidal area was being investigated. A plan with the sample locations is included within **Appendix 51**. Samples were submitted to a

laboratory for grain size analysis. The grain size analysis sorts the sediment particles into categories, which are: Cobbles, Coarse Gravel, Fine Gravel, Coarse Sand, Medium Sand, Fine Sand, and Total Fines. Fines are typically silts, clays and organic material (see analytical results contained within **Appendix 51**).

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Based upon the definition of mud flats contained within 40 CFR 230, 404(b)(1), Subpart E, it appeared prudent to assume that samples which presented "mud" (or a high degree of fines) would indicate an area that should be categorized as mudflat. Although the definition of mud flats does not specify what percentage of fines would delineate mudflat, it seems likely that 100% fines would clearly qualify, that greater than 50% fines would likely qualify, that 1% fines would likely not qualify (as areas dominated by sand would likely not be considered "muddy"), and that it was possible that percentages between 50% and 1% might theoretically qualify. The following is a summary of the percentage of fines within the samples sent for grain size analysis:

Sample	% Fines
A1	0.60%
A2	9.10%
B1	0.50%
B2	1.60%
C1	0.90%
C2	0.90%
D1	1.20%
D2	12.80%
E1	1.10%
E2	0.10%
F1	2.30%
F2	0.10%
G1	4.20%
G2	0.50%
G4	0.50%

G5	0.40%
G6	0.80%
H1	4.50%
H2	2.50%
H4	0.20%
H5	0.20%
I1	5.60%
I2	1.00%
I3	0.90%
I4	0.50%

The average percentage of fines identified within the samples collected within the intertidal zone at the proposed South Terminal CDF is 2.12%. NOAA-Fisheries representatives have previously stated that the presence or absence of benthic invertebrates is also utilized in determining the presence or absence (although 40 CFR 230, 404(b)(1), Subpart E does not list this as a criteria within its definition). Please note that an investigation into the presence of benthic invertebrates was conducted as part of a Shellfish Survey conducted at the site. A map showing the location of benthic invertebrate sample locations and a table outlining the findings for each location is included within **Appendix 52**.

The data seems to indicate that, although the area in question may be important intertidal area that provides significant ecological function/habitat, the intertidal area within the proposed South Terminal CDF location does not meet the regulatory definition of "mud flat". Nevertheless, if the area (or some portion of the area) does meet the regulatory definition of mud flat, the area of impact is relatively small compared to the quantity of similar habitat within New Bedford Harbor (see **Section 6**), and the impacts caused by the project will be mitigated as outlined within **Section 7**.

6.4.2. Wetland Identification (Cowardin, et. Al.)

The following is an assessment of wetland classes at the site that will be effected by the proposed work, in accordance with the system presented by Cowardin, et.al. (1979) "Classification of wetlands and deepwater habitats of the United States," Office of Biological Services, FWS/OBS-79/31, December 1979:

For areas submerged at low tide:

System: Estuarine

Subsystem: Subtidal

Class: Unconsolidated Bottom

Subclass: Mud

For areas between low tide and high tide:

System: Estuarine

Subsystem: Intertidal

Class: Unconsolidated Shore

Subclass: Sand

For salt marsh areas:

System: Estuarine

Subsystem: Intertidal

Class: Emergent Wetland

6.4.3. Wetland Identification (Hydrogeomorphic Classification)

The following is an assessment of wetland classes at the site that will be effected by the proposed work, in accordance with the system presented by Brinson, M.M. (1993). "A hydrogeomorphic classification for wetlands", Technical Report WRP-DE-4, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. NTIS No. AD A270 053.

For intertidal areas, subtidal areas, and salt marsh at the site:

Geomorphic Setting: Coastal – Sea Level Location

Water Source: Lateral Surface Flows (tides)

Hydrodynamic Properties: Bi-directional Flows – Astronomical Tides (Regular Flooding)

6.4.4. Shellfish Survey

A shellfish survey was conducted in order to determine potential impacts to the local shellfish population due to the South Terminal CDF Project, and an estimate of the shellfish anticipated to be impacted as part of this project has been formulated, and is attached as **Appendix 52**. As part of the process of estimating shellfish impacts, discussions were held with the Massachusetts Department of Marine Fisheries (MassDMF). The result of these discussions was that the combination of both shellfish survey data (the Relative Abundance Survey) and shellfish sampling conducted by MassDMF and summarized within a report entitled *Quahog Standing Crop Survey, New Bedford/Fairhaven Inner and Outer Harbors,* by Mr. David K. Whittaker, dated June 6, 1999 be used to formulate the total number of shellfish anticipated to be impacted by the project. Using this data, shellfish estimates were conducted for the proposed facility

dredge footprint, proposed maintenance dredging within the Federal Navigation Project, the proposed CAD Cell, intertidal and subtidal mitigation projects immediately outside of the Hurricane Barrier (within the OU-3 Area), the Winter Flounder Spawning Habitat creation mitigation measures (see **Section 7** for descriptions of these mitigation measures).

Prior to preparing the scope for this particular shellfish survey Ms. Eileen Feeney, Program Coordinator II, of the Environmental Impact Assessments division of DMF was consulted at a meeting on April 29, 2010 regarding the scope of the South Terminal CDF. At that meeting, Ms. Feeney stated that sandy intertidal areas represented Horseshoe Crab habitat. Based upon this input, the area of Intertidal Area/Horseshoe Crab habitat that will be impacted at the site is approximately 1.43 acres (5,787 square meters), as shown on **Figure 5**.

The Relative Abundance Survey estimates the existing shellfish population within the proposed footprint of the South Terminal CDF in New Bedford. This was done by creating a grid over the projected footprint and then projecting the results found within the individual grid sections over the area of the whole Survey Area. The Survey Area consisted of 1.27 acres of intertidal area and 2.99 acres of subtidal area, (a total of 4.26 acres which is approximately 17,240 square meters). A grid of lines, spaced 150 linear feet on center in the north-south direction and spaced every 20 linear feet in the east-west direction within intertidal areas and every 40 linear feet in the east-west direction within subtidal areas was utilized. A set of transect lines were superimposed upon the proposed footprint of the South Terminal CDF within the identified resource areas, resulting in thirty four (34) sampling locations.

The shellfish survey was conducted in one of the following two methods:

1. On the beach or within shallow water, using a three-tined garden hoe to sort sediment in a ¼ square meter (a "quadrat"). The garden hoe was to penetrate at least 12 inches into the substrate. All shellfish or other organisms found during the survey were to be brought to the surface and sorted by length.

2. Within deep water, a diver utilized a three-tined garden hoe to sort one quadrat of sediment to a depth of at least 12 inches. All shellfish or other organisms found in this manner would be placed into a mesh diving bag and brought to the surface and sorted by length.

The survey activities were conducted using both methods described above on May 2, 2010 and May 3, 2010. A diver collected samples from 3 (three) of the thirty four locations. Survey locations are shown on a figure within **Appendix 52**.

Recovered shellfish and invertebrates were identified using *The Peterson Field Guide Series: A Field Guide to the Atlantic Seashore*, by Kenneth L. Gosner, Houghton Mifflin Company, 1978. A table summarizing recovered shellfish and invertebrate data is included as Table 1 within **Appendix 52**. Recovered Quahogs were categorized using Table 1 of the *Quahog Standing Crop Survey, New Bedford/Fairhaven Inner and Outer Harbors* by David K. Whittaker, Massachusetts Division of Marine Fisheries, published June 6, 1999. A table summarizing Quahog data is included as Table 2 within **Appendix 52**.

Intertidal and subtidal portions of the Survey Area were divided into areas where Quahogs were present and absent. Using Tables 3a and 3b within **Appendix 52**, the average concentration of "seed" Quahogs, "littleneck" Quahogs, "cherrystone" Quahogs, "chowder" Quahogs, Common Oysters, and Soft-Shelled Clams for both the intertidal and subtidal portions of the Survey Area were determined.

As stated earlier, the Survey Area is approximately 17,240 square meters (5,140 square meters of intertidal area and 12,100 square meters of subtidal area). Changes in the anticipated size of the footprint of the project were driven by the needs of the future users of the facility and were made after the shellfish survey was conducted. As a result, the current Impacted Area is larger than the Survey Area. The intertidal portion of the full Impacted Area of the project is 1.61 acres (6,516 square meters) and subtidal portion of the full Impacted Area is 20.12 acres (81,425 square meters). Therefore, the shellfish frequency calculated based upon the results collected within the Survey Area has been projected over the full Impacted Area.

It is assumed that the frequency of shellfish within the Survey Area is consistent within the whole Impacted Area. The projection of the Survey Area results onto the full Impacted Area is shown on Table 4 within **Appendix 52**. Based upon this calculation, the following numbers of shellfish are likely to be impacted by the project:

Type of Shellfish	**Projected #**
"Seed" Quahogs	1,059,505
"Littleneck" Quahogs	2,183,249

"Cherrystone" Quahogs	2,938,348
"Chowder" Quahogs	3,104,198
Total Shellfish	9,285,300

Note that this impact will be mitigated. US EPA has indicated that there will be limitations imposed on the potential methods available for shellfish mitigation (see letter from US EPA attached to **Appendix 52**. Mitigation is identified in **Section 7** below.

6.4.5. Essential Fish Habitat Assessment

This assessment of Essential Fish Habitat (EFH) for the South Terminal CDF construction is prepared in conformance with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a federal fisheries management plan (FMP). Section 305(b)(2) of the Magnuson-Stevens Act requires federal agencies to consult with the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH. Consistent with EPA's directive, this EFH involved review and analysis of existing literature, rather than additional field work.

The Magnuson-Stevens Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth maturity." The proposed project is located within an area designated as EFH for 20 fish species and is under the management jurisdiction of the New England Fisheries Management Council.

The South Terminal CDF construction involves the extension of an existing marine terminal via the installation of sheet piling, dredging in front of the sheet piling and filling behind the sheet piling at South Terminal located in New Bedford Harbor. A Site Location Map and a figure showing the proposed work are included as **Figures 1** and **2**, respectively.

The EFH assessment was conducted to supplement the resource area assessment for the proposed extension to the existing marine terminal. This report identifies the existing habitat for spawning, nursery, foraging, and shelter/escape cover. The report quantifies the proposed conditions after the action on these habitats and the mitigation efforts utilized during and after the action to minimize it effects. This report has been peer reviewed, and the resumes of some relevant reviewers are included within **Appendix 53**.

6.4.5.1. Proposed Action

Sheet piling will be extended in a line to the south, parallel to the existing face of South Terminal, and then will turn to the southwest, and then toward shore, as shown on **Figure 2**. The sheets will be driven to an appropriate depth, as determined by geotechnical testing, to allow for dredging in front of the sheet pile wall to a depth of between -30 to -32 MLLW at the northern portion of the sheet pile wall, and to a depth of -14 MLLW for the southern portions of the sheet pile wall. Once secured, the landward area behind the sheet pile wall will be backfilled with free draining material, and then filled to meet the grade of the existing South Terminal elevation. It is currently anticipated that the area will be completed with a covering of crushed stone. The area

in front of the east face of the sheet piling is anticipated to be dredged to between -14 MLLW and -30 MLLW, depending upon the location along the sheet pile wall. The proposed dredge footprint is also shown on **Figure 2**.

The environmental effects of the proposed project are both short-term and long-term.

This project will have the following long-term effects upon Essential Fish Habitat:

For the areas to be filled and bulkheaded:

- Loss of 4.06 acres of shallow, near-shore subtidal habitat.
- Loss of 1.43 acres of intertidal habitat.
- Loss of 0.18 acres of salt marsh.

For the areas to be dredged to accommodate berthing and transit of vessels:

- Loss and/or significant change in resource value of 4.43 acres of shallow, near-shore subtidal habitat that will be dredged from an existing depth of between -1 and -6 MLLW to -14 MLLW.
- Loss and/or significant change in resource value of 4.03 acres of shallow, near-shore subtidal habitat that will be dredged from an existing depth of between -5 and -14 MLLW to -14 MLLW.

- Loss and/or significant change in resource value of 3.68 acres of shallow, near-shore subtidal habitat that will be dredged from an existing depth of between -1 and -6 MLLW to between -30 and -32 MLLW.

The long-term effects involve the filling of near-shore shallow subtidal areas as well as intertidal areas that serve as habitat and spawning grounds for essential fish. Additional long-term effects involve the dredging of near-shore shallow subtidal areas from an elevation of approximately -1 to -6 MLLW to between -14 to -30 MLLW, the alteration of which will result in the conversion of these areas from shallow subtidal habitat to deep subtidal habitat.

Additional dredging of areas currently between -4 and -6 MLLW to between -6 and -7 MLLW (Gifford Street Channel Re-Alignment and Mooring Mitigation Areas - 8.01 acres), areas currently between -20 and -25 MLLW to -30 MLLW (South Terminal Channel Area - 7.01 acres), from -26 to -30 MLLW to -30 MLLW (Federal Navigational Project Maintenance Dredging – 19.6 MLLW), or from -4 to -6 MLLW to -45 MLLW with subsequent filling and capping (CAD Cell Area – 8.67 acres) are not expected to cause any significant change to the functions and values of these existing areas.

This project will have the following short-term effects upon Essential Fish Habitat:

For the areas to be dredged to accommodate berthing and transit of vessels:

- Temporary disturbance of 4.43 acres of benthic habitat that will be dredged from an existing depth of between -1 and -6 MLLW to -14 MLLW.
- Temporary disturbance of 4.03 acres of benthic habitat that will be dredged from an existing depth of between -5 and -14 MLLW to -14 MLLW.
- Temporary disturbance of 3.68 acres of benthic habitat that will be dredged from an existing depth of between -1 and -6 MLLW to between -30 and -32 MLLW.
- Temporary disturbance of 8.01 acres of benthic habitat that will be dredged from an existing depth of between -4 and -6 MLLW to between -6 and -7 MLLW.
- Temporary disturbance of 7.01 acres of benthic habitat that will be dredged from an existing depth of between -20 and -25 MLLW to -30 MLLW,
- Temporary disturbance of 19.6 acres of benthic habitat that will be dredged from an existing depth of between -26 and -30 MLLW to -30 MLLW.
- Temporary disturbance of 8.76 acres of benthic habitat that will be dredged from an existing depth of between -4 to -6 MLLW to -45 MLLW, with subsequent filling and capping,

6.4.5.2. Purpose

The purpose of the project is *to develop a multi-purpose marine terminal, as a component of the approved State Enhanced Remedy for New Bedford Harbor, a primary purpose of which will be to provide critical infrastructure to serve offshore renewable energy facilities, and which is also capable of beneficially re-using sand from navigational dredging or the construction of confined aquatic disposal facilities to the extent approved by US EPA.*

The purpose of the EFH Assessment is to address the potential impact to finfish and shellfish resources from the construction of the proposed CDF and associated dredging.

6.4.5.3. Need for CDF Construction at South Terminal

Shore-side infrastructure is necessary to support construction, assembly and transshipment of foundation and turbine components for off-shore renewable energy projects. Such facilities have specific requirements that need to be met, and cannot currently be met by utilizing existing resources. Extensive study of potential locations for an off-shore renewable energy support facility has concluded that the South Terminal CDF location is the only practicable location at which such a facility can be constructed. The terminal as proposed represents the minimum lay-down area, berthing space and dredging necessary to facilitate the terminal construction, such that it meets the minimum specifications required for off-shore renewable energy development (although also designed to accommodate a range of future potential uses). Additionally, the proposed terminal represents an opportunity to beneficially reuse and/or manage material dredged from the harbor as part of the State Enhanced Remedy and ongoing EPA Superfund harbor cleanup activities.

6.4.5.4. Description of the Study area

New Bedford/Fairhaven Harbor is located on the northern shore of the Buzzards Bay coast and borders the communities of Fairhaven to the east, and New Bedford to the west. It is approximately 56 miles south of Boston and 11 miles east of Fall River Massachusetts. New

Bedford/Fairhaven Harbor is a coastal embayment with a mean tidal range of approximately 3.3 feet or 1 meter (Howes and Goehringer, 1996). The Acushnet River is the most significant freshwater inflow to the harbor. It forms the border between New Bedford to the west and Fairhaven to the east. Other smaller tidal streams fed by fresh water intermittent and perennial tributaries drain into either the Acushnet River or New Bedford/Fairhaven Harbor.

The limit of the harbor lies at an imaginary line that extends from Clarks Point in New Bedford, east to Wilbur Point in Fairhaven. New Bedford/Fairhaven Harbor is divided into three separate regions: the Upper Harbor, the Lower Harbor (together referred to as the Inner Harbor) and the Outer Harbor. There are also distinct smaller coves and embayments around its perimeter. Beginning from the mouth of the Harbor and proceeding upstream, the following distinct regions of the harbor are delineated: The Outer Harbor region extends from the harbor mouth, north (upstream) to the hurricane barrier seawall that extends from Fort Phoenix Beach in Fairhaven west to New Bedford, just south of Palmer Island. From the seawall north to the I-195 Bridge lies the Lower harbor segment. From I-195 Bridge upstream lies the Upper Harbor segment.

Distinct areas of the harbor include the following: Proceeding north from the mouth of the harbor along the western shore lays the community of Clarks Point. North of the seawall along the western shore of the Acushnet River lie commercial wharves within the City of New Bedford. Some of the more notable wharves (proceeding from north to south) include the New Bedford Gas and Edison Light Company wharf, Homer's Wharf, the State Pier, Pier 3, Pier 4, and South Terminal (the Site). Continuing upstream (north), Fish Island lies under Route 6 and the New Bedford/Fairhaven Bridge in the Lower Harbor. To the east of Fish Island lies Popes Island

Marine Park, which also lies beneath the New Bedford/Fairhaven Bridge. Continuing clockwise, and proceeding south along the eastern shore of the Acushnet River lies, first, Delano Wharf, then Kelly, Union, and Railroad wharves, north of the seawall. Just east of the seawall on the eastern side of the southern limits of the Lower Harbor in Fairhaven lies the Fort Phoenix Beach State Reservation. East of Fort Phoenix lies the community of Harbor View on the west side of Priests Cove, a small embayment on the north shore of the Outer Harbor in Fairhaven. East of Priests Cove lies the Community of Pope Beach. Continuing south and counterclockwise along the western shore of the Outer Harbor lies Silver Shell Beach within the community of Sconticut Neck, a peninsula that extends southward from the middle of Fairhaven's southern shore. South of Silver Shell Beach lies a small unnamed tidal cove embayment and salt marsh. Further south lies the limits of Sconticut neck at Wilbur Point.

The main federal navigation channel leading into New Bedford/Fairhaven Harbor (the Entrance Channel) is authorized to a depth of 30 feet. It begins at a location just south of the Butler Flats Lighthouse in the Outer Harbor and continues northwesterly through the break in the seawall and into the Lower Harbor. The main navigation channel splits into two channels once inside the hurricane barrier. One channel provides access to the New Bedford Commercial Wharves (the New Bedford Reach) and the other (the Fairhaven Reach) provides access to the Fairhaven Wharves on the east side of the Lower Harbor. The New Bedford Reach terminates at an area between New Bedford Harbor to the west and Popes Island to the east. A turning basin authorized to a depth of 30 feet lies at the terminus of the New Bedford Reach. A maneuvering area lies adjacent to the west side of the New Bedford Reach between the commercial wharves and the reach.

The smaller Fairhaven tributary channel services the commercial wharves along the eastern shore of the Lower Harbor segment in Fairhaven. The Fairhaven Channel has an authorized depth of 15 feet adjacent to a 25-foot anchorage area within the Lower Harbor. This 15-foot channel extends northeasterly between Crow's Island and Fairhaven. In the vicinity of Old South Wharf, the authorized depth of the Fairhaven reach changes from 15 to 10 feet.

The Upper and Lower segments of the Inner Harbor contain several marinas, a significant recreational fleet, harborside historical attractions, various commercial fishing fleets and fish processing/cold storage facilities. Land usage along the western shore of the Outer Harbor contains a mixture of residential commercial and industrial uses. Land usage along the eastern shore of the Outer Harbor is predominantly residential.

6.4.5.5. Description of the Marine Terminal

Hydrography

The circulation of water in coastal embayments such as New Bedford/Fairhaven Harbor is influenced by a complex combination of forces produced by basin morphology, tidal fluctuations, wind, and density gradients. Although general data regarding circulation conditions and sediment transport within the harbor has been collected (see below), no data exist describing the actual site-specific sediment transport and circulation patterns within the South Terminal CDF site.

General sediment transport and circulation conditions within the vicinity of the South Terminal CDF site can be assessed using the existing available information to quantitatively determine the suitability of the proposed sites. Circulation patterns within New Bedford/Fairhaven Harbor are primarily driven by meteorological events and mixed semi-diurnal tidal currents (EBASCO, 1991; Howes and Goerhinger, 1996; NBHTC, 1996). In the Upper Harbor, the mean tidal amplitude is approximately 3.7 feet (1.1 m). Spring tide range is reported to be 4.6 feet (1.4m). In the Outer Harbor, the tidal range is reported to be from 1.41 ft (0.43m) to 5.05 ft (1.54m) with a mean of 4.65 ft (1.42 m)(ACOE, 1990). Flushing of the harbor was determined to take 2 days under winter conditions, and 8 days under summer conditions (Bellmer, 1988).

Local embayment and channel restrictions produce faster currents. Examples of these locations include: within the opening in the hurricane barrier, within the vicinity of Popes Island, and within the vicinity of the Coggeshall Street Bridge. At the Coggeshall Street Bridge, the average ebb tide velocity is 0.7 knots, however currents as fast as 3.5 knots have been recorded here during ebb tide (USACE, 1990).

Bathymetry

Water depth at the site varies between the portions of the site which have and have not been improved by navigational dredging in 2009 and 2010. The water depths in the area not improved as a part of navigational dredging range from 0 MLLW to -6MLLW. Areas improved as a part of navigational dredging in 2009 and 2010 are at a depth ranging from -19 to -22 MLLW (within the existing South Terminal basin) and ranging from -7 to -13 MLLW (within the Gifford Street Boat Basin and channel).

Sediment Characteristics

Sieve size analysis of the surficial soils at the site revealed the predominant particle size is fine sand, with varying amounts of coarse sand and fine grained material. The analysis indicated that the fines content of the material was between .01% and 12.8%. However there were only three samples which had silt content greater than 5%. The US Department of Agriculture Natural Resource Conservation Service maps the soil type at the site as Udorthents, smoothed. Udorthents are defined as man-made land over loose sandy and gravelly glaciofluvial deposits and/or firm coarse-loamy basal till derived from granite and gneiss. Onsite observation of the soil types at the site were consistent with USDA definitions as upland areas were determined to be urban fill and not naturally occurring.

Water Quality

Water Quality at the Site

The NAI Report from 1999 indicated water temperatures are at their highest between June and August. Temperatures in the Inner Harbor Range between 17.1 C to 23.5 C in the summer and 1.6 C and 7.3 C in the winter. The outer harbor has similar water conditions. Salinity ranges in the inner harbor are from 29.2 ppt to 30.7 ppt. The salinity ranges in the outer harbor are from 26.7 ppt to 31 ppt.

Water Quality From Past Dredging Work

Water quality monitoring during navigational dredging and CAD Cell construction indicated small elevated swings in turbidity during dredging and disposal operations. Water quality data associated with CAD Cell Construction and Navigational Dredging is attached as **Appendix 54**.

Water Quality Disposal

Water quality monitoring completed by Battelle on behalf of the Environmental Protection Agency (EPA) at the disposal site (CAD Cell 2) was completed on April 14, May 20, May 21, May 27, and July 8, 2009. The conclusions within the Battelle Technical Memo to the United Stated Army Corps of Engineers (USACE) dated December 15, 2009 are below, and the report is attached within **Appendix 55**. Although this report does not specifically describe impacts due to dredging within New Bedford Harbor (the report focuses on turbidity plumes generated during disposal events within CAD Cells), the report does provide some information with regard to the effect, duration, and dissipation rate of turbidity plumes from disturbed sediment within New Bedford Harbor. Conclusions included:

- Water column plumes created during disposal of dredge material into the CAD cell were nearly completely contained within the CAD cell silt curtain;
- Inside the silt curtain, turbidities were observed as high as 110 NTU with TSS concentration as high as 260 mg/L;
- Outside the silt curtain, the highest turbidities observed were only 20 NTS with TSS concentration of 50 mg/L and then only within close proximity to the cell in small filaments of plume which appear to have escaped the silt curtain at one of its seams;
- The presence of the silt curtain nearly eliminated any tidal current within the CAD cell; currents inside the cell were less than 2cm/s and too weak to measure;
- Within the CAD cell, the bulk of the turbidity plumes were limited to the lower half of the water column, down within the excavated cell, with the highest values usually with 1 to 2 meters of the bottom;

- All plumes dissipated to near background levels within 1 to 1 ½ hours;
- During near slack tide conditions the disposal plumes largely pooled beneath the barge with the cell, but during flood or ebb tides some of the plume collected against the inside of the silt curtain of the north or south side, respectively;
- There were no significant reductions in endpoints for any of the toxicity test species, indicating that there were no measurable acute or sub-lethal impacts to marine organisms for exposures to the plume samples collected.

Water and Sediment Quality

Sediment quality within New Bedford Harbor has been the subject of many studies. In order to evaluate the quality of potential sediment to be dredged from New Bedford/Fairhaven Harbor, a preliminary determination of its suitability for open ocean disposal was conducted as part of the DMMP in 1999 and 2002. The preliminary determination was based upon a comparison of sediment chemistry results from samples taken within proposed New Bedford/Fairhaven dredging projects with results from Massachusetts Bay Disposal Site (MBDS) reference sites and other sediment guidelines such as those developed by NOAA and the New England River Basins Commission (NERBC). Based on a review of sediment chemistry data available from the harbor, it is assumed that all sediments from New Bedford/Fairhaven would be unsuitable for ocean disposal at MBDS, requiring disposal with in a CAD Cell or CDF.

Habitat Areas of Particular Concern

No Habitat Areas of Particular Concern (HAPC) are located within the project areas. HAPC are described by NOAA as "subsets of EFH which are rare, particularly susceptible to human-

induced degradation, especially ecologically important or located in an environmentally stressed area" (NOAA, 1998).

6.4.5.6. Fisheries Resources of the Project Area

All of New Bedford/Fairhaven Harbor is designated as EFH. The harbor provides EFH for at least one life stage for 20 managed species listed by the NEFMC. Data collected by NMFS for EFH areas is presented in tabular summaries, which correspond to ten-minute by ten-minute squares of latitude and longitude. The tabular data summary presented for this square is presented in Table 3-1. A notation "X" within the table indicates that the EFH has been designated within the square for a given species and life stage. A notation "n/a", if it appears in one or more life stage columns, denotes that that particular life stage does not occur for that particular species.

Distribution of the managed species is a function of three major interdependent components: physical, chemical, and biological. Variation of any or all of these components may affect the distribution of the managed species within the harbor. This EFH Assessment was prepared based on the known specific habitat requirements for each life history stage of the listed managed species within New Bedford/Fairhaven Harbor and the tidally influenced portion of the Acushnet River, and knowledge of potential pending and future projects within the harbor that may impact these managed species.

Federally Managed Fish of New Bedford/Fairhaven Harbor

New Bedford/Fairhaven Harbor is home to a number of fish species and other marine life (Howes and Goerhinger, 1996; USEPA, 1996; NAI, 1999). Fish species include both commercial and recreational species, both bottom dwelling and free-swimming water column species, and both resident and migratory species. Ecologically, the harbor functions both as an ocean embayment and estuarine environment. Compared to classic estuaries, which receive large freshwater inputs, New Bedford/Fairhaven Harbor does not have a major freshwater drainage entering the harbor. The Acushnet River is the largest freshwater drainage entering the harbor. The harbor's smaller coves and the Acushnet River, provide spawning and nursery potential for a number of the harbor's fish.

Table 3-1: New Bedford/Fairhaven Harbor EFH Designated Species

10'x 10' Square Coordinates:

Boundary	*North*	*East*	*South*	*West*
Coordinate	41□ 40.0' N	70□ 50.0' W	41□ 30.0' N	71□ 00.0' W

Square Description (i.e. habitat, landmarks, coastline markers):

Waters within Buzzards Bay within the Atlantic Ocean within the square affecting the following: south of Dartmouth, MA., New Bedford, MA., and Fairhaven, MA., from Sconticut Neck and the western part of West Island to Slocum Neck and Barneys Joy Point in Dartmouth, MA. Also affected are: Wilkes Ledge, Mishaum Pt., Round Hill Pt., Smith Neck, Dumpling Rocks, Negro

Ledge, Great Ledge, Phinney Rock, Pawn Rock, White Rock, Hussey Rock, Apponagansett Bay, Ricketson Pt. in South Dartmouth, MA., Apponagansett, MA., Clarks Cove, Clarks Pt., in Fairhaven, MA., Butler Flats, Mosher Ledge, Wilbur Pt. on Sconticut Neck, Bents Ledge, Middle Ledge, and West Ledge. These waters are also within western Nasketucket Bay, east of Sconticut Neck and north of West I., and within New Bedford Harbor.

Species	*Eggs*	*Larvae*	*Juveniles*	*Adults*
Atlantic cod *(Gadus morhua)*	X	X	X	X
haddock *(Melanogrammus aeglefinus)*	X	X		
pollock *(Pollachius virens)*				
whiting *(Merluccius bilinearis)*				
offshore hake *(Merluccius albidus)*				
Red hake *(Urophycis chuss)*		X	X	X
white hake *(Urophycis tenuis)*				
redfish *(Sebastes fasciatus)*	n/a			
witch flounder *(Glyptocephalus cynoglossus)*				
winter flounder *(Pleuronectes americanus)*	X	X	X	X
yellowtail flounder *(Pleuronectes ferruginea)*				
windowpane flounder *(Scopthalmus aquosus)*	X	X	X	X
American plaice *(Hippoglossoides platessoides)*			X	X
ocean pout *(Macrozoarces americanus)*				
Atlantic halibut *(Hippoglossus hippoglossus)*				
Atlantic sea scallop *(Placopecten magellanicus)*				
Atlantic sea herring *(Clupea harengus)*			X	X
monkfish *(Lophius americanus)*				
bluefish *(Pomatomus saltatrix)*			X	X
long finned squid *(Loligo pealei)*	n/a	n/a	X	X

Species	*Eggs*	*Larvae*	*Juveniles*	*Adults*
short finned squid *(Illex illecebrosus)*	n/a	n/a		
Atlantic butterfish *(Peprilus triacanthus)*	X	X	X	X
Atlantic mackerel *(Scomber scombrus)*	X	X	X	X
summer flounder *(Paralicthys dentatus)*	X	X	X	X
scup *(Stenotomus chrysops)*	X	X	X	X
black sea bass *(Centropristus striata)*	n/a	X	X	X
surf clam *(Spisula solidissima)*	n/a	n/a	X	X
ocean quahog *(Artica islandica)*	n/a	n/a		
spiny dogfish *(Squalus acanthias)*	n/a	n/a		
tilefish *(Lopholatilus chamaeleonticeps)*				
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
cobia *(Rachycentron canadum)*	X	X	X	X
sandbar shark *(Charcharinus plumbeus)*				X
bluefin tuna *(Thunnus thynnus)*			X	

Source: NMFS, 2001

New Bedford / Fairhaven Harbor Finfish Community

A study consisting of seine and trawl samples were conducted in New Bedford/Fairhaven Harbor waters between 1998 and 1999 by Normandeau Associates Inc (NAI). For each seine and trawl sample, all fish were identified to species, counted, then measured for biomass in grams and total length to the nearest mm. Exceptionally large catches were estimated through volumetric sub-sampling, in which a minimum of twenty fish were measured. Ages of the fish were estimated based on their lengths. Catch data was analyzed by descriptive statistics, including mean, range, and percent composition, to characterize seasonal and geographic features of the fish community in New Bedford/Fairhaven Harbor.

Seine Survey

Nearshore sampling locations consisted of a 50-foot seine with a 3/16 delta mesh, positioned parallel to shore in approximately 1 m of water and then directly hauled to shore covering a rectangular area. One seine sample was collected at each of the three sampling areas. Station NS1 was located in the south end of New Bedford near the ferry dock landing, while station NS2 was located to the east of Fort Phoenix on a shallow sandy beach. Station NS3 was located on the northeast side of Crow Island in the Inner Harbor. The resources were calculated as a Catch Per Unit Effort (CPUE) based on the number of fish per haul.

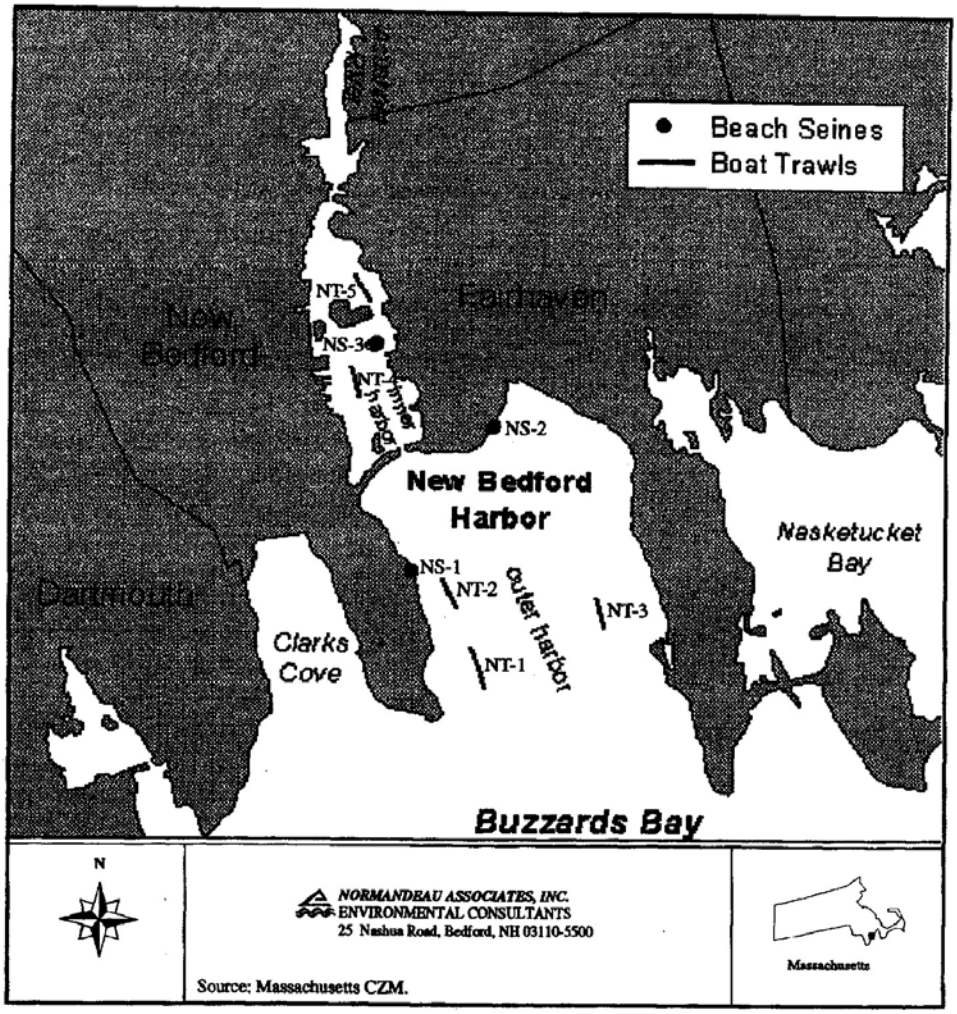

Figure 2-1. Location of fish sampling stations in New Bedford Harbor, June 1998 through May 1999.

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Figure 3-1. NAI (1999) Finfish Sampling Locations in the Inner Harbor

Beach seine hauls attempted to cover equal distance, but hauls were not standardized to haul length.

Seine catches in New Bedford harbor were, at times, dominated by large catches of a few species. On a few sampling dates no fish were caught (January and February), due to fish moving to deeper waters. The most numerous fish captured by the seine was Atlantic silversides (*Menidia menidia*), accounting for 44 % of the total catch at all seine-sampling locations. Striped killifish (*Fundulus majalis*) comprised 16%, mummichog (*Fundulus heteroclitus*) 9%, cunner (*Tautogolabrus adspersus*) 7%, and winter flounder (*Psuedopleuronectes americanus*) 6% of the fishes captured in nearshore New Bedford Harbor (Table 3-2). Inner Harbor data is represented by Station NS3.

Table 3-2: Percent of fish caught in seine samples taken in New Bedford Harbor from June 1998 through May 1999.

Species	Station NS1 %	Station NS2 %	Station NS3 % (Inner Harbor)	All Stations Combined (NS1-4) %
Atlantic silverside (*Menidia menidia*)	45.2	33.4	54.1	43.6
striped killifish (*Fundulus majalis*)	11.1	19.1	14.0	16.0
cunner (*Tautogolabrus adspersus*)	--	10.2	5.8	7.5
mummichog (*Fundulus heteroclitus*)	--	17.9	--	8.7
Atlantic menhaden (*Brevoortia tyrannus*)	11.2	--	--	--

Species	Station NS1 %	Station NS2 %	Station NS3 % (Inner Harbor)	All Stations Combined (NS1-4) %
black sea bass (*Centropristus stiata*)	--	6.8	--	--
winter flounder (*Psuedopleuronectes americanus*)	--	--	11.7	6.3
northern kingfish (*Menticirrhus saxatilis*)	--	--	3.2	--
northern puffer (*Sphoeroides testudineus*)	6.3	--	--	--
bluefish (*Pomatomus saltatrix*)	9.3	--	--	--
Other species	17	12.6	11.2	17.9
Total	100.1	100	100	100

Notes: -- = not determined for that species due to absence or extremely low abundance (If present, included in numbers tallied as part of other species category). Some totals do not equal 100% because of rounding.

CPUE of Atlantic silversides generally rose throughout the summer to a peak in abundance in August, primarily due to an increase in the capture of Young of Year (YOY, annual fry) fish. The CPUE started to decrease in December, no fish were caught in January and February, and began to increase thereafter. Striped killifish, which ranked second in CPUE, were most abundant, appearing in seine samples from July through December. Most of the captured striped killifish comprised of YOY fish (less than 40 mm) collected in September hauls. Mummichog ranked third in overall CPUE and was most common at sampling station NS2. The CPUE for mummichog peaked in August and mummichog were most common at sampling station NS2,

which is in close proximity to a salt marsh. Mummichog is a common shore-zone fish in the Atlantic coast estuaries, flooded salt marsh and mud flats which are important habitats for foraging (Haplin1997; Javonillo 1997). At sampling station NS1 a large CPUE was documented for Atlantic menhaden (*Brevoortia tyrannus*) during the August sampling occasion.

Station NS2 yielded the largest geometric mean of CPUE for all three stations followed by NS1 and the lowest yielding station, NS3. On average the other species categories accounted for approximately 18 % of the catch. This category included such fish as black sea bass (*Centropristus stiata*), northern kingfish (*Menticirrhus saxatilis*), winter flounder and northern puffer (*Sphoeroides nephelus*). Based on the captured fish length, most of the species were considered YOY fish.

Trawl Survey

Deeper water sampling was conducted with a 30-foot trawl made of 2-inch stretch mesh in the body and 1-inch stretch mesh in the cod end with a 1/4-inch liner. Each trawl was towed for approximately 400 m. When a 400 m tow length was not achieved, the length and catch was standardized by the following mathematical equation:

$$CPUE_{s,t} = (CATCH_{s,t}/TOW_t)\ 400$$

Where: $CPUE_{s,t}$ = Catch per unit effort for species S in Sample T

$CATCH_{s,t}$ = Catch of species S in sample T

TOW_t = Tow length in m of sample T

The trawl catches characterized the fish community of depths from 6.5 to 33 feet (2 to 10 meters), within New Bedford Harbor. Trawl sampling locations are identified as NT1 through NT5 as shown in Figure 3-1. Sampling location NT1 was in the outer harbor South End at depths of 23 to 26 feet (7 to 8 meters). Station NT2 was also located in the Outer Harbor but north of the lighthouse at a depth of 16.5 to 20 feet (5 to 6 meters). Sampling station NT3 was located in the Outer Harbor, but on the eastern side, at depths ranging from 23 to 26 feet (7 to 8 meters). Station NT4 was located in the Inner Harbor, to the east of the New Bedford docks, at depths between 26 and 29.5 feet (8 to 9 meters). Lastly, station NT5 was also located in the Inner Harbor, north of Popes Island at depths between 6.5 to almost 10 feet (2 to 3 meters).

Generally, the observations of the trawl catches were scup representing 23% of CPUE, cunner 21%, winter flounder 13%, black sea bass 9%, and northern pipefish 6% (Table 3-4). On a few occasions single large catches of a less abundant species affected the total annual catch statistics. Other species caught in substantial quantities were Atlantic herring (March, stations NT1 & NT4) and Atlantic silversides (December & March -station NT2, March - station NT3).

Monthly CPUE steadily increased from May, peaked in August, and then decreased to a seasonal low in February as water temperatures decreased and the fish moved to deeper water. Highest CPUE occurred in August with scup dominating the catch. Recruitment of young-of-the-year (YOY) of scup, cunner and black sea bass influenced the samples and reflected the seasonality of the deeper-water fish community.

Station NT1 ranked second among the five stations in CPUE, and the sample consisted mainly of scup (Table 3-3). Black sea bass, cunner, northern pipefish and Atlantic herring comprised the remainder of the sample. However, these species were substantially less abundant than scup. The CPUE peaked in August and again rose significantly in March due to a large catch of Atlantic herring. CPUE were low during the months of November through February and no fish were caught in November. YOY fish of Atlantic herring, scup, cunner and butterfish were present in the catches for most of the sampling events from March through October.

Table 3-3: Percent of fish caught in trawl samples taken in New Bedford Harbor from June 1998 through May 1999.

Species	% of Catch Per Station					
	NT1	NT2	NT3	NT4 (Channel Inner)	NT5 (Popes I.)	combined (NT1-5)
Atlantic herring (*Clupea harengus*)	8.6	--	--	12.6	--	--
Atlantic silversides (*Menidia menidia*)	--	10.3	8.7	--	8.1	--
bay anchovy (*Anchoa mitchilli*)	--	--	--	--	6.5	--
black sea bass (*Centropristus striata*)	11.3	7.1	13.1	--	--	9.1
Atlantic butterfish (*Peprilus triacanthus*)	8.6	--	--	--	--	--
cunner (*Tautogolabrus*	10.7	34.0	30.1	18.2	--	20.8

adspersus)						
northern pipefish (*Syngnathus fuscus*)	--	4.6	--	13.4	--	6.0
seaboard goby (*Gobiosoma ginsburgi*)	--	--	--	--	9.5	--
scup (*Stenotomus chysops*)	35.3	25.3	26.8	17.3	--	23.4
windowpane flounder (*Scopthalmus aquosus*)	--	--	--	--	5.7	--
winter flounder (*Pseudopleuronectes americanus*)	--	--	6.2	11.5	52.5	12.5
Other species	25.5	18.7	15.3	27.1	17.8	28.2
Total	100	100	100.2	100.1	100.1	100

Notes: -- = not determined for that species due to absence or extremely low abundance (If present, included in numbers tallied as part of other species category) Some totals do not equal 100.0% because of rounding.

Sampling station NT2, north of the lighthouse in the south end of outer New Bedford harbor, ranked third in CPUE among sampling stations. The most common fish captured was cunner, with significant total catch yields from scup, Atlantic silversides, black sea bass, and northern pipefish. CPUE peaked in August at this sampling station due to the large numbers of scup, cunner and black sea bass. The CPUE decreased through October and few fish were caught in November. The CPUE was low through November to February, when no fish were caught. A significantly large catch of Atlantic silversides occurred in March and the CPUE steadily increased through July. Observed in the catches at this station were large amounts of *Codium spp.* and other red and green filamentous algae.

At sampling location NT3, which was located in the east side of outer New Bedford harbor, the CPUE ranked fourth among the five stations. Here again, the catches were dominated by the cunner, scup, black sea bass, Atlantic silversides and winter flounder. Cunner was captured in every sampling event except during September. Young-of-Year fishes for the scup, cunner (except September), and black sea bass were observed in catches from June through October. Atlantic silversides were caught in January and March and the catch consisted of both YOY and yearlings. Winter flounder were captured in September and March through May, and catches comprised of both one year and older fish.

Station NT4 is located in the Inner Harbor, east of the New Bedford Docks. This station was highest in CPUE for all stations. The high ranking was in part related to the large captures of Atlantic herring in March. Cunner was captured in each sampling event occurring April through November. The highest CPUE occurred in September, at this location, decreasing to near zero catches in February and increasing in March through August. YOY fish for cunner, scup, Atlantic herring, and winter flounder were all recruited during many sampling efforts. Interestingly, the distribution of the species was fairly consistent and equal with no one species consistently dominating the catches. For the five species listed, the percentage of catch per species ranged between 11.5 % to 18.2 % and the other species category equaled 27.1%.

Sampling station NT5 was located in the Inner Harbor north of Popes Island. This station consistently yielded the lowest CPUE of all sampling stations. The catches consisted of winter flounder (52%), followed by seaboard goby, *Gobiosoma ginsburgi* (9.5 %), Atlantic silverside

(8%), bay anchovy, *Anchoa mitchilli*, (6.5 %), windowpane flounder, *Scopthalmus aquosus*, (5.75%) and other species comprised the remainder.

Diadromous Fish Activity

Alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), striped bass (*Morone saxatilis*), rainbow smelt (*Osmerus mordax*) and white perch (*Morone americana*) are diadromous in the Buzzards Bay area. The Acushnet River supports an annual anadromous fish run of alewife (*Alosa pseudoharengus*), which spawn in Sawmill pond, generally beginning in March/April and continuing into June (Howes and Goehringer, 1996). Other anadromous and diadromous species known to utilize Buzzards Bay waters are the blueback herring, and rainbow smelts

Anadromous fish are those that migrate from the sea to breed in fresh water. Diadromous fish are fish that partake in regular, periodic (typically seasonal), and obligatory movements between fresh and marine water habitats. These movements are further classified into one of three categories: anadromy, catadromy, and amphidromy, defined below by Matthews (1998):

- Anadromy: the periodic and obligatory migration of fish from marine waters into fresh water to spawn. Examples in the New Bedford/Fairhaven Harbor icthyofaunal community would be the rainbow smelt, blueback herring, alewife and striped bass.
- Catadromy: the periodic and obligatory migration of fish from fresh water into marine waters to spawn. An example in the New Bedford/Fairhaven Harbor icthyofaunal community would be the American eel.

- Amphidromy: the periodic movement of immature or juvenile fish between fresh and marine waters. Winter flounder, which tolerate a wide range of salinity from fresh water to seawater salinities (Pereira, 1999), would be an example of an amphidromous fish species known to inhabit the New Bedford/Fairhaven Harbor icthyofaunal community.

Recent finfish sampling in New Bedford/Fairhaven Harbor has provided current data on diadromous fish activity within the New Bedford/Fairhaven Harbor/Acushnet River estuary (NAI, 1999). Alewife was found to appear in trawl samples collected from the harbor in September, but was absent in other months. Trawl sampling also revealed that significant rainbow smelt runs occur in the harbor in the early spring and then again in summer, with peak densities occurring in March and July. White perch were found to occur in New Bedford/Fairhaven Harbor waters solely in March. American shad and blueback herring were not caught in either seine or trawl samples collected from New Bedford Harbor during NAI finfish sampling efforts (NAI, 1999). The restoration of alewife and blueback herring runs in the Acushnet River Estuary has been identified as a priority by the NOAA Fisheries, Restoration Center (Turek, personal communication).

Alewife are anadromous non-residents of the Buzzards Bay waters. They return each year with regularity and are important both as a recreational and commercial resource. This finfish resource has a substantial number of early laws and regulations in the Commonwealth of Massachusetts statutes designed to protect the fishery. The alewives return to their freshwater spawning grounds beginning in late April to early May. The young typically spend their early stages in the ponds and as early as July migrate out to the estuaries to spend their first year

(Cooper, 1961). The diet of the alewife mainly consists of copepods, shrimp, eggs and larvae (Howes and Goehringer, 1996). The mean catch per unit effort (catch per haul) for alewife captured during finfish trawl sampling within New Bedford/ Fairhaven Harbor was greatest in September (NAI, 1999).

Blueback herring are closely related to alewife and sometimes mistaken for alewife. Like their kin, they are also anadromous, usually entering the brackish estuarine waters by mid-May to spawn. The blueback or river herring tend to be more salinity tolerant and do not depend on the freshwater nursery habitat as much as alewives (Chittenden, 1972; Clayton et al., 1978). The diet of the blueback herring consists of copepods, pelagic shrimp, fish eggs and larvae (Howes and Goehringer, 1996). Both the alewives and the blueback herring are an important prey source for many other fish including EFH species that occur in the New Bedford/Fairhaven quadrant, such as bluefish (Bowman et al., 2000).

Nursery Potential

Certain intertidal and subtidal habitats are favorable for finfish nurseries in that they provide areas for cover, feeding, and development. For instance, salt marsh (intertidal) and subtidal eelgrass (*Zostera marina*) habitats provide nursery habitat for numerous fish species. Certain other benthic substrate conditions outside of salt marsh or eelgrass areas can also be good nursery habitat. Therefore, the presence of these habitats to the finfish resources of New Bedford/Fairhaven Harbor is discussed below.

The various subtidal and intertidal habitats with nursery potential are an important part of the ecology for New Bedford/Fairhaven Harbor and other communities within Buzzards Bay. These habitats generally occur around the perimeter of the embayment although in some areas they have been dramatically altered or eliminated by development. New Bedford/Fairhaven Harbor has the smallest amount of salt marsh area due to the large-scale development and the physical structure of the harbor (Howes and Goehringer, 1996). Therefore, the remaining intertidal and subtidal benthic substrates identified as having a high nursery potential, are important resource areas to the harbor's finfish community.

Both resident and non-resident species inhabit these areas and represent an important element in the ecological web of both the harbor and Buzzards Bay. Most resident fish species spend their entire life within these habitats and, therefore, within the waters of New Bedford/Fairhaven Harbor. Non-resident adult species enter these habitats to spawn, and juveniles of other species use these habitats only as nursery grounds. Typical resident species include the Atlantic silverside, which generally live for only one year, but those that do survive migration to deeper warm waters in the winter, return to nearshore nursery areas to spawn in the spring. Three species of killifish are typical residents of the salt marsh. These fish usually winter in the lower sandier areas of the marsh. Spawning generally occurs between April and October. mummichogs are also residents, typically these fish will live several years and winter by burrowing or clinging to the bottom of creeks and marsh pools, generally in brackish waters in the upper reaches of the marsh system (Howes and Goehringer, 1996). Resident species may be susceptible to impacts associated with dredging since they may be exposed to suspended sediment generated during dredging activities for a long duration, and throughout various stages

of their life cycles. Exposure to contaminated sediment during larval and juvenile development may have health implications for the species during later life stages.

Non-resident species include bay anchovy, sheepshead minnow, striped mullet (*Mugil cephalus*), northern pipefish, butterfish, black sea bass, cunner, American eel (*Anguilla rostrata*), and sand lance (*Ammodytes americanus*). Non-resident species growth rate in the salt marsh is almost 10 times the rate of the residents. An investigation of the gut contents of residents and non-residents showed that gut contents were consistent with the observed growth rates. The non-resident species maintained a higher feeding rate and consumed a higher percentage of animal foods than residents (Howes and Goehringer, 1996).

Although non-residents may spend less time within the estuaries, they may not necessarily be less susceptible to impacts associated with dredging. Their higher feeding rates and higher percentage consumption of animal foods may make them more susceptible to toxic effects of sediment contaminants. As developing larvae or juveniles in a nursery, they may be highly susceptible to certain toxicants. This exposure also represents a pathway of dredge materials impact to areas outside of the harbor, should these fish leave the estuarine nursery for offshore adult habitats.

Utilizing the information from the DMMP Seine and Trawl Surveys (NAI, 1999), REMOTS® survey (Valente, 1999), and other literature, the potential value for Aquatic Disposal Sites as a nursery for finfish and large invertebrates was assessed. Dredging is more likely to affect sensitive larval and juvenile stages of fish and invertebrates, so the protection of areas with high

nursery potential is important. Nursery potential was estimated using the method described by Wilbur (1999), using data on habitat complexity and presence of juvenile fish.

All New Bedford Harbor candidate aquatic disposal sites were determined to have moderate to high nursery potential for juvenile fish. Beach seine and open water trawl sampling conducted within New Bedford Harbor (NAI, 1999) revealed that many areas of the harbor are important finfish nursery areas. For instance, the Inner Harbor was found to be an important nursery area for winter flounder, while deeper water areas of the Outer Harbor were found to provide nursery for scup, cunner, and black sea bass.

Spawning

Spawning is an essential life history activity of all marine and estuarine organisms. Specific habitat conditions are required to induce spawning and support successful reproduction and development. Spawning occurs over a wide range of substrates depending on the species. These substrates include, but are not limited to, silty sand, sand, gravel, cobble, boulder, shellbeds, eelgrass, etc. Spawning periods and conditions for the most common fish and invertebrates are widely known and many local surveys have identified important habitat associations that appear to be essential to induce spawning and for the reproduction and development of fishes and invertebrates after spawning.

Based on habitat associations and regional distribution of spawning activity, several demersal finfish species may locate suitable environmental conditions for spawning within Massachusetts' ports, estuaries and/or open water (Wilbur, 2000). Some of the more abundant fish known to

spawn within New Bedford/Fairhaven harbor include Atlantic silversides, striped killifish, cunner, mummichog, northern pipefish, ocean pout, winter flounder, Atlantic butterfish, and Atlantic mackerel. Abundant shellfish known to spawn in the harbor include Atlantic rock crab (*Cancer irroratus*), green crab (*Carcinus maenus*), blue mussel (*Mytilus edulis*), softshell clam (*Mya arenaria*), Northern quahog (*Mercenaria mercenaria*), and green sea urchin (*Stronglyocentrotus droebachiensis*). Blueback herring, alewife, and rainbow smelt spawn in upstream waters in the Acushnet River and pass through the harbor en route to spawning grounds from offshore wintering areas. Winter flounder, and Atlantic butterfish can also spawn in offshore waters. Table 3-5 lists the dominant fish and invertebrate species and their known spawning seasons in New Bedford/Fairhaven Harbor and adjacent waters.

Within the season, spawning can be spatially variable in Massachusetts' coastal waters due to presence or absence of specific habitat requirements that are required for spawning (e.g., temperature, salinity, depth, substrate, etc,). Spawning potential can be better predicted in a given location based on presence or absence of these special spawning habitat requirements. Table 3-6 lists the special habitat requirements for spawning of managed fish species known to occur within New Bedford/Fairhaven Harbor.

Table 3-5: Spawning Seasons for Common Nearshore Invertebrates and Fish Species of Buzzards Bay, including New Bedford/Fairhaven Harbor

Common Name	Spawning Season
Invertebrates	
American lobster (*Homarus americanus*)	April - May[1]

Common Name	Spawning Season
Atlantic rock crab (*Cancer irroratus*)	July - October[1]
green crab (*Carcinus maenus*)	June - October[1]
blue mussel (*Mytilus edulis*)	April - October[1]
softshell clam (*Mya arenaria*)	March - July[1]
northern quahog (*Mercenaria mercenaria*)	June - August[1]
green sea urchin (*Stronglyocentrotus droebachiensis*)	February - April[1]
Finfish	
winter flounder (*Pseudopleuronectes americanus*)	February - June[1]
butterfish (*Peprilus triacanthus*)	spring and summer[2]
rainbow smelt (*Osmerus mordax*)	March - May[1]
striped bass (*Morone saxatilis*)	June - July[1]
alewife (*Alosa pseudoharengus*)	April - May[1]
blueback herring (*Alosa aestivalis*)	April - July[1]

Source: [1] Howes and Goerhinger, 1996

[2] NMFS/NERO, www.nero.nmfs.gov/ro/doc/efhtables.pdf

Table 3-6: Spawning Requirements for some Common Managed Inshore Fish and Invertebrate Species known to Spawn in New Bedford/Fairhaven Harbor.

Species Name	Temp. (^{O}C)	Salinity (□)	Depth (m)	Substrate
winter flounder	<10	10 - 32	0.3 - 4.5	sand, muddy sand,

(*Pleuronectes americanus*)			(inshore)	mud, gravel
Atlantic butterfish (*Peprilus triacanthus*)	11 - 17	25 - 33	0 - 1829	pelagic waters
Atlantic mackerel (*Scomber scombrus*)	5 - 23	18 - >30 (peak >30)	0 - 15	pelagic waters
scup (*Stenotomus chyrsops*)	13 - 23	13 - 23	<30	pelagic waters in estuaries
black sea bass (*Centropristis striata*)	n/a	n/a	0 - 200	upper water column

Source: NMFS/NERO, www.nero.nmfs.gov/ro/doc/efhtables.pdf

6.4.5.7. Essential Fish Habitat Descriptions

Information on habitat requirements for the listed EFH species of the 10-minute x 10 minute EFH Quadrant is discussed in this section. This information was synthesized from various publications from NOAA, NMFS and the NEFMC. The information provided herein presents the special habitat requirements only for the specific life cycles stages of the EFH species listed for the EFH quadrant. It should be noted that it is possible during dispersal, disturbance events, or as a result of other stimuli in the environment, for these listed EFH species to be found in habitats that deviate from those listed here. Therefore, the reader should note that potential seasonal and spatial variability of the conditions associated with these species is possible and should be expected.

LEAST AFFECTED SPECIES

The following species are anticipated to be affected the least by the proposed project, due to either their preference for bodies of water with either greater depth or greater salinity than that

found within New Bedford Harbor, or that only juveniles and adults would potentially be present within the work area, and that the species are mobile enough to flee the construction site before injury to the fish would occur. It is anticipated that some short-term impacts to these species could occur from sediment entrained within the water column during dredging operations; however, these potential impacts could be mitigated by sediment and turbidity controls.

ATLANTIC COD (*Gadus morhua*)

Atlantic cod is an economically important member of the family Gadidae. This fish ranges in North America from southern Greenland and southeast Baffin Island, south to Cape Hatteras, and North Carolina (winter) (Robins and Ray, 1986). In southern New England, Atlantic cod are common only in winter and spring in shallow waters under 12 m (40') deep, but are common year round in deeper water (Weiss, 1995). The New Bedford/Fairhaven Harbor Quadrant provides EFH for Atlantic cod eggs, larvae, juveniles and adults. The NOAA Technical Memorandum is attached in **Appendix 56**.

Eggs

Viable eggs are reportedly found in harbor waters with a salinity range of greater than 32 to 33°/$_{00}$ and temperatures below 63°F (12°C). Eggs are observed beginning in the fall, with peak densities occurring in the following winter and spring (NEFMC, 1998; Fahay et al., 1999a).

Larvae

Cod larvae are typically pelagic. They can be found in near-shore waters at depths between 98 and 230 feet (30 and 70 meters) when sea surface temperatures are below 50ºF (10ºC) and

salinity ranges from 32 to 33°/$_{00}$. Larvae are most often observed in the spring (NEFMC, 1998; Fahay et al., 1999a).

Juveniles

Atlantic cod juveniles are found in bottom habitats dominated by cobble or gravel substrates. Juveniles require water temperatures below 68°F (20°C), prefer water depths from 82 to 246 feet (25 to 75 meters) and salinity of 30 to 35°/$_{00}$ (NEFMC, 1998; Fahay et al., 1999a).

Adults

Atlantic cod adults are typically found in bottom habitats dominated by cobble, gravel or rock substrates but also occupy sand or shell areas (NEFMC, 1998). Adults prefer water temperatures below 10ºC (50ºF), depths from 10 to 150 m (33 to 492 ft) and tolerate a wide range of salinities. Most cod are observed spawning during the fall, winter and early spring (NEFMC, 1998; Fahay et al., 1999a).

HADDOCK (*Melanogrammus aeglefinus*)

In North America, haddock (family Gadidae) range from northern Newfoundland south to Cape Hatteras, NC (Robins and Ray, 1986). Haddock is an important species to the New Bedford Harbor commercial fishery industry. The New Bedford/Fairhaven Harbor Quadrant is designated EFH for eggs and larvae haddock. The NOAA Technical Memorandum is attached in **Appendix 56**.

Eggs

Eggs of this species are found in the greatest abundance in surface waters where temperatures are below 50°F (10°C), at water depths between 164 and 295 feet (50 and 90 meters) and in salinity ranging from 34 to 36°/00 (NEFMC, 1998). Eggs occur between March to May with the greatest densities occurring in April (Cargnelli, et al., 1999a).

Larvae

Larvae are found in surface waters where temperatures are below 57ºF (14°C), water depths are between 98 and 295 feet (30 and 90 meters) and salinity ranges from 34 to 36°/00 (NEFMC, 1998; Cargnelli et al., 1999a).

RED HAKE (*Urophycis chuss*)

Red hake, a commercially harvested species of the family Gadidae, ranges in North America from southern Labrador to North Carolina (Robins and Ray, 1986). The New Bedford/Fairhaven Harbor Quadrant is designated EFH for larvae, juveniles, and adults of this species. The NOAA Technical Memorandum is attached in **Appendix 56**.

Larvae

Larvae are found in pelagic waters. They prefer sea surface temperatures below 19°C (66ºF), water depths less than 200 m (656 ft), and a salinity of greater than 0.5°/00. They appear from May through December with peak densities recorded for the months of September and October (Steimle et al., 1999a).

Juveniles

Juvenile red hake seek out bottom habitat with shell fragment or live sea scallop bed substrates. Juveniles prefer water temperatures below 16°C (61ºF), water depths less than 100 m (328 ft), and a salinity range from 31 to 33°/00. Juveniles tend to avoid shallow waters warmer than 22°C (71°F). Juveniles remain pelagic until they reach a size of 25-30 millimeters (mm) total length (TL), after which they seek out sheltered areas. Juveniles are present along coastal regions from spring to fall (NEFMC, 1998; Steimle et al., 1999a).

Adults

Adult red hake seek out bottom habitats, especially depressions with a substrate of sand and mud in areas where water temperatures are below 12°C (54ºF). They prefer depths of 10 to 130 m (33 to 427 ft) and salinities between 33 and 34°/00. Adults spawn in the depressions of sand and mud when water temperatures are less than 10°C (50ºF), at depths of less than 100 m (328 ft) and in areas where salinity falls to less than 25°/00. Spawning typically occurs during the months from May to November, with peak spawning activity occurring in June and July (NEFMC, 1998; Steimle et al., 1999a).

AMERICAN PLAICE (*Hippoglossoides platessoides*)

American plaice is a right-eye flounder (family Pleuronectidae) that ranges in North America from southern Labrador and Greenland, south to Rhode Island (Robins and Ray, 1986). American plaice is common in the Gulf of Maine waters over 40 m (125') deep and colder than 13°C (55°F), however they rarely stray into shallow estuarine waters (Weiss, 1995). The New Bedford/Fairhaven Harbor Quadrant is a designated EFH for American plaice juveniles and adults. The NOAA Technical Memorandum is attached in **Appendix 56**.

Juveniles

American plaice juveniles are found in bottom sediments ranging from fine–grained to sand or gravel substrates. Juveniles require water temperatures below 63°F (17°C). They prefer water depths between 148 and 492 feet (45 and 150 meters) but tolerate a wide range of salinities (NEFMC, 1998; Johnson et al., 1999).

Adults

American plaice adults are also found in bottom sediments ranging from fine–grained to sand or gravel substrates. Adults prefer water temperatures below 63°F (17°C) and water depths between 148 and 574 feet (45 and 175 meters). They tolerate a wide range of salinities. Beginning in March, adults move shoreward to spawn in water depths of less than 295 feet (90 meters). Spawning continues through June (NEFMC, 1998; Johnson et al., 1999).

ATLANTIC BUTTERFISH (*Peprilus triacanthus*)

This species is a commercially important member of the family Stromateidae, a family comprised largely of coastal and oceanic warm-water fish (Robins and Ray, 1986). These fish migrate shoreward in the spring. By summer, they can be found in loose schools inhabiting waters from sheltered bays, seaward to the edge of the mid-Atlantic shelf to depths of 200 m (656 ft). They then return to deeper and more southerly waters in the fall, as water temperatures again decrease (Cross, et al., 1999). New Bedford/Fairhaven Harbor Quadrant provides EFH for eggs, larvae, juveniles, and adults of this species. The NOAA Technical Memorandum is attached in **Appendix 56**.

Eggs

Inshore, butterfish eggs are collected from mixing, seawater, or both salinity areas of estuaries. Egg densities are greatest in water temperatures between 52 and 63 ^{o}F. Eggs may be collected from shore to a depth of 1,829 m (6000 ft) (Cross, et al., 1999; NMFS/NERO, 2001).

Larvae

Larvae inhabit the upper layer of open waters, usually associated with floating cover such as cnidarians or *Sargassum* weed. They become more abundant at night near the water surface than during the day, suggesting a diel vertical migration behavior pattern (Kendall and Naplin, 1981). Larvae are reported from waters within their range at temperatures between 4.4 and 27.9°C (40 and 82°F), but prefer temperatures of between 9 and 19°C (48 and 66°F). They are found in mixing zone and seawater salinities (Cross, et al., 1999; NMFS/NERO, 2001). Larvae are most frequently observed in July and August, with abundance sharply declining by the end of September.

Juveniles

Juvenile butterfish inhabit open waters from the surface to depth on the continental shelf. Juveniles typically occupy a vertical range in the water column of 10 to 330 m (33 to 1,082 ft). These fish are commonly observed in coastal bays and estuaries, and other inshore areas. Frequent sightings in the surf zone have also been documented. Juvenile butterfish can tolerate a wide range of salinity (3.0 to 37.4°/$_{00}$), hence their sightings in estuaries, bays and in offshore waters. In previous sampling studies, the greatest numbers of fish collected were at sampling

depths of 120 m (393 ft). The schools can be found over sandy to muddy substrates and prefer a temperature range from 4.4 to 29.7ºC (40 to 85ºF). However, their survival rate is reduced when the temperature falls below 10ºC (50ºF). Juveniles are generally present from spring through fall (Cross, et al., 1999).

Adults

Inshore, butterfish eggs are collected from mixing, seawater, or both salinity areas of estuaries. Egg densities are greatest in water temperatures between 11 to 17 ºC (52 and 63 ^{o}F). Generally adult butterfish inhabit water columns between 10 to 366m (33 to 1200 ft) and are typically found in water with temperatures from 37 –82 ºF (Cross, et al., 1999; NMFS/NERO, 2001).

ATLANTIC MACKEREL (*Scomber scombrus*)

Atlantic mackerel (family Scombridae) range in North America from southern Labrador to Cape Hatteras (Robins and Ray, 1986) and is very common in southern New England waters (Weiss, 1995). The New Bedford/Fairhaven Harbor Quadrant is designated EFH for eggs, larvae, juveniles, and adults of Atlantic mackerel. The NOAA Technical Memorandum is attached in **Appendix 56**.

Eggs

Eggs of the Atlantic mackerel are found in both near-shore and offshore waters. In near-shore waters they are typically found in mixing water salinity (between 0.5 and 25°/$_{00}$) to seawater salinity (greater than 25°/$_{00}$) and at depths between zero and 50 feet (zero and 15 meters). Eggs require temperatures between 41 and 73°F (5 and 23ºC) (Studholme, et al., 1999).

Larvae

Larvae of the Atlantic mackerel are found in both near-shore and offshore waters. In near-shore waters such as New Bedford Harbor they are typically found within mixing water salinity (between 0.5 and 25°/$_{00}$) to seawater salinity (greater than 25°/$_{00}$) range, at depths of 33 to 425 feet (10 to 130 meters), and at temperatures between 43 and 72°F (6 and 22ºC) (Studholme, et al., 1999; NMFS, 2001).

Juveniles

Atlantic mackerel juveniles are found in both near-shore and offshore waters. In near-shore waters, such as New Bedford Harbor, they are typically found in mixing water to seawater salinities, at depths ranging from zero to 320 m (zero to 1,050 ft) and temperatures between 4ºC and 22ºC (39 and 72°F) (Studholme, et al., 1999; NMFS, 2001). Juveniles tend to peak in density from May through August, with numbers declining sharply thereafter.

Adults

Adults are found in both near-shore and offshore waters. In near-shore waters, such as New Bedford Harbor, they are typically found in mixing water and seawater salinities, at depths ranging from zero to 381 m (zero to 1,250 ft) and at temperatures between 4ºC and 16ºC (39 and 61°F) (Studholme, et al., 1999; NMFS, 2001). Adult mackerel are present during the late winter to early spring, after which they migrate to deeper open water. A brief return of adults may occur in late fall.

SANDBAR SHARK (*Charcharhinus plumbeus*)

A member of the requiem sharks (family Carcharhinidae), the sandbar shark inhabits the western Atlantic from Massachusetts to southern Brazil (Robins and Ray, 1986). In southern New England, sandbar sharks are not common in estuarine waters (Weiss, 1995). The New Bedford/Fairhaven Harbor Quadrant is designated EFH for sandbar shark adults. The NOAA Technical Memorandum is attached in **Appendix 56**.

Adults

Adult Sandbar sharks inhabit shallow, muddy, coastal waters to the 50 m (165 ft) isobath from Nantucket, Massachusetts, south to Miami Florida. They also inhabit waters surrounding peninsular Florida, west to the Florida panhandle at water temperatures up to 30ºC (85°F), and saline portions of Florida Bay (NMFS/NERO, 2001). This species is known to migrate south in winter to wintering grounds from North Carolina, south to Florida and the Caribbean Sea.

BLUEFIN TUNA (*Thunnus thynnus*)

A member of the family Scombridae, and renown as a food and game fish, bluefin tuna range from southern Labrador, Canada south to northern Brazil (Robins and Ray, 1986). The New Bedford/Fairhaven Harbor Quadrant is designated EFH for bluefin juvenile stages. The NOAA Technical Memorandum is attached in **Appendix 56**.

Juveniles

EFH for bluefin juveniles is essentially all coastal pelagic surface waters that exceed temperatures of 12°C (52ºF) and lie between the 25 and 200 m (82 and 656 ft) isobaths from Cape Ann, MA, south to Cape Hatteras, NC (NMFS/NERO, 2001).

ATLANTIC SEA HERRING (*Clupea harengus*)

Atlantic sea herring is an economically important member of the family Clupeidae. This fish ranges in North America from Greenland and northern Labrador, south to North Carolina (Robins and Ray, 1986). The New Bedford/Fairhaven Harbor Quadrant is designated EFH for juveniles and adult Atlantic sea herring. The NOAA Technical Memorandum is attached in **Appendix 56**.

Juveniles

Atlantic sea herring juveniles frequent open waters and bottom habitats with temperatures below 10°C (50ºF). They prefer water depths from 15 and 135 m (49 to 443 ft) and a salinity range of 26 to 32°/$_{00}$ (NEFMC, 1998; Reid et al., 1999).

Adults

Atlantic sea herring adults are found in open waters and bottom habitats. They generally prefer water temperatures below 10°C (50°F), inhabit water depths from 20 to 130 m (66 to 427 ft), and prefer salinities above 28°/00. Atlantic herring adults use bottom habitats with gravel, sand, cobble or shell fragment substrate for spawning. Patches of aquatic macrophytes are also used. Spawning typically occurs in water depths between 20 and 80 m (66 and 263 ft) and in salinities ranging from 32 to 33°/00. Spawning occurs from July through November in areas of well-mixed water with tidal currents between 1.5 and 3.0 knots (NEFMC, 1998). Adults are present in smaller numbers in the spring and fall, and are typically not observed during the summer (Reid, et al., 1999).

BLUEFISH (*Pomatomus saltatrix*)

Bluefish (family Pomatomidae) is an important commercial and sport fish ranging from Nova Scotia, Canada, south to Argentina (Robins and Ray, 1986). In southern New England, young "snapper" bluefish are very common near-shore and in estuaries, while the larger bluefish are common offshore (Weiss, 1995). The New Bedford/Fairhaven Harbor Quadrant is designated as EFH for bluefish juveniles and adults. The NOAA Technical Memorandum is attached in **Appendix 56**.

Juveniles

All major estuaries from Penobscot Bay, Maine south to St. Johns River in Florida is considered EFH for bluefish juveniles. Juvenile bluefish prefer estuaries or shallow water with temperatures between 15 and 30°C (59 and 86°F). Typical salinities of waters frequented by this species

range from 23 to 33°/$_{00}$. Preferred substrates include sand, mud, silt, and clay (Fahay et al., 1999b).

Adults

Adult bluefish are most common in near-shore open waters with temperatures ranging from 15 to 25°C (59 to 77°F), and with seawater salinities. Adults are highly migratory, appearing in New Bedford/Fairhaven Harbor from May through October, after which they migrate southward, returning to warmer waters. They reportedly prefer salinities greater than 25°/$_{00}$ (Fahay et al., 1999b). Most fish collected in the New Bedford Harbor area are juveniles with some adults. The peak abundance for adults is summer through fall (NAI, 1999).

LONG-FINNED SQUID (*Loligo pealei*)

In North America, long-finned squid (family Loliginidae) ranges from southern Maine to the Caribbean, with greatest abundance from Cape Ann south to Cape Cod. This species is of great economic importance as a bait source and for consumption overseas in Italian fish markets (Gosner, 1978). New Bedford/Fairhaven Harbor Quadrant is designated EFH for the juvenile and adult life stages of this species. The NOAA Technical Memorandum is attached in **Appendix 56**.

Juveniles

Juveniles (pre-recruits) are found in greatest abundance in open water ranging in depth from shore to 700 feet (213 meters) deep, and in temperatures from 39 to 81°F (4 to 27ºC) (Cargnelli et al., 1999b; NMFS, 2001).

Adults

Adults (recruits) are found in greatest abundance in open water ranging in depth from shore to 1,000 feet (305 meters) deep, and prefer the same temperature range as juveniles (Cargnelli et al., 1999b).

SURF CLAM (*Spisula solidissima*)

The surf clam, family Mactridae, is a major commercial commodity; accounting for a majority of the clam crop in this country (Gosner, et al., 1978). In southern New England, these clams are harvested for chowder and other food products (Weiss, 1995). Surf Clams are usually found from Nova Scotia south to South Carolina. In southern New England, surf clams are common offshore in sand (Weiss, 1995). New Bedford/Fairhaven Harbor Quadrant provides EFH for surf clam juveniles and adults. The NOAA Technical Memorandum is attached in **Appendix 56**. An extensive shellfish surveys at the site did not reveal surf clams at the site.

Juveniles

Juvenile surf clams are found in well-sorted, medium and fine-grained sands and in waters with temperatures less than 77°F (25ºC). They are typically found in water with a salinity of 28°/$_{00}$ or higher (Steimle et al., 1999c).

Adults

Adults are found in medium sized sands and prefer temperatures between 59 and 86°F (15 and 30ºC). Adults can survive in salinities as low as 12.5°/$_{00}$ but are more commonly found in salinities above 28°/$_{00}$ (Steimle et al., 1999c; NMFS/NERO, 2001).

KING MACKEREL (*Scomberomorus cavalla*)

King mackerel (family Scombridae) range in North America from Massachusetts and the northern Gulf of Mexico south to southern Brazil. It is an important food and game fish typically caught by trolling over deep water (Robins and Ray, 1986). New Bedford/Fairhaven Harbor Quadrant is designated EFH for king mackerel eggs, larvae, juveniles, and adults. EFH for all life stages of this federally managed species is defined as "sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone, but from the Gulf Stream shoreward". *Sargassum* also provides EFH for this species, as do all coastal inlets and all state-designated nursery habitats known to support coastal migratory species. King mackerel are typically found in waters with salinities >30°/$_{00}$, and temperatures >20°C (68°F) (NMFS/NERO, 2001). A brief NOAA Fact Sheet on the EFH for King Mackerel is attached in **Appendix 56**.

SPANISH MACKEREL (*Scomberomorus maculatus*)

Spanish mackerel (family Scombridae) range in North America from Cape Cod, south to southern Florida and the Gulf of Mexico. However, it is reportedly rare north of the Chesapeake Bay (Robins and Ray, 1986). Like other Scombrids, it is a popular food and game fish. It typically enters shallow bays and can be caught by bridge fisherman (Robins and Ray, 1986). The New Bedford/Fairhaven Harbor Quadrant is designated EFH for Spanish mackerel eggs,

larvae, juveniles, and adults. EFH for all life stages of this federally managed species is the same as that defined for king mackerel. Spanish mackerel are typically found in water with salinities greater than 30°/$_{00}$, and temperatures greater than 20°C (68°F), preferably between 21 and 31°C (70 and 88°F), and rarely below 18°C (64°F). Spanish mackerel spawn off the coast between late spring and late summer (NMFS/NERO, 2001). A brief NOAA Fact Sheet and a NOAA Technical Report for Cobia is attached in **Appendix 56**.

COBIA (*Rachycentron canadum*)

Most closely related to remoras and jacks, cobia are the only extant member of the family Rachycentridae. They range from Massachusetts south to Argentina and are valued as food and game fish (Robins and Ray, 1986). The New Bedford/Fairhaven Harbor Quadrant is designated EFH for all life stages of cobia eggs, larvae, juveniles, and adults. Areas designated as essential fish habitat for cobia are the same as for king and Spanish mackerel. Additionally, the Gulf Stream is designated EFH for cobia since it is essential to the dispersal of coastal migratory pelagic larvae of this species. Cobia are typically found in waters with salinities greater than 30°/$_{00}$, and temperatures greater than 20°C (68°F) (NMFS/NERO, 2001). A brief NOAA Fact Sheet on the EFH for Spanish Mackerel is attached in **Appendix 56**.

SUMMER FLOUNDER (*Paralicthys dentatus*)

Summer Flounder is a left-eye flounder (family Bothidae) that ranges in North America from Maine and (rarely) Nova Scotia, south to northern Florida (Robins and Ray, 1986). This species is common in southern New England from mid-spring through mid-fall (Weiss, 1995). The New

Bedford/Fairhaven Harbor Quadrant is designated EFH for eggs, larvae, juveniles, and adults of this species. The NOAA Technical Memorandum is attached in **Appendix 56**.

Eggs

Summer flounder eggs occur from October to May. Depth of occurrence is dependent on season. In the fall eggs are typically found from 30-70 m (98 – 230 feet). In the winter, eggs are typically found in greatest abundance at 110m (361 feet) (Packer, et al., 1999).

Larvae

Larvae are typically found to be most abundant 19 to 83 km (11.8 to 51.6 mi) from shore in water column depths from 10 to 70 m (33 to 230 ft). The larvae proceed to migrate inshore, seeking coastal and estuarine nursery areas to start and complete metamorphosis. Temperature appears to have a significant bearing on the duration of metamorphosis. Mortality occurs when the water temperature reaches 2 to 4ºC (35 to 39ºF). The transforming larvae are sensitive to the types of predators present and modify their burying behavior accordingly (Packer, et al., 1999). Peak existence of summer flounder larvae occurs from October through January (Packer, et al., 1999; NMFS/NERO, 2001).

Juveniles

The preferred habitat substrate of juveniles is sand. Estuarine marsh creeks, tidal flats and channels with depths of 0.5 to 1.5 m (1.6 to 4.9 ft) are preferred habitat areas for summer flounder. Increased temperature directly relates to a short metamorphic period. Juveniles experience a higher mortality when temperatures fall below 4ºC (39ºF) (Packer, et al., 1999).

Adults

Adults prefer bottom habitats of both inshore (warmer months) and offshore (colder months) waters to depths of 152 m (500 ft). They tolerate both the mixing water and seawater salinities (Packer, et al., 1999). Stands of submerged aquatic vegetation, sea grasses, and macroalgae are recognized as HAPC for this species by NMFS (2001).

MOST AFFECTED SPECIES

The following species will be most affected by the completion of the project due to their preferential use of shallow, near-shore subtidal and intertidal areas within estuaries such as New Bedford Harbor for spawning and foraging. The project will be removing spawning and foraging habitat within the area to be filled, and significantly changing the area within areas to be dredged, such that it will be significantly less available as spawning or foraging habitat (if not completely unavailable) subsequent to construction. Note, however, that these impacts will be mitigated, as explained in **Section 7** below. In addition, even with this project, there are many nearby areas that will remain usable for spawning and foraging habitat. Thus, the work associated with the terminal will not have any significant impact on populations of fish and other organisms.

BENTHIC ORGANISMS (various species)

Benthic organisms serve as an important food source for many fish species. Benthic organisms will be lost permanently behind the area that will be filled. Benthic organisms inhabiting the area to be dredged will be removed by the dredging activities. The project proposes to dredge areas which presently have a water depth of -1 MLLW to -6 MLLW (or -5 MLLW to -14

MLLW) to a water depth of between -14 MLLW and -30 MLLW. The increased depth will have an increase in pressure of approximately 1 atmosphere. The increase in pressure and diminished levels of light may limit the colonization of the newly exposed substrate. However, benthic organizations observed during the shellfish survey at the site have been observed in previously completed shellfish surveys within the Harbor at similar depths to the proposed dredge depths. Therefore, although recovery of benthic organisms within the dredge areas will occur, the productivity of these areas may be reduced. Within areas that will have minimal changes in depth (for example, areas that are planned to be dredged from -20 MLLW to -30 MLLW) benthic resources are documented to recover very quickly; therefore, impacts to EFH are expected to be minimal within these areas.

WINTER FLOUNDER (*Pleuronectes americanus*)

Winter flounder is a right-eye flounder (family Pleuronectidae) that ranges in North America from Labrador, south to Georgia (Robins and Ray, 1986). The New Bedford/Fairhaven Harbor Quadrant is designated EFH for winter flounder eggs, larvae, juveniles, and adults. The NOAA Technical Memorandum is attached in **Appendix 56**.

Eggs

Winter flounder eggs are found in bottom habitats with sand, mud, and gravel where water temperatures are less than 10°C (50°F), salinities range between 10 and 30°/$_{00}$, and water depths are less than 5 m (16 ft). Spawning areas occur where hydrodynamics function to keep the hatched larvae from being dispersed. Winter flounder seem to time their hatching to the advent of favorable environmental conditions (Pereira, et. al., 1999).

Larvae

Larvae inhabit open water and benthic habitats in areas where sea surface water temperatures are less than 15°C (59°F) and salinities range from 4 to 30°/$_{00}$. Within inshore waters such as the New Bedford Harbor, they are typically found in waters less than 6 m (17 ft) deep. Larvae are often observed from March to July with peaks in April and May (NEFMC, 1998; Pereira, et. al., 1999).

Juveniles

Juvenile winter flounder are found in bottom habitats with a substrate of mud or fine- grained sand. They are generally found in waters from 0.1 to 10 m (0.3 to 33 ft) deep, water temperatures below 28°C (82°F), and salinities between 5 and 33°/$_{00}$. Young of the year (YOY) flounder (i.e., those less than one year old) spend much of their first year in very shallow inshore waters (NMFS, 1999; Pereira, et. al., 1999).

Adults

Adults are also found in bottom habitats with sand, gravel, and mud substrates. The habitat is usually less than 6 m (17 ft) deep, with temperatures below 15°C (59°F), and salinities between 5.5 and 36°/$_{00}$ (NEFMC, 1998).

WINDOWPANE FLOUNDER (*Scopthalmus aquosus*)

Windowpane flounder is a left-eye flounder (family Bothidae) ranging in North America from the Gulf of Saint Lawrence, south to northern Florida (Robins and Ray, 1986). This species is

very common throughout southern New England (Weiss, 1995). The New Bedford/Fairhaven Harbor Quadrant is designated EFH for eggs, larvae, juveniles and adults of this species. The NOAA Technical Memorandum is attached in **Appendix 56**.

Eggs

Eggs of the windowpane flounder are found in surface waters with temperatures less than 20°C (68°F), and at water depths less than 70 m (230 ft). Eggs appear from February to November with peak densities occurring in July and August (NEFMC, 1998; Chang et al., 1999).

Larvae

Larvae inhabit pelagic waters where sea surface temperatures are less than 20°C (68°F) and water depths are less than 70 m (230 ft). Larvae appear from February to November, with peak densities occurring in July and into August (NEFMC, 1998; Chang et al., 1999).

Juveniles

Juveniles inhabit benthic areas with mud or fine-grained sand substrates; water temperatures are below 25°C (77°F), and depths ranging from 1 to 100 m (3 to 328 ft). They tolerate a wide range of salinity, between 5.5 and 36°/$_{00}$ (NEFMC, 1998; Chang et al., 1999).

Adults

Adults inhabit benthic areas with mud or fine-grained sand substrates where water temperatures are below 27°C (80°F), and depths range from 1 to 75 m (3 to 246 ft). Adults also tolerate a wide range of salinity, between 5.5 and 36°/$_{00}$. Spawning conditions are met when water

temperatures are below 21°C (70°F), water depths are between 1 and 75 m (3 and 246 ft) and salinity is between 5.5 and 36°/00. Spawning normally occurs from February to December (NEFMC, 1998; Chang et al., 1999).

SCUP (*Stenotomus chrysops*)

This species is a member of the family Sparidae. It is found from Nova Scotia, south to Florida (Robins and Ray, 1986). In southern New England, scup is very common in bays and sounds (Weiss, 1995). The New Bedford/Fairhaven Harbor Quadrant is designated EFH for eggs, larvae, juveniles and adults of this species. The NOAA Technical Memorandum is attached in **Appendix 56**.

Eggs

EFH for Scup eggs is described as estuaries where scup eggs were identified as common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Scup eggs typically appear from May through August in southern New England. They reach their greatest density in estuarine waters with temperatures between 55 and 73 °F and in salinities > 15 °/00 (Steimle et al., 1999b; NMFS/NERO).

Larvae

EFH for Scup larvae is described as estuaries where scup were identified as common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Scup larvae reach their greatest densities from May through September, in inshore waters with temperatures between 55 and 73 °F and salinities > 15 °/00 (Steimle et al., 1999b; NMFS/NERO).

Juveniles

Juvenile scup are found in estuaries and bays with sand, mud, mussel, and eelgrass bed substrates. They generally require water above 16ºC (61°F) and salinities greater than 15°/$_{00}$ (Steimle et al., 1999b).

Adults

Adult scup are also found in estuaries with mixing to seawater salinity ranges and temperatures above 16ºC (61°F). They prefer depths of 2-38 m (6.6 – 125 ft) and are generally found in areas with fine to silty sand, mud, mussel beds, rock, artificial reefs, wrecks, and other structures (Steimle et al., 1999b).

BLACK SEA BASS (*Centropristis striata*)

Black sea bass (family Serranidae) range in North America from Maine to northeastern Florida, and the eastern Gulf of Mexico (Robins and Ray, 1986). New Bedford/Fairhaven Harbor Quadrant is designated EFH for black sea bass larvae, juveniles and adults. The NOAA Technical Memorandum is attached in **Appendix 56**.

Larvae

Black sea bass frequent coastal areas and marine parts of estuaries at depths less than 100 m (328 feet) within a salinity range of 30 to 35°/$_{00}$, and in water with temperatures between 11 and 26ºC (52 – 79 °F). After transformation into juveniles, black sea bass become demersal and seek out structured substrate (Steimle et al., 1999c; NMFS, 2001).

Juveniles

Winter juveniles and YOY fish migrate from the Middle Atlantic Bight to the Gulf of Maine and then into estuaries upon further development. Juvenile habitat ranges from estuarine to coastal waters, and from the water surface to a depth of 38 m (125 ft). Juvenile sea bass may be found around the edges of salt marshes and channels. Substrate most likely inhabited by the black sea bass consists of rough bottom in and amongst shellfish, sponge, eelgrass beds, near-shore shell patches, or man-made objects (Steimle, et al., 1999c).

Adults

Adults are typically found within inshore waters of mixing water to seawater salinities. The adults prefer rock jetties and rocky bottom substrate areas, but may also be found in sand and shell fragment substrates. These fish enter near-shore waters in greatest abundance from May through October. They require a minimum water temperature of 6ºC (43°F) (Steimle, et al., 1999c).

6.4.5.8. Analysis of Dredging, Sheet Piling, and Filling Impacts to Fish and EFH

The primary impacts associated with the South Terminal CDF project are anticipated to be related to habitat alteration/loss due to sheet pile installation and filling needed for construction of the marine terminal. Additional habitat alteration/loss is anticipated due to dredging of near-shore, shallow subtidal areas to depths of -14 and -30 MLLW.

Dredging and dredged material disposal, if not conducted properly with adequate planning and proper engineering controls, may adversely affect fish and fish habitat. Potential dredging areas associated with the proposed South Terminal CDF include shipping berths, turning basins, and entrance channels.

Potential adverse effects to fish and fish habitat related to typical dredging projects include the following: destruction of benthic habitat, impairment of water quality and the direct (e.g., habitat alteration/loss) and indirect (e.g., toxicological) and effects on the fish and their prey species. Table 4-1 lists the impacts or effects of human-induced alterations on food source, water quality, habitat structure, flow regime and biotic interactions. The extent of the effect depends on hydrologic processes, sediment texture and composition, chemical content of the sediment and pore water matrices, and the behavior or life stage of the receptor species.

6.4.5.9. Impairment of Water Quality

Water quality impacts from dredging and dredge disposal include physical, chemical and biological impacts. Changes in water quality have concurrent impacts to the system which affect fish and EFH in various ways (Table 4-1). The impacts to the water quality that are to be expected during dredging and dredged material disposal will be temporary and diminish with the cessation of dredging and disposal (water quality impairment is not anticipated from to filling, as it is likely to occur behind completed sheet piling, which will minimize filling-generated turbidity). Changes to the water turbidity, pH, and dissolved oxygen (DO) are expected both during the actual dredging activity within the Harbor, and during disposal activity. However using proper controls, these impacts will be minimized and the anticipated changes to the water

quality of the marine system will return to pre-project conditions once the project is completed. No appreciable or permanent changes to the salinity regime, tidal cycle, or current patterns are anticipated.

6.4.5.9.1. Physical Impairment

Physical impairment of the water column due to dredging and dredge disposal occurs from changes in dissolved oxygen, salinity, pH, oxidation-reduction state, and turbidity with a resultant decrease in light penetration. The degree of change or alteration of the water column's physical component depends on various physical and chemical parameters (e.g., pH, oxidation-reduction potential, sediment size, organic matter content, concentration of reactive iron and manganese, etc.).

The water column proximal to the dredging operation will experience temporary physical impairment due to increased turbidity during dredging. Likewise, the water column proximal to the disposal area will also be impacted by increased turbidity during disposal. The temporary water quality impacts that can be expected include the release of dissolved hydrogen sulfides into the water column, as well as an increase in Total Suspended Solids (TSS) loads. A concurrent decrease in DO would be anticipated in response to the Table 4-1

Table 4-1: Impact of Human-Induced Alterations to Various Ecological Attributes

Ecological Attribute	Impact of Human-Induced Alterations
Food (energy) source -type, amount, and particle size of organic	-decreased availability of food source (filling/dredging only)

material entering a tidal stream or tributary from the riparian zone vs. primary production in the stream -seasonal pattern of available energy -primary production of the basin	-decreased coarse particulate organic matter to estuary -increased fine particulate organic matter to estuary -increased algal production in basin -shifts in feeding guilds
Water Quality -temperature -turbidity -dissolved oxygen -nutrients (primarily nitrogen and phosphorus) -organic and inorganic chemicals -heavy metals and other toxic substances -pH -salinity	-expanded temperature extremes -increased turbidity -altered diurnal cycle of dissolved oxygen -increased nutrients (especially soluble nitrogen and phosphorus) -increased suspended solids -increased toxics -altered salinity
Habitat Structure -substrate type -water depth and current tidal velocity -spawning, nursery, and hiding places -diversity/complexity (pools, riffles, woody debris in tidal streams; SAV, shell beds, sand wave ripples, structures, reefs, wrecks, etc. in basin -basin size and shape	-loss of habitat (filling/dredging only) -decreased stability of substrate, banks and shoreline due to erosion and sedimentation -more uniform water depth -reduced habitat heterogeneity -decreased channel sinuosity of tidal or tributary streams -reduced habitat areas due to shortened channel, removed structures or debris -decreased instream cover and riparian vegetation
Flow Regime -water volume -temporal distribution of floods, low flows, tides	-altered flow extremes (both magnitude and frequency of high and low flows) -increased maximum flow velocity -decreased minimum flow velocity -reduced diversity of microhabitat velocities -fewer protected sites
Biotic Interactions -competition -predation -disease -parasitism -mutualism -introduction of non-native organisms	-increased frequency of diseased fish -altered primary and secondary production -altered trophic structure -altered decomposition rates and timing -disruption of seasonal rhythms -shifts in species composition and relative abundance -shifts in invertebrate functional groups (e.g. filler feeders vs. suspension feeders) -shifts in trophic guilds (e.g. increased omnivores and decreased piscivores) -increased frequency of fish hybridization -increased frequency of exotic species

Source: Adapted to marine systems from Karr (1991) and other sources.

The magnitude of TSS released or generated during dredging can be minimized using best management practices such as the deployment of appropriate dredging equipment and techniques. The areal extent of impact will be minimized by avoiding dredging during days of adverse weather and resultant increased wave and current velocities. The temporary impacts to the water column associated with turbidity will cease following completion of the maintenance dredging.

6.4.5.9.2. Chemical Impairment

Chemical impairment of the water column produced by dredging and dredge disposal is caused by release of various chemical contaminants that may occur within the sediment. Such contaminants typically include heavy metals, organochlorine compounds, polyaromatic hydrocarbons, total petroleum hydrocarbon, pesticides, and other anthropogenic compounds or materials. These compounds are introduced into the harbor sediment via a variety of sources including but not limited to surface runoff (non-point sources), municipal wastewater treatment effluent, industrial discharge, accidental and incidental oil and chemical spills, illegal discharges, etc. Depending on basin characteristics, and composition of the receiving matrix (i.e., sediment) concentrations of the chemicals can be greatest at the point of discharge or away (e.g., downcurrent) from the discharge.

The following contaminants occur in the material to be dredged from the harbor at varying detectable concentrations: polyaromatic hydrocarbons (PAH_S), polychlorinated biphenyls

(PCBs), heavy metals, and dioxins/furans. Many of these compounds are ubiquitous in sediments of multi-use estuaries. At elevated concentrations, exposure of fish to these chemicals in the water column or sediment matrices can cause various acute and chronic toxicological effects (Suter and Rosen, 1988).

The concentrations of the chemicals detected in the sediment of the project area, are not considered hazardous, and therefore their handling and disposal as hazardous waste in accordance with 40 CFR 260-268 is neither necessary nor required by law.

6.4.5.9.3. Biological Impairment

Microorganisms such as bacteria, viruses, and plankton cause biological impairment of water quality. Biological impairment can occur when introduction of dredge materials into the water column kills submerged aquatic vegetation and macroalgae (either through direct smothering or via impaired light penetration) leading to higher rates of bacterial decomposition and a resultant increase in bacterial oxygen demand. Disposal of materials contaminated by wastewater treatment effluent, failing sewer pipes, or failing individual subsurface sanitary disposal systems may introduce disease-causing organisms (i.e. bacteria and viruses) into the water column and into the biota proximal to the disposal site. Pathogens, alone (i.e., without accompanying sediment), are typically rapidly assimilated or neutralized by the estuarine system. Aside from potential serious human health impacts, they typically pose little impact to the biota of the system (Wilson, 1988).

Pathogens may exist within the water column of the New Bedford/Fairhaven Harbor, which is closed to harvest for direct sale of shellfish without depuration. Dredging at the South Terminal CDF site is unlikely to cause irreversible impact to marine resources due to pathogenic impairment since the area is not used for shellfishing.

6.4.5.10. Destruction of Benthic Habitat

Dredging and dredge disposal may result in the destruction of benthic habitat either by direct removal of the benthic substrate by the dredging operation itself, or via disposal of dredged material onto the benthic habitat at the disposal site. Filling will also result in the destruction of benthic habitat. Either operation may result in the change in substrate composition, rendering the formerly suitable benthic substrate unsuitable for certain benthic organisms or disrupting existing ecological processes or interactions between resident benthic and water column communities.

Changes to the bathymetry of both the dredged areas (due to the removal of sediment) and the filled areas (due to the placement of dredged material behind the sheet pile wall) will occur. Resultant impact to the EFH species that inhabit these areas will vary based on the mobility, life history, and behavior of the species. For instance, sessile and slow moving invertebrate species and taxa would be removed via dredging during construction and/or buried within the filled area. Highly mobile species and taxa such as adult pelagic fish would likely avoid the disturbance areas.

Sediment texture would undergo a series of changes within dredging areas. Native sediments would be removed, exposing deeper till layers. The recessed dredged areas would begin to

accumulate organic material settling out of the water column. The dredged areas would slowly, over time, accumulate a layer of smaller fraction sediment such as silts, clays and organic matter.

6.4.5.10.1. Direct Removal of Benthic Substrate

Direct removal of suitable benthic substrate via dredging typically impacts EFH by removing prey species (e.g., benthic organisms) or food species (e.g., macroalgae), removal of suitable cover or settlement structure (e.g., shell beds, SAV) or by destruction of spawning areas. Re-colonization of the newly exposed substrate after dredging is a factor not only of site-specific basin characteristics (e.g., wave or tidal energy, bathymetry, etc.) but also of substrate requirements of the larvae of recolonizing species (Rhoads and Germano, 1982). Dredge or disposal areas that continue to be disturbed after dredging activities have ceased (e.g. such as areas within dredged channels and shipping maneuvering areas) may not return to pre-disturbance conditions or may not progress beyond the initial re-colonization seral stage community (Kaplan, et al, 1975).

Removal of benthic sediment through dredging homogenizes the bottom substrate, reduces structural complexity and may release hydrogen sulfide; all factors that tend to discourage recruitment of benthic invertebrates, which in turn, are the food of many demersal fish. This impact is of even greater significance in areas where organisms with special microhabitat requirements that have now been removed via dredging, formerly dominated the benthos. Even small structures or inconsistencies in the sea floor are exploited by various species of benthic invertebrates or demersal fish species. Examples of these smaller structures include sand ripples; thalassinid crustacean mounds; sea cucumber fecal deposits; pits left by feeding elasmobranchs and crabs; submerged aquatic vegetation blades; urchin spines, kelp holdfasts and stipes; sponge,

sea pen and bryozoan colonies; annelid worm, amphipod crustacean, vermetid gastropod, and cerianthid anemone tubes (Norse and Watling, 1999). Regardless of the sizes of the structure, structural complexity provides smaller species with living space, increased food abundance, and refuge from predation. Certain species of demersal fish prefer one substrate over another for fishing or spawning. For instance, red hake are known to exploit the downcurrent side of sand wave crests catching prey items by surprise as they are carried by bottom currents over the sand wave (Norse and Watling, 1999). Black sea bass occupy areas around the base of boulders and rock reefs. As a general rule, both prey and fish species diversity increases with habitat complexity, therefore, the more structurally complex the marine habitat the greater the organism diversity. This is illustrated in the diverse communities that form among the structurally complex coral reef (Kaplan, 1982) and rocky intertidal zone (Hughes, 1986) communities.

6.4.5.10.2. Filling of Benthic Substrate

Disposal of the material directly onto the substrate may impact EFH by burying food sources, changing microhabitat requirements, destruction of spawning areas, and changing basin hydrology and bathymetry, as well as loss of habitat. In addition, the disposal of the material into the water column above the benthic substrate could impact the physical, chemical, and biological suitability of the water column within the EFH; however, sheet piling is anticipated to be advanced prior to filling, which will minimize impacts to the surrounding water column.

6.4.5.11. Direct and Indirect Effects On Organisms

Sheet piling installation, filling, dredging and dredged material disposal can cause adverse direct impact (e.g., via habitat loss and/or toxicity) and indirect impact (e.g., disruption of ecosystem attributes) to marine organisms.

Direct Effects

Direct effects caused by sheet piling and filling include permanent loss of habitat, reduction in the availability of food supply, loss of foraging habitat, loss of spawning areas, and loss of refuge areas from predators.

Direct effects caused by disposal of the dredge materials include behavioral impairment (e.g., inhibition of migration patterns), destruction of eggs or spawning areas, physical impairment (e.g., turbidity-induced clogged gills resulting in suffocation, or abrasion of sensitive epithelial tissue), or physiological impairment due to acute or chronic toxicity to contaminants within the dredge sediments.

Some physical impairment of resident fish species within the harbor would be expected. Pelagic fish are more likely to avoid the turbidity plumes and leave that portion of the harbor occupied by the sediment plume. Anadromous fish may either be temporarily impacted by the sediment plume as they pass through it to freshwater spawning areas, or they may avoid returning to their spawning areas altogether, potentially affecting their reproductive success for the season. Dredging during winter months may directly impact hibernating marine organisms that may have buried into the soft sediment of the bay.

Indirect Effects

Ecological impacts of dredging, if implemented without the proper controls and planning, can affect various ecological attributes of the system, including energy flow, habitat structure, and biotic interactions.

Energy Flow

Food sources enter the system based on organic material input and via primary productivity by phytoplankton, algae, emergent or submerged aquatic vegetation. Phytoplankton productivity is a major source of primary food-energy for temperate zone estuaries (Day et al., 1989). These organisms have metabolic pathways that convert light energy into biological energy with the resultant fixation of carbon dioxide and the production of oxygen and carbohydrates. Phytoplankton production typically exhibits spring and fall maxima, with the highest rates typically occurring during annual water temperature maxima. These seasonal patterns are usually a result of various environmental factors including salinity, turbidity, nutrients, turbulence, and depth.

Energy from phytoplankton production is transported to primary consumers such as zooplankton and benthic marine invertebrates. These primary consumers, in turn, provide prey for secondary consumers and higher trophic level organisms. Disruption in seasonal patterns of salinity, turbidity, nutrients, turbulence, and depth can impact phytoplankton productivity and therefore the flow of energy from primary producers to higher trophic level consumers. Many organisms have evolved migration patterns and spawning activity to coincide or correspond with increased

inputs of energy into the system. Disruption in these energy flow patterns could, therefore, disrupt these aspects of the organism's life cycle.

Habitat Structure

Habitat structural attributes vary with water depth, current and tidal velocity, basin size and shape, and the diversity or complexity of substrate types. Examples of the diverse sediment types typically found in marine and estuarine environments include, but are not limited to, the presence or absence of depressions, sediment wave ripples, woody debris, submerged aquatic vegetation, shell beds, structures, reefs, and wrecks. Potential dredging and dredge material disposal activities can alter these structural attributes resulting in dramatic change or homogenization of habitat structure by decreasing the stability of the substrate, creating a more uniform water depth, reducing habitat heterogeneity, reducing habitat area, and decreasing availability of cover.

Biotic Interactions

Indirect effects on fish and EFH are produced by dredging and dredge disposal through disruption of the symbiotic associations and ecological principles that govern the fish community (i.e. predator - prey relationships or other symbiotic relationships). Predator - prey relationships can be locally disrupted by direct impact to the prey organism's population. Prey species are impacted by direct coverage of the organism during dredge disposal, impact to egg settlement rate (either through removal of suitable substrate or via release of hydrogen sulfide), destruction of prey species habitat, or otherwise impacting predator or prey species fecundity, survivorship, recruitment, or colonization rates. The degree or complexity of symbiotic interactions among

many fish species are not completely understood; therefore impacts to one species may have unknown or currently unobserved impacts to others.

Additionally, animals that have been stressed by the various negative impacts associated with dredging and dredge disposal can succumb to parasitism, disease, predation, intense competition or other stresses. The loss of one species in an obligatory mutualistic relationship will result in the demise of the other. Finally, the interbasin transfer of sediment may aid in the spread of non-native species. These exotic species may add additional predation or competition pressure on the native organisms, and may also introduce exotic diseases from which the native organisms may have little natural resistance.

The abundance and local distribution of prey species for EFH designated fish, may directly and indirectly be impacted during dredging and dredged material disposal. Many of the EFH designated fish species prey on benthic marine organisms living in or on the sediment. Direct impact to these prey species will occur during the dredging and disposal process activities via removal at the dredge site and burying at the disposal site, respectively. Indirect impact will occur using the same temporary changes in the water quality as discussed, such as impact from TSS concentrations (which could result in local depletion of DO), and the release of hydrogen sulfide (which may discourage settlement of many sessile, benthic invertebrate prey species). A loss of prey (e.g., lower trophic level) species may degrade the habitat value of EFH for higher trophic level fish by depleting the food sources of those fish. The prey of each of the EFH species and their various life stages are presented in Table 4-2.

However, the anticipated impact to the prey species is considered temporary, as the benthic community will eventually return to pre-impact conditions over time. The return to pre-impact conditions will not occur immediately, but rather in phases as various invertebrates re-colonize disturbance areas in successive stages over a temporal scale (Rhoads and Germano, 1982, 1986; Zajac and Whitlach, 1982). Therefore, the anticipated impact to the prey species is considered temporary, as the benthic community will succeed toward pre-impact conditions over time, following cessation of dredging activities. However a return to pre-disturbance conditions will not occur immediately, but rather in phases, as various invertebrates re-colonize disturbance areas at different rates (Kaplan et al., 1975; Rhodes and Germano, 1982, 1986; Gallagher and Keay, 1998).

Table 4-2 Essential Fish Habitat Species and their Respective Prey

Species	Life Stage	Likely Prey Species in Project Area	Source
Atlantic cod (*Gadus morhua*)	Larvae	Copepods	Fahay et al., 1999a
	Juvenile	Small zooplankton, capelin, crustaceans, polychaetes	
	Adult	Herring, haddock, redfish, plaice, codling, shrimp	
haddock *(Melanogrammus aeglefinuss)*	Larvae	Invertebrate eggs, copepods, phytoplankton	Cargnelli, et al., 1999a
red hake (*Urophycis chuss*)	Larvae	Copepods, microcrustaceans	Steimle et al., 1999a
	Juvenile	Mostly crustaceans such as Crangon, but also amphipods and polychaetes	
	Adult	Fish and Crustaceans	
winter flounder (*Pleuronectes americanus*)	Larvae	Nauplii, invertebrate eggs, protozoans, polychaetes	Pereira et al., 1999
	Juvenile	Sand dollar, bivalve siphons, polychaetes, amphipods,	
	Adult	Amphipods, polychaetes, bivalves or siphons, capelin eggs, crustaceans	
windowpane	Larvae	Copepods and other zooplankton	

Species	Life Stage	Likely Prey Species in Project Area	Source
flounder (*Scophthalmus aquosus*)	Juvenile	Polychaetes and small crustaceans such as mysids	Chang et al., 1999
	Adult	Polychaetes, mysids, decapods, shrimp, hake, and tomcod	
American plaice (*Hippoglossoides platessoides*)	Juvenile	Small crustaceans, polychaetes, cumaceans	Johnson et al., 1999
	Adults	Echinoderms, sand dollars, sea urchins, brittle stars	
Atlantic sea herring (*Clupea harengus*)	Juveniles	Selective opportunistic feeders, mostly copepods	Reid et al., 1999
	Adult	Euphausiid, chaetognaths, and copepods	
bluefish (*Pomatomus saltatrix*)	Juvenile	Crustaceans, fish, and polychaetes	Fahay et al., 1999b
	Adult	Sight feed on other fish such as silversides, spot, weakfish. Also eat shrimp, crabs, and worms	
long-finned squid *(Loligo pealei)*	Juvenile	Plankton, copepods, cuphausiids, arrow worms, crabs, polychaetes, shrimp	Cargnelli et al., 1999b
	Adult	Clupeids, myctophids, squid larvae/juveniles, silver hake, mackerel, herring, menhaden, sand lance, bay anchovy, menhaden, weakfish, silversides	
Atlantic butterfish (*Peprillus triacanthus*)	Larvae	Undetermined	Cross et al., 1999
	Juvenile	Copepods, squid, amphipods, decapods, coelenterates, polychaetes, small fish, ctenophores	
	Adult	Copepods, squid, amphipods, decapods, coelenterates, polychaetes, small fish, ctenophores	
Atlantic mackerel (*Scomber scombrus*)	Larvae	Copepods, fish larvae: yellowtail flounder, silver hake, redfish	Studholme et al., 1999
	Juvenile	Small crustaceans, such as copepods, euphausiids, amphipods, mysid, shrimp, and decapod larvae	
	Adult	Similar to juvenile but with selection of larger fish such as, euphausiid, pandalid, and crangonid shrimp	
summer flounder (*Paralicthys*	Larvae	Polychaete tentacles, harpactacoid copepods, and clams siphons	Packer et

Species	Life Stage	Likely Prey Species in Project Area	Source
dentatus)	Juvenile	Crustaceans, polychaetes, and invertebrate parts	al., 1999
	Adult	Invertebrates, shrimp, weakfish, mysids, anchovies, squid, Atlantic silversides, herring, and hermit crabs	
scup (*Stenotomus chrysops*)	Larvae	Zooplankton	Steimle et al., 1999b
	Juvenile	Small benthic invertebrates, fish eggs and larvae	
	Adult	Benthic and near bottom invertebrates and small fish	
black sea bass (*Centropristus striata*)	Larvae	Zooplankton	Steimle et al., 1999c
	Juvenile	Small epibenthic invertebrates such as crustaceans	
	Adult	Benthic, near-bottom invertebrates, and small fish	
surf clam *(Spisula solidissima)*	Juvenile	Planktotrophic	Cargnelli et al., 1999c
	Adult	Planktivorous siphon feeders, ciliates, diatoms	
king mackerel (*Scomberomorus cavalla*)	Larvae	Larval fish, especially carangids, clupeids, and engraulids; also some crustaceans	GSMFC, 2001
	Juvenile	Small fish such as anchovies, shad, sardines	
	Adult	Jacks and herrings; also squid and shrimp	
Spanish mackerel (*Scomberomorus maculatus*)	Larvae	Larval fish, especially carangids, clupeids, and engraulids; also some crustaceans	GSMFC, 2001
	Juvenile	Small fish, shrimp and squid	
	Adult	Jacks and herrings; also squid and shrimp	
cobia (*Rachycentron canadum*)	Larvae	Wild zooplankton, dominated by copepods	GSMFC, 2001
	Juvenile	Carnivorous fish, shrimp, and squid	
	Adult	Crustaceans and fishes, primarily crabs	
sandbar shark (*Charcharinus plumbeus*)	Adult	Finfish, rays, benthic fauna, seabirds, sea turtles	CBP, 2001
bluefin tuna (*Thunnus thynnus*)	Juvenile	Schooling fish, including gar, herring, mackerel, snappers, and blues, as well as squid.	

6.4.5.12. Indirect and Cumulative Impacts

Much of the land area surrounding New Bedford Harbor is developed with multiple land uses, which support a variety of uses including industrial, commercial, institutional, residential, and open space. The various land uses within the watershed might ultimately contribute to human-induced alterations to the various ecological attributes of the marine system. The impacts of these human induced alterations are comparable to those presented in Table 4-1. The new terminal at the South Terminal CDF location will result in some additional boat traffic by virtue of providing additional services to the harbor (although some traffic may simply be relocating from other locations within New Bedford Harbor to the vicinity of the South Terminal CDF). As discussed above, approximately 22 trips (during an approximately 12 to 18 month period) of the international vessel are anticipated in and out of New Bedford Harbor. Additional traffic will include movement of installation vessels (which will likely not be under their own power) by ferry boats, pilot boats and other tender vehicles that may be necessary. The traffic anticipated at the South Terminal CDF is not expected to create net secondary cumulative impacts due to the present busy nature of New Bedford Harbor. A discussion of the various fishing and non-fishing activities and their effects on marine EFH and EFH designated species is provided below.

6.4.5.12.1. Non-Fishing Activities and their Potential Effects on Marine EFH

Non-fishing activities that may impact EFH include those projects, actions or procedures that may:

- Alter sediment inputs to the estuary;
- Alter water flows, quantities, cycling, physical or chemical characteristics;
- Impact soil through compaction, or other changes in permeability;

- Alter riparian, or estuarine vegetation;
- Reduce or alter the stability of coastal landforms;
- Alter estuarine wetlands and wetlands along tributary waters;
- Alter predator species richness and abundance;
- Alter the amount or types of nutrients or prey;
- Alter estuarine or marine habitat (including water quality, vegetation, structure, or conveyances);
- Introduce or transfer exotic organisms and disease;
- Disturb nursery or spawning areas;
- Create a barrier or hazard to fish migration; and;
- Discharge pollutants, nutrients, or contaminants.

Any on-shore activity that disturbs or alters the watershed around the harbor (e.g. land clearing, urbanization, stream relocation, etc) has the potential to impact EFH directly (e.g. via pollutant or sediment inputs) or indirectly by altering watershed processes that affect tributary streams, salt marsh wetlands, shorelines and estuaries. This is typically the case as these alterations tend to be of such magnitude, scale, or duration as to surpass those produced by natural disturbances, or they exceed limits of the natural recovery processes in which the ichthyofauna have adapted. The potential impacts to the major components of the marine environment caused by human induced alterations in the landscape were presented in Table 4-1.

6.4.5.12.2. Wetland/Estuarine Alteration and Destruction

Wetlands associated with the marine and estuarine environment are valuable habitat types relative to fish and EFH. These habitats are the transition areas between the upland and the open water communities. They provide a food rich environment for productive foraging (Levington, 1982), they are used as physiological transition zones between fresh and salt water environments (Schmidt-Nielsen, 1983), they offer refuge to juveniles and prey species from predators, and it is here where the transfer of energy from the upland to open water environments occurs (Day et al., 1989).

Changes to the systems may occur through tideland conversion, exogenous material (i.e. material originating outside the system) input, runoff and sedimentation induced turbidity, physical disruption (e.g., noise, turbulence, obstructions), shading by structures and vessels, SAV control, water diversion, and the introduction of non-native species. Alteration of the watershed can result in changes to the pollutant quantities and concentrations, organic matter concentrations, or physical parameters of the water column (i.e., temperature, dissolved oxygen, salinity, pH, light penetration). The alteration of these parameters may negatively impact the wetland/estuarine communities.

Alteration of the wetland and estuarine systems can cause a reduction or loss of juvenile or prey species rearing habitats, exposure of fish to pollutants, exposure of fish species to mammalian and avian predators, and alteration in the timing of life history stages or events. Vegetated wetlands associated with the estuarine and marine environment include intertidal mudflats, submerged aquatic vegetation beds, and emergent (intertidal) salt marsh. These communities

typically are productive interfaces between the upland and open water environments. Estuarine aquatic bed lies proximal to the project area.

Estuarine submerged aquatic vegetation beds, composed largely of eelgrass (*Zostera marinus*), historically occurred within the New Bedford/Fairhaven Harbor but have all but disappeared (Howes and Goerhinger, 1992). The disappearance of eelgrass followed a general decline in Europe and North America in the decade between 1935 and 1945, and was attributed to "wasting disease" a phenomenon thought to have been caused by a general increase in summer temperatures (Day et al., 1989). Like other areas of the northeast, these aquatic beds are now most likely dominated by marine algae such as sea lettuce (*Ulva lactuca*), spaghetti grass (*Codium fragile*) and the red algae *Gracilaria spp*. or vascular plants such as widgeon grass (Tiner, 1985; Metzler and Tiner, 1992). SAV beds are especially high value to fish habitat since they provide strategic cover for juvenile diadromous fish.

Of the 20 EFH fish species listed for the project and disposal areas, four can be considered estuarine dependent. Estuarine dependent fish are those species of fish, which require estuarine habitats for some, if not all, of their life cycle. Among the 20 EFH fish species listed for the project areas, Day et al., (1989) listed the summer flounder, winter flounder, scup, and the black sea bass as estuarine dependent species. Typically, the primary estuarine habitats such as tidal creeks, salt marshes, and sea grass beds are used as nursery areas by many marine fish. These nursery areas are sought out by larval and juvenile life stages of the estuarine dependent fish, since not only do the estuaries tend to provide relative safety or protection from predators, but they also supply an abundant food source (through detrital food chains) with reduced

competition at critical trophic levels (Day et. al., 1989). Typically, these species are adapted to survive in a dynamic environment subject to frequent environmental fluctuations. However, prolonged or permanent alterations of the physiochemical parameters of their environment (e.g., temperature, salinity, turbidity, dissolved oxygen) due to human-induced impact can be detrimental to the fish that reside in these estuarine habitats (Newcome and Jensen, 1996) or pass through them (Gibson, 1987).

Temporary disturbance generated by the proposed action could indirectly impact the five estuarine-dependent EFH fish species and additional anadromous fish (many of which are prey for EFH species) by generating turbidity in the bay, preventing or confounding movement of these species between the Acushnet River Estuary and more distal seawater offshore. This impact can have an additive negative effect on the ichthyofauna is coincident with other turbidity generating activities in the bay.

6.4.5.12.3. Aquaculture

Shellfish farming and depuration is an example of a common aquaculture activity in the northeast. Shellfish farming typically requires the dumping of shell spawn into appropriate waters. Harvesting requires raking and other disturbances to the benthic environment. These practices can cause the destruction of SAV beds; increased erosion of areas formerly stabilized by SAV; increased turbidity; loss of habitat complexity, juvenile refugia, or substrate; reduction in primary productivity; and increased wave energy resulting in juvenile displacement or strandings. The proposed action is proposed within an area that is currently banned for

shellfishing (see **Appendix 52**). Therefore, the proposed action would not result in changes to aquacultural practices and therefore, would not negatively impact EFH species or their habitats.

The proposed site does not contain any active commercial shellfish beds due its proximity to contaminated water or sediment and due to their proximity to navigation lanes. However suitable shellfish habitat exists within or proximal to the site, particularly outside of the Hurricane Barrier. Proposed disposal activities will result only in a temporary loss of shellfish habitat within dredging areas, and a permanent loss of shellfish habitat within filling areas. Given that re-colonization of disposal mounds is influenced, at least in part, by the benthos of the surrounding area and the larvae in the water column (Maurer et al., 1982a,b; Rhoads et al., 1978), quahog and soft shell clam are expected to re-colonize the area. This re-colonization rate, however, is expected to occur in stages (Stages I, II, III) and higher trophic level benthos such as most bivalve mollusks are typically part of the Stage II, II/III assemblage (Rhoads et al., 1978). Stage I organisms will re-colonize first, followed by succession to Stage II and Stage III. Monitoring will be needed to track the progress of recovery. Providing seed stock to the area could speed recovery.

6.4.5.12.4. Construction/Urbanization

Construction and general urbanization activities include road-building, land-clearing for development, excavation for utilities, etc. These activities typically result in a greater impervious upland surface area due to development of areas that formerly contained natural vegetation as the predominant land coverage. Increased urbanization is directly proportional to an increase in interception of precipitation producing greater runoff of untreated stormwater.

Urbanization typically reduces habitat complexity, alters tidal streams through channelization, decreases channel stability, and impairs water quality. It results in the increase of frequency and magnitude of flood events, and accelerated runoff rates result in lower stream flows during drier months by disrupting groundwater retention times. This typically impacts fish with extended freshwater larval or juvenile rearing stages of their life history. The net effect of urbanization is disruption of the hydrologic processes by increasing peak flows and decreasing low flows (CTDEP, 1995). Disturbance to sediments as a result of the proposed action would result in direct impact to EFH.

6.4.5.12.5. Marina/Dock Construction

Impacts typically generated during dock or bulkhead construction, expansion, replacement or demolition activities typically occur as construction/ urbanization impacts (i.e., removal of vegetation, turbidity and sedimentation, increased surface water runoff, etc.). The proposed bulkhead surfaces will offer some amount of subtidal and inter tidal habitat.

6.4.5.12.6. Removal of In-water Structures

Removal of in-water structures such as, reefs, rock ledges, jetties, vertical bulkhead or seawalls, and even wrecks could impact fish and EFH. This action is sometimes necessary to maintain safe navigation channels. The removal of navigational obstructions such as derelict pilings, dilapidated wharves, and shipwrecks and other long established structures, reefs, rock ledges, jetties, and bulkhead walls, could remove productive marine communities living within, on, or in association with the given structure. It acts to reduce habitat complexity, remove shelter, breeding, and feeding substrates. Typically, removal of these structures produces turbidity, may

subject land areas to erosion, and may alter flows in embayments and tidal creeks. Removal of woody debris also removes a source of detrital nutrients for wood boring marine organisms. Norse and Watling (1999) cite various studies that have shown that the removal of structures and the reduction of habitat structural complexity have resulted in the favoring of sand-loving fish species and the loss of some commercially important species such as grouper and cod. No in-water structures have been identified within the CAD cells, therefore no removal of these structures would be required for CAD cell construction and operation.

6.4.5.12.7. Road-building and Maintenance

Impacts to fish and EFH from road building and maintenance are similar to those associated with urbanization/construction impacts. Typically, the major effects to wetland systems due to road building and maintenance projects are disruption/alteration of hydrologic regime, sediment loading and direct wetland removal (Mitsch and Gosselink, 1993). No new road construction would occur as a result of the proposed action.

6.4.5.12.8. Shipping Operations

Shipping operations are an integral part of the economic vitality of the harbor. New Bedford/Fairhaven Harbor serves as homeport for commercial fishing fleets, destination port for commercial barges and container shipping, and a terminal for passenger ferries. In addition, the harbor has been developed with marinas and mooring areas that support, recreational fishing party boats, and many pleasure crafts. Shipping related activities that impact fish and EFH include oily bilge water/ballast water discharge, oil release from shipping accidents, ship wakes, and ship-induced wave energy. Wave energy and wakes generated by shipping operations can

produce erosion of beach sediment, displacement of juveniles and larval fishes and can cause juvenile strandings when waves over-wash rocks, jetties and beach areas. Changes to shipping operations in the form of increased activity could occur as an indirect result of the proposed action

6.4.5.12.9. Wastewater/Pollutant Discharge

Wastewater discharge to surface waters occurs via direct discharges (point sources) such as sewage treatment plants, power-generating facilities, combined sewer overflows and industrial effluents, or via non-discrete surface runoff (non-point sources), such as agricultural runoff, runoff from over-fertilized lawns and gardens, and runoff from parking lots and roadways. Other pollutant discharge can occur via atmospheric deposition, accidental release or spills, and via intentional discharge or disposal such as via pump-outs of oily bilge water or via the disposal of unsuitable dredge or fill materials. Pollutant discharges can also occur from the seepage of contaminated groundwater into the harbor from landside contaminated sites.

Wastewater/pollutant discharges can impact fish and EFH via acute and chronic toxicity to various pollutants, via turbidity effects and via depletion or reduction of dissolved oxygen in the water column or benthic sediment. Implementation of the proposed action could reduce the risk of spills associated with shipping accidents, since maintenance of the navigation channels would allow safer operation of ships in the harbor. Dredging represents a temporary and controlled source of pollutant discharge since dredging produces a sediment plume that is in direct contact with the overlying water column. However, after cessation dredging activities, the pathway of contaminated sediment exposure to the overlying water column would be eliminated.

6.4.5.12.10. Habitat Restoration

Habitat restoration projects usually occur as a result of wetland mitigation requirements in response to impacts from other projects such as new roadway or bridge construction. When habitat restoration projects fail, most fail typically due to the following reasons (Hammer, 1992):

- Inaccurate assessment of physical processes governing the system;
- Inadequate knowledge of the habitat's community ecology;
- Inadequate assessment of the original cause of habitat degradation;
- Ineffective restoration efforts;
- The lack of pristine reference sites proximal to the restoration area;
- Failure to set appropriate monitoring or performance standards;
- Focus on benefit to a single species rather than the community; and
- Focus on mitigating losses rather than on preventing loss.

This project will include creation of intertidal habitat in presently subtidal areas through the placement of suitable dredged material adjacent to the hurricane barrier outside of the harbor and north of Pease Park in Fairhaven. Construction controls will be used to ensure that material is placed to create intertidal habitat suitable for colonization by a diversity of organisms and will result in an increase in species diversity along the outside of the hurricane barrier. This project will also include construction of a successional marsh area within a stormwater management conduit adjacent to the hurricane barrier. Mitigation of direct, indirect, and cumulative impacts would be achieved through conformance to required permits and approvals, development and

adherence to a disposal site monitoring plan, and implementation of CAD cell best management practices (discussed below).

6.4.5.13. Conclusions

6.4.5.13.1. Sheet Pile Installation, Filling, and Habitat Alteration Due to Dredging

The sheet pile installation and filling, as well as dredging of shallow, near –shore subtidal areas to depths of -14 and/or -30 MLLW, associated with the proposed action will result in local, direct, permanent impact to at least four federally managed fisheries resources and various prey organisms to other EFH species (winter flounder, scup, black sea bass and windowpane flounder). Direct impacts generated from the proposed actions include permanent loss of habitat, reduction in the availability of food supply, loss of foraging habitat, loss of spawning areas, and loss of refuge areas from predators for areas that are to be sheet piled and filled, and areas that will be dredged from between -1 to -6 MLLW to -14 to -30 MLLW. However, the potential impact area would be minimal in comparison to the more prime and less disturbed habitat available to these fish species elsewhere in the region (see **Section 6**). Additionally, dredging will have a positive impact to the fish habitat because of the removal of contamination. Options considered for impact avoidance and minimization are discussed within **Section 7** and mitigation for unavoidable impacts is proposed within **Section 7**.

6.4.5.13.2. Secondary Dredging Impacts

Dredging associated with the proposed action could result in local and temporary impact to EFH for the four federally managed fisheries resources, and various prey organisms of other EFH species. Potential temporary impacts generated by the proposed actions include localized impairment to water quality, destruction of benthic habitat, and direct effects to EFH species and other marine organisms. Indirect effects to EFH species and other marine organisms within the area may occur due to the alterations of energy flow, habitat structure, and biotic interaction.

The fisheries resources within New Bedford/Fairhaven Harbor identified as particularly susceptible to dredging and turbidity induced impacts include the winter flounder and anadromous fish. Winter flounder eggs are demersal and attach to benthic substrate and, therefore, are susceptible to removal via dredging and via smothering during the re-settlement of sediment from the water column. Winter flounder begin spawning once water temperatures reach 8-9°C. Peak spawning occurs in February and larvae remain proximal to their nursery areas through June.

Anadromous fish runs between Buzzards Bay and the Acushnet River begin in the early spring with rainbow smelt returning first. Alewife and blueback herring follow in April. Restoration of anadromous fish runs in the Acushnet River Estuary has been identified as a priority by NOAA-Fisheries, Restoration Center (J. Turek, NOAA Fisheries, personal communication).

Potential turbidity-induced impacts to the water column are considered temporary and reversible and are expected to be comparable to the magnitude of natural events incurred during seasonal storms and peak discharges from the Acushnet River. The duration of increased turbidity of the

water column during dredged sediment disposal activity (which is a conservative worst-case estimate of dredging-related turbidity) are estimated to be less than 90 minutes. Therefore, water column turbidity should return to pre-disposal conditions relatively quickly.

Other water quality parameters (such as DO, chlorophyll *a* concentration, nutrients, and contaminant concentrations) are predicted to cause minimal temporal changes to the water column and, therefore, are not expected to have a permanent adverse impact to EFH species.

Local disruptions to the predator/prey cycle within the Inner Harbor may occur during dredging of sediment, since many EFH species are known to feed on organisms inhabiting the harbor, especially benthic invertebrates that have colonized the sediment. Many of the EFH species and certain motile invertebrate prey species will flee the dredging areas during construction. Other prey species such as sessile invertebrates (e.g., shellfish, and colonial invertebrates) would be removed. Recolonization of the sediment surface would occur following construction.

Impact to prey species such as anadromous fish could also occur but would be minimized by avoidance of dredging during sensitive life cycle habits (e.g., migration) and/or use of silt curtains during dredging to minimize suspension of sediment. Other prey species such as sessile benthic marine invertebrates would be directly impacted by removal of sediment from the project area. However, this impact would only be temporary as adjacent source populations are expected to re-colonize the disturbance areas.

Results of this EFH assessment indicate that some secondary effects, such as increased turbidity generated during dredging operations, should be minimized at those times of the year when there is the greatest potential for impact to EFH. Options considered for impact avoidance and minimization are discussed within **Section 7** and mitigation for unavoidable impacts is proposed within **Section 7**.

6.4.6. Avian Wildlife Assessment

An assessment with regard to the potential for usage of the site by avian wildlife for nesting and foraging activities was conducted as a part of this study. The avian wildlife assessment consists of review, analysis, and evaluation of existing data. A peer review of the data evaluation was performed by an independent party, and the resume of the individual is attached as **Appendix 57**. Existing data for Southern New England, Bristol County, New Bedford and its Surroundings, and New Bedford Harbor include:

- **New Bedford Harbor** - A bird survey conducted within New Bedford Harbor by USEPA in 1987.
- **Bristol County Data** - Raw bird observations within Bristol County made via the Massachusetts Audubon Society's online "eBird" system,
- **Southern New England Data** - The species prioritization list associated with Bird Conservation Region 30,
- **New Bedford and Its Surrounding Communities** - Information from the Paskamansett Bird Club's 2007 Christmas Bird Count.

- **New Bedford and Its Surrounding Communities** - Specific identifications made by an individual within New Bedford from 2005-2008.
- **New Bedford Harbor** - Observations made for Mass Audubon Society's Breeding Bird Atlas 2.

These data provide a reasonable estimate of the avian wildlife that utilizes the site at any point in time for habitat. Data is summarized within tables included within **Appendix 58**. Although other avian wildlife could utilize the site as well, it is anticipated that that use would be infrequent, due to the absence of that avian wildlife in the surveys that focus closely on New Bedford Harbor. The following is a description of the evaluation undertaken in order to produce a list of avian wildlife that are anticipated to be present within New Bedford Harbor and utilize the site:

A bird survey for the New Bedford Superfund Site was conducted in the Summer of 1987. This survey was completed in support of a wetland analysis promulgated by the US Army Corps of Engineers. Of particular interest in this document was the comparison of avian wildlife populations present within the survey area (Upper New Bedford Harbor) as compared to the avian wildlife present at a location in Fairhaven in the Outer New Bedford Harbor (immediately to the east and south of the New Bedford Hurricane Barrier). The comparison indicates distinctly different avian wildlife populations within and outside of the Hurricane Barrier. The information associated with this bird survey is included within **Appendix 59**.

Data from the Massachusetts Audubon Society were accumulated between the years 2000 and 2010. This data were collected via an online data collection system utilized by bird watchers associated with the Mass Audubon called "eBird". "eBird" is an easy to use, interactive, computerized database that provides a simple way for bird watchers to keep track of the birds they see, and share that information with Mass Audubon (as well as researchers and other bird watchers). The data from the "eBird" site were easy to download into an excel spreadsheet and to sort by species and sighting frequency; however, the "eBird" data could only be collected on a county-wide basis, and are not immediately representative of New Bedford Harbor. In fact, it may be an inaccurate representation of the actual species located at the project site. Due to restrictions in property access, bird watching is mainly conducted from public areas and not in locations specific to the project area. Therefore, the raw "eBird" data were also combined with a few other sources of more site-specific information. Information on "eBird" is included within **Appendix 60**.

Information regarding "Priority Species" within Bird Conservation Region 30 (New England/Mid-Atlantic Coast) was collected and analyzed. Bird Conservation Regions are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues. Bird Conservation Regions were developed through a mapping team comprised of members from the United States, Mexico, and Canada assembled at the first international North American Bird Conservation Initiative (a forum of governmental agencies, private organizations, and bird initiatives helping partners across the continent to meet their common bird conservation objectives). "Priority Species" within Bird Conservation Region 30 were noted by the Atlantic Coast Joint Venture, a partnership focused on the conservation habitat

for native birds in the Atlantic Flyway of the United States from Maine south to Puerto Rico (representing 18 states and commonwealths and key federal and regional habitat conservation agencies and organizations in the joint venture area). The management board of the Atlantic Coast Joint Venture includes the Regional Refuge Chief from Region 4 and the Regional Director of Region 5, of the U.S. Fish and Wildlife Service as well as the Director of the Massachusetts Division of Fisheries & Wildlife. In addition six of the eight staff members listed on the Atlantic Coast Joint Venture website are noted to be U.S. Fish and Wildlife Service employees. Information on the North American Bird Conservation Initiative and the Atlantic Coast Joint Venture are included within **Appendix 61**.

Each Christmas, the National Audubon Society promulgates a nation-wide bird count. In 2007, the Paskamansett Bird Club 2007 completed its Christmas Bird Count within the greater New Bedford, Acushnet, Fairhaven, Dartmouth and Mattapoisett cities. This information was collected in the winter, and therefore would miss migrating birds; however, it provides some additional information regarding avian wildlife presence in New Bedford and its surrounding communities. More detailed information regarding the 2007 Christmas Bird Count is included within **Appendix 62**.

Information from the postings of an amateur bird watcher were collected from an online web log or "Blog" posted by Mr. Daniel Harper. From August, 2005- September, 2008 Mr. Harper was the minister for the First Unitarian Church of New Bedford. During that time period, Mr. Harper conducted amateur bird watching events, during which he identified a range of birds inhabiting New Bedford Harbor (although not necessarily at the site). Mr. Harper posted the results of his

observations, and posted a list at http://www.danielharper.org/blog/?page_id=454. Mr. Harper did not keep detailed records of his observations, and therefore only posted a summary of the birds he viewed, and did not have information on specific dates, times, or weather conditions at which he viewed the birds. Mr. Harper visited locations both within New Bedford and Fairhaven; therefore, the information that he collected is not specifically representative of the South Terminal area, but is helpful in presenting a range of avian wildlife present in the vicinity of the project area. Information on Mr. Harper's blog are attached as **Appendix 63.**

The Massachusetts Audubon Society is nearing the end of its second effort to collect data on distribution of birds statewide in order to promulgate its Breeding Bird Atlas. The first Atlas was undertaken in the 1970s. Surveyors visit specific quadrants (approximately 10 square miles each) within Massachusetts and record all of the avian species observed. Due to the intense investigation requirements, no more than four quadrants are investigated by any surveyor in any one year. Surveyors conduct their investigations only during breeding periods (typically May 15 – August 1), and spend a minimum of 20 hours surveying for birds in each quadrant. This survey would have been conducted during time periods within which migrating birds would have been present within New Bedford Harbor. The quadrant for New Bedford North 06 encompasses most of the area north of the New Bedford Hurricane Barrier, and is primarily water, and therefore presents an ideal opportunity to record the presence or absence of shore birds within New Bedford Harbor. Information on the Breeding Bird Atlas is included within **Appendix 64**.

Data from the sources listed above, are presented and sorted within **Table 1A** through **Table 1D** contained within **Appendix 58**. The data are presented in raw form (unsorted) within **Table 1A**, and are gradually sorted in steps until a final list is presented within **Table 1D** as follows:

- Table 1A: Unsorted Raw Data
- Table 1B: Only birds observed by one of three field observers (Mr. Dan Harper, 1987 New Bedford Superfund Site Survey, and Mass. Audubon Breeding Bird Atlas Survey).
- Table 1C: Includes only birds observed by surveyors located (at all times) within New Bedford Harbor (1987 New Bedford Superfund Site Survey and Mass. Audubon Breeding Bird Atlas Survey).
- Table 1D: Includes only Bird Conservation Region 30 Priority Species observed by surveyors located (at all times) within New Bedford Harbor (1987 New Bedford Superfund Site Survey and Mass. Audubon Breeding Bird Atlas Survey).

Although Table 1D does not necessarily represent all birds that could utilize the site for habitat, it does represent the "Priority Species" most likely to utilize the site. It is likely that if other species utilize the site, they do so infrequently. The species of concern, therefore, are:

- American Black Duck
- American Oystercatcher
- Baltimore Oriole
- Black-crowned Night-Heron
- Blue-winged Warbler

- Canada Goose
- Chimney Swift
- Eastern Kingbird
- Eastern Towhee
- Gadwall
- Gray Catbird
- Great Crested Flycatcher
- Killdeer
- Least Tern
- Mallard
- Nelson's Sparrow
- Northern Flicker
- Saltmarsh Sparrow
- Snowy Egret
- Spotted Sandpiper
- Willet
- Willow Flycatcher
- Wood Duck

6.4.7. Endangered Species Analysis

The site is not located within an area identified as federal critical habitat or state priority habitat for rare or endangered species; however, due to the wide range of avian wildlife habitat use, it is

unavoidable that some impacts to shallow-water feeding areas for some rare avian species may occur, but are anticipated to be minimal.

The Roseate Tern and Common Tern are noted to be state-listed as "Endangered" and "Special Concern" species, respectively, within the Commonwealth of Massachusetts. The Roseate Tern is listed as a Federally "Endangered" species. Common Tern presence is often indicative of the presence of the Roseate Tern, as the Roseate Tern nests within Common Tern colonies and also often forages with Common Terns. Fact sheets regarding these two birds are included within **Appendix 65**.

Common Terns nest generally on sandy or gravelly offshore islands and barrier beaches. Roseate Terns typically nest among Common Tern colonies, but typically choose areas with denser vegetation to use as cover for chicks. Both species prefer to nest on islands to avoid predators and intruders. A variety of predators, including birds, mammals, snakes, ants, and land crabs eat tern eggs, young, and adults. Neither species has ever been known to nest at the project site or elsewhere in New Bedford Harbor.

Common Terns feed mainly on a wide variety of small fish and crustaceans; however, their primary prey in most Atlantic coast breeding areas is the American sand lance. Similarly, the Roseate Tern feeds almost exclusively on small fish. About 70% of its diet consists of sand lance. Both the Roseate Tern and the Common Tern forage by plunge-diving (diving from heights of between 1-12 meters and oven submerging to greater than 50 centimeters. Sand lance occur throughout the water column over sandy substrates into which they burrow. The sand

lance burrows for rest and escape from predators; hence much time may be spent within the substrate, isolated from the water column. Due to this specific defense behavior, the sand lance is particularly vulnerable to become contaminated by adjacent contaminated sediment, such as the high levels of PCBs within the contaminated sediment of New Bedford Harbor. It is likely the Common Tern and Roseate Tern's preference for American sand lance is the source of high levels of PCBs found in chicks found dead at Bird Island in 1970, and increased levels of PCBs within existing Roseate and Common Tern colonies. Additional details with regard to the American sand lance are included within **Appendix 66**.

The information gathered within bird surveys outlined within **Section 6.4.6** above, indicates that Common Terns and Roseate Terns forage within Buzzard's Bay and the outer portions of New Bedford Harbor. Bird surveys that included areas outside of New Bedford Harbor (eBird information and observations completed by Mr. Dan Harper's surveys) noted the Common Tern and/or the Roseate Tern as being identified, while bird surveys conducted solely within the Hurricane Barrier (1987 New Bedford Superfund Site Bird Survey and Mass Audubon Breeding Bird Atlas surveys) did not note the presence of the Common Tern or the Roseate Tern. It should also be noted that the 1987 New Bedford Superfund Site Bird Survey in fact noted the presence of the Common Tern at a control site located outside of the New Bedford Hurricane Barrier. (The Paskamansett Bird Club 2007 Christmas Bird Count was conducted in the winter, when Common Terns and Roseate Terns would have already migrated south for the winter.)

These surveys indicate that the Common and Roseate Terns likely do not travel inside of the New Bedford Hurricane Barrier, and if they do, they do so infrequently and have not been noted within the surveys in question.

It is likely that Common and Roseate Terns do not utilize the area within the New Bedford Hurricane Barrier for the following reasons:

- **Food –** As stated above, the primary food source for the Common or Roseate Tern is the American sand lance, whose protective behavior appears to create a significant vulnerability to contaminated sediment. Therefore, foraging within New Bedford Harbor presents a particular risk to the Common and Roseate Tern, who both selectively forage for this fish. It is likely that, if Common and Roseate Terns ever foraged within New Bedford Harbor historically, that their preference for sand lance resulted in bioaccumulation of PCBs within the birds, perhaps resulting in higher chick mortality rates, such as those found dead at Bird Island in 1970. As a result of this preference, it appears that, at least until PCB contamination is removed from New Bedford Harbor, that areas north of the New Bedford Hurricane barrier represent poor foraging habitat for Common or Roseate Terns.
- **Noise –** New Bedford Harbor is a highly industrialized area, and produces regular noise of human industrial and commercial activity. This includes the operation and repair of over 500 commercial fishing vessels, operation of dozens of fish processing plants, multiple cargo ship receiving facilities, multiple ship-yards, ferry boats, cruise ships, and repair yards. This activity produces a significant quantity of noise, particularly in the

spring, summer, and early fall, during which the activity within the harbor is at its peak, and when foraging for the Common or Roseate Tern would be at its peak.

- **Human Activity** - Most areas of New Bedford Harbor contain some level of human activity, be it industrial (ship-building, commercial fishing, cargo transport), commercial (recreational sailing or fishing vessels), or recreational (recreational fishing along the shoreline, recreational boating, mooring, canoeing or rowing). It is likely that this level of activity would be discouraging to the Common or Roseate Tern.

As a result of this analysis, it appears that neither the Common Tern, nor the Roseate Tern are likely to utilize the site for regular foraging. In fact, regular foraging would likely be detrimental to either species within the areas north of the New Bedford Hurricane Barrier, as the tern's foraging patterns make them extremely vulnerable to PCBs in sediment. Therefore, it does not appear that the project as proposed will have a significant impact upon either the Common Tern or the Roseate Tern. In fact, mitigation measures proposed as part of the project, specifically those proposed south of the New Bedford Hurricane Barrier, may be very beneficial to the Common and Roseate Terns, due to enhancement of foraging habitat (see **Section 7** for a discussion of proposed mitigation).

A request for a consultation on the potential impact of the proposed project on the Roseate Tern was filed with the Natural Heritage & Endangered Species Program, resulting in a letter prepared by Dr. Thomas French (Assistant Director), which stated the Roseate Tern and Common Tern (species that could utilize the site as foraging habitat) are state-listed as "Endangered" and "Special Concern" species within the Commonwealth of Massachusetts. The Roseate Tern is also listed as a Federally "Endangered" species. The nearest breeding colony for the Roseate

Tern is located at (Bird Island), which is approximately 17 kilometers away from the site (the daily flight radius of the Roseate Tern is approximately 25 km).

The letter from Dr. French states that "It appears that the proposed dredging and terminal extension would only impact a small acreage of shallow-water feeding habitat for terns. Given the relatively small project footprint within mapped tern habitat, it does not appear that the project will result in measurable harm to state-listed species" (see **Appendix 67**). Please note that since Mr. French's review was completed, that the project has been modified slightly; however, the overall area of impact to avian wildlife habitat has not significantly changed.

6.4.8. Functions and Values Assessment

Apex conducted an evaluation of functions and values for the wetlands present within the work area. Apex completed the Wetland Function-Value Evaluation Form from "The Highway Methodology Workbook Supplement: Wetland Functions and Values, A Descriptive Approach" (the completed form is attached as **Appendix 68** of this document). The following sections provide a descriptive evaluation of functions and values for wetland areas within the area of work. A subsequent section summarizes the principal functions/values of the proposed South Terminal CDF area, and discusses the potential impacts that the proposed work will have on the principal functions/values of the proposed South Terminal CDF area:

6.4.8.1. Groundwater Recharge/Discharge

Groundwater Discharge is one of the principal functions/values of the wetland. The area is a primary intersection of a freshwater groundwater table and a saltwater estuary. Groundwater generated via precipitation and runoff typically intersects with saltwater intrusion and discharges/mixes at this location; therefore, Groundwater Discharge is one of the Primary Functions. Groundwater recharge does not occur at this location.

6.4.8.2. Floodflow Alteration (Storage & Desynchronization)

The wetland area provides storage for flood flows present within the Acushnet River; however, flood storage is not as crucial at the base of the Acushnet River, where New Bedford Harbor intersects with Buzzard's Bay. Reduction of flood storage at this end of the Acushnet River provides less benefit due to the ease at which flood waters drain out through the Hurricane Barrier at the mouth of New Bedford Harbor. Flood flows during storm surges are many orders of magnitude higher than what can be accommodated at properties within New Bedford Harbor; and the New Bedford Hurricane Barrier protects New Bedford Harbor from significant storm surges. Therefore, although flood flow alteration is one of the functions/values of the wetland, it is not a Principal Function.

6.4.8.3. Sediment/Shoreline Stabilization

The wetland areas provide a buffer to reduce the energy of the high-velocity waves within New Bedford Harbor. The filling of the wetland areas will reduce the ability of the area to reduce the energy of these waves, which would result in slightly higher energy waves within the Harbor

impacting upon other structures, vessels, and natural features. Therefore, sediment/shoreline stabilization is one of the Principal Functions of the wetland areas.

6.4.8.4. Fish and Shellfish Habitat

Shallow, near-shore subtidal areas serve as fish habitat as well as spawning grounds. An Essential Fish Habitat Assessment has been conducted and is included within previous sections of this document. The Essential Fish Habitat Assessment provides a more thorough assessment of the existing fisheries habitat that will be altered by completion of this project.

Visual evidence as well as the results of a shellfish survey have indicated that the coastal beach and aquatic areas of the site serve as shellfish habitat. The results of the shellfish survey are included within previous sections of this document. The Shellfish Survey provides a more thorough assessment of the existing shellfish resources that will be altered by completion of this project.

Fish and shellfish habitat is one of the Principal Functions of the wetland areas.

6.4.8.5. Wildlife Habitat

The site is isolated on all sides by industrial properties, which minimizes the accessibility of the site for large mammals. However, the shallow water habitat, and the intertidal areas provide nesting and feeding locations for shore birds. Avian wildlife has been observed onsite as well as

within New Bedford Harbor and Bristol County. A more thorough assessment of the avian wildlife that may frequent the site, due to the presence of such wildlife within the greater region, and also based upon local bird-watching information is included within previous sections of this document.

It should be noted that the quality of the avian habitat is questionable due to the PCB impacts to shoreline sediments as well as the impacts to shellfish that serve as a food source for avian wildlife at the site. Nevertheless, wildlife habitat is one of the Principal Functions of the wetland areas.

6.4.8.6. Sediment/Toxicant Retention

Rather than retaining sediment or toxics, the wetland area, as well as New Bedford Harbor as a whole, acts as a source of contaminants for the surrounding environment, such as Buzzard's Bay. The tidal flows, and high velocity waves that periodically impact the shoreline, act to mobilize fine grained sediment, rather than retain it. Fine grained material or sediment are present below the low tide line and are also interspersed within the sand-dominated coastal beach, which results in the elevated concentrations of PCBs in both locations; however, this area of New Bedford Harbor is not one typically that is responsible for sediment retention, and it definitely is not responsible for toxicant retention, and instead serves to export toxicants to un-impacted areas within Buzzard's Bay.

6.4.8.7. Nutrient Removal/Retention/Transformation and Production Export (Nutrient)

The capacity of the wetland areas to export production is limited. The wetland areas are man-made, via fill that has been utilized to extend the shoreline to the east over time. The coastal beach and aquatic areas do not serve as a sink for nutrients. The flow regime, low detention time, absence of slowly draining fine-grained material or deep organic/sediment deposits limit the capabilities of the wetland areas to act as a sink for nutrients. As stated before, the sediments within the wetland areas are contaminated with PCBs. The production of food or usable products for humans or other living organisms by the wetland areas are not beneficial to humans, wildlife, fish or the environment. Therefore, the functions/values of Nutrient Removal/Retention/ Transformation and Production Export (Nutrient) are not highly functioning for the wetland areas, and those aspects that are functioning, present a significant risk to the environment.

6.4.8.8. Recreation (Consumptive & Non-Consumptive), Educational/Scientific Value, Uniqueness/Heritage, Visual Quality/Aesthetics

The site is an open area, and has a length of coastline that can be viewed from multiple locations. However, the site is strewn with trash, and debris, and is not a popular location for the locals to view. The site is located within New Bedford Harbor, which is an active industrial and commercial Harbor, and the site is located within an area designated by the Commonwealth of Massachusetts as a Designated Port Area; an area that is set aside specifically for industrial development. The site does not have any cultural or heritage significance. The site is not part of a recreation area, is private property, is fenced off, and the public is discouraged from entering.

The wetland areas are adjacent to navigation areas, but are not accessible for recreational boaters; a recreational boat ramp and mooring fields are adjacent to the site, and accessible through City of New Bedford-owned facilities. Impacts to the wetland areas will not impact accessibility to New Bedford Harbor. Therefore, the functions/values of Recreation, Educational/Scientific Value, Uniqueness/Heritage, and Visual Quality/Aesthetics are not particularly applicable to the wetland areas.

6.4.8.9. Endangered Species

The site is not located within an area identified as critical habitat or priority habitat for rare or endangered species; however, to the wide range avian wildlife habitat use, it is unavoidable that some impacts to shallow-water feeding habitat for some rare avian wildlife will occur, even if only minimally.

A request for a consultation on the potential impact of the proposed project on the Roseate Tern was filed with the Natural Heritage & Endangered Species Program, resulting in a letter prepared by Mr. Thomas French (Assistant Director), which stated the Roseate Tern and Common Tern (species that could utilize the site as foraging habitat) are state-listed as "Endangered" and "Special Concern" species within the Commonwealth of Massachusetts. The Roseate Tern is also listed as a Federally "Endangered" species. The nearest breeding colony for the Roseate Tern is located at (Bird Island), which is approximately 17 kilometers away from the site (the daily flight radius of the Roseate Tern is approximately 25 km).

The letter from Mr. French states that "It appears that the proposed dredging and terminal extension would only impact a small acreage of shallow-water feeding habitat for terns. Given the relatively small project footprint within mapped tern habitat, it does not appear that the project will result in measurable harm to state-listed species" (see **Appendix 67**). Please note that since Mr. French's review was completed, that the project has been modified slightly; however, the overall area of impact to Tern Habitat has not significantly changed.

6.4.8.10. Evaluation of Principal Functions and Values

As identified above, the principal functions and values identified for the site are:

- Groundwater Discharge;
- Sediment/Shoreline Stabilization;
- Wildlife Habitat; and
- Fish and Shellfish Habitat.

It is anticipated that the proposed work will impact two of these four functions and values minimally. The planned cap will be permeable, and thus should not impede groundwater discharge. Weep holes within the sheet piling will allow groundwater to flow into the Harbor, and will also allow hydrostatic forces built up via tidal intrusion into the upland area to flow back out into the Harbor. The cap will also isolate the impacted sediment within the area of the site, and will prevent it from entraining within the water column and transporting out into Buzzard's Bay; thereby increasing water quality within the Acushnet River and Buzzard's Bay.

The sheet piling will provide a barrier for the waves that impact upon it. Although some shoreline stabilization will be lost (as the wave energy may be re-directed rather than dissipated), the decrease in shoreline stabilization should be minimal.

The largest impacts anticipated are to be due to the loss of Essential Fish Habitat from filling and dredging, destruction of shellfish, loss of shellfish habitat from filling and dredging, and the loss of shallow-water and intertidal habitat for avian wildlife. Again, note that shellfish within the area are impacted with PCBs and the shellfish themselves are banned for consumption indefinitely; also note that the contaminated shellfish represent the primary food source for avian wildlife, and the removal of this food source remove a source of contamination within the avian wildlife food chain.

6.5. Secondary Impacts

During the construction and operation of the proposed facility, additional resource impacts are expected to occur from the construction operations, as well as the operation of the facility and vessels which will be utilizing it. Some of these effects are temporary in nature, such as those associated with construction, while others will be ongoing effects of operation of a marine terminal. Many of the impacts, such as those caused by boat traffic, are already occurring at the project site, during the operation of the existing marine terminal and the Gifford Street boat ramp, and the project will not be creating new impacts to the area, but will be contributing to them.

6.5.1. Dredging or Other Construction Related Turbidity and Re-Suspension/Bioavailability Impacts

Dredging of the channel and berthing area and the driving of the sheetpiles will produce locally elevated turbidity levels during their installation. The installation equipment will also require the use of tug or push boats which, in the shallow water environment, will disturb and temporarily suspend sediment in the water column. The actual process of dredging will suspend sediments in a similar fashion to that described above, however it is anticipated that the volume of sediment suspended by the process will be larger than that produced by installation of pilings, or the movement of equipment. High levels of turbidity have been associated with decreased feeding success in some fish species, and the local productivity of the habitat may be temporarily depressed during such events, but the effect should be short term in nature. Additionally, high levels of turbidity could effect shorebird foraging. The suspended sediments will settle back out of the water when water velocities decrease at the cessation of pile driving or vessel movement. During the resettlement the sediment may cover and prevent the development of larval fish species, or eggs.

Completion of the proposed dredging may result in some re-suspension/bioavailability of contaminated sediments. The re-suspension will be a by-product of the dredging activity that will result from either mechanical or hydraulic means of collecting sediment for sequestration and disposal. The re-suspension will be controlled utilizing a combination of Bests Management Practices, including the use of environmental buckets, silt curtains, time of year restrictions, filtration of decant water and other methodologies.

However, the removal of the contaminated sediments within the dredge area will result in a significant reduction in bioavailability of contaminants in the long-term. The suspension of harbor sediments within the water column during dredging operations will cause a temporary increase in the bioavailability of superfund contaminants of concern. However, based on the results of previous studies (WES, 1986; Bohlen et al., 1979), re-suspended dredged material should settle rapidly (within approximately 1,500 feet) of the dredge area, and typically within hours of the cessation of dredging activities. This information is further supported by a study completed by Battelle on behalf of USEPA, dated December 15, 2009, and referenced within the Essential Fish Habitat Assessment prepared for this project which stated that the plume of suspended sediment that was generated during disposal of sediment within a CAD Cell dissipated to near-background levels within 90 minutes.

Given the commitment to using best management practices, and the documented minimal re-suspension effects of dredging, the dredging will not significantly increase the bio-availability of the contaminants and will not have a significant adverse effect on aquatic life.

Dredging will produce conditions similar to those which arise whenever rough seas or turbid conditions form within New Bedford Harbor, as the result of storm events. Observed conditions over the past nine years in New Bedford Harbor have indicated that storm events, particularly in shallow-water areas, are very likely to create sufficient turbulence due to wave action such that visibility when diving within New Bedford Harbor is virtually non-existent. The removal of the fine-grained contaminated material reduces the amount of turbidity that such storm events will create in the future, and will further reduce the bioavailability of PCB and

metals impacts within sediment that is entrained within the water column during these storm events in the vicinity of the South Terminal CDF.

It is expected that the dredging portion of the project will last for approximately one to two months and suspended sediment (absent the proposed controls) would be elevated during this time period. Although dredging will temporarily increase turbidity during the dredging activity (which will last a matter of hours before settling out from the water column), this effect will only last for the short lifespan of the dredge project. The re-suspension and increased bioavailability of sediment due to storm events in shallow waters (such as those at the South Terminal CDF) will be a continual process, repeated during each storm event, until such time as the impacted sediment is removed.

Avoidance, minimization and/or mitigation for secondary effects are noted within **Section 7**.

6.5.2. Stormwater Runoff

The following abbreviated stormwater management plan has been prepared to address concerns raised by USEPA. A more formal stormwater management plan, with additional detail, will be finalized with design documents prior to construction:

6.5.2.1. Soils, Slopes, Vegetation, and Current Drainage Patterns

Soil type(s): The two major soil types on the site are defined as (651) Udorthents smoothed and (602) Urban Land. Their approximate distribution on the site is depicted in the figure below. These two soil types compose the landward soils with the other unit on the map (607) being salt water.

Approximate distribution of NRCS Mapped Soil Units at Site
(http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx)

Udorthents smoothed (651) - These soils are described as made land over loose sandy and

gravelly glaciofluvial deposits and/or firm coarse-loamy basal till derived from granite and gneiss. They have a wide range of water transmitting capability which ranges from moderately low to very high. Typical profile is 0 to 6 inches variable and 6 to 60 inches variable. The depth to the water table is typically more than 80 inches.

Urban Land (602) – These soils are filled lands composed of urban fill material which has been excavated and transported to the area. These are not naturally occurring soils.

Slopes/Drainage Patterns: The project site is located on a parcel of land approximately 7 acres abutting the New Bedford Inner Harbor New Bedford, MA. The parcel is relatively flat and gently slopes towards the harbor. The current site consists mainly of previously disturbed land which has reverted back to shrubland and small amounts of developed and paved surfaces. The site slopes generally from west to east.

Existing off-site runoff currently flows across the site via sheet flow and discharges into New Bedford Inner Harbor. Two stormwater easements are located on the northern and southern portions of the projects and contain stormwater outfalls which discharge directly into the harbor. During construction stormwater which would be traveling through the site will be temporarily re-routed around the construction area to minimize sediment in the runoff. This rerouted runoff will be controlled by BMPs utilizing diversions, check dams, and temporary sedimentation basins. The current stormwater outfalls will be extended and not impacted during construction activities. The outfalls will be extended to ensure that the water conveyed by them is not discharged into the new bulkhead area being created as part of the project.

Vegetation: Vegetation on the site in the project area is representative of disturbed shrubland community. Native grasses and weeds are interspersed in the herbaceous layer. The site is partially located within the footprint of a former mill building which was demolished in 1939. Much of the rubble from the factory remains on-site and pioneering vegetation has taken over and stabilized the soils. The vegetation on the beach is sparse limited to some occasional beach grass. The beach is not a barrier beach and the project will not impact any existing dune areas. The entire area surrounding the project has been previously disturbed and developed.

6.5.2.2. Receiving Waters

Description of receiving waters: The receiving water for this project is the New Bedford Inner Harbor. The Inner Harbor abuts the site and direct discharges to the harbor will be avoided. The Inner Harbor is considered an impacted water body and has TMDL limits set for it. Through the use of properly engineered sediment and erosion controls no sediment from the project will enter into the receiving waters without prior treatment for suspended solids and other TMDL limits. The stormwater system will be designed and operated to ensure that discharges from the site do not cause or contribute to a violation of any applicable water quality standard, in accordance with federal and/or state ARARs.

Description of stormwater:

Existing stormwater patterns

Two existing piped drainage systems pass through the project in the northern portion of the property and include outfalls within the project limits. One system is near the northern limit of the project roughly extending east from Wright Street. This storm drain discharges through the

existing bulkhead into New Bedford Harbor. The second piped system extends east from the cul-de-sac on Blackmer Street passing beneath the shoreline and discharges just offshore. Only limited amounts of runoff from the margins of the project area drain to these piped systems. The majority of runoff from the landward portions of the project area is generally by overland flow easterly to the harbor.

The southern portion of the project has no defined drainage system. Runoff is overland either onto abutting commercial/industrial property to the east or to existing storm drainage systems in Gifford Street to the north and Cove Street to the south. The small portion of the project areas located north of Gifford Street are drained primarily by overland flow directly or indirectly (across abutting property) to the harbor with small portions draining toward Gifford Street.

Proposed Stormwater System

With respect to the existing stormwater outfalls on the northern portion of the project, it is proposed that the northern pipeline will be maintained in its existing condition, while the southern pipeline will be replaced and re-routed along the southern face of the new bulkhead. The existing pipelines will be modified and strengthened or replaced as necessary to accommodate anticipated loads from filling, storage, trucks and other heavy equipment including cranes.

During construction considerable effort will be taken to eliminate the potential of sediment or other pollutants reaching the harbor. As is typical of any project covering several acres and requiring the movement of large quantities of earth materials, the project must be designed to address concerns for control of erosion and sedimentation due to potentially large areas of

unstabilized soil materials. As detailed below, these will be addressed by implementation of conventional stormwater controls and BMPs. The project must also address control of the runoff from dredged materials used for site fills. Containment of stormwater and active controls will be implemented to address this potentiality. A system including handling and dewatering basins; monitoring stormwater; active control of outlet; additional settling, as necessary; and testing and monitoring will be implemented to control runoff.

Following construction, the stormwater system must accommodate the intended facility use for support of offshore wind energy. It is anticipated that small portions of the site (less than 10%) will have paved access driveways or haul routes, but the predominant surface will be crushed aggregate (stone and other clean material) for the storage of components and the operation of cranes and other heavy equipment. It is reasonable to assume that over time there will be some changes in surfaces as equipment changes occur which may require isolated hardstands or support pads. However at this time it is envisioned that crushed aggregate will remain the predominant surface material.

After the initial use of the facility for offshore renewable energy support, the facility will be utilized for other types of maritime commerce. As previously stated, it is currently anticipated that sufficient compaction of the crushed aggregate surface will have occurred during the facility's initial use, that the crushed stone surface can be used without paving to service maritime commerce. Although it may be found to be necessary to pave the site at some future date, it is currently not anticipated that that will be necessary at this time. Therefore, it is not practical at this time to predict when this might occur or how much additional land area might be covered by additional impervious surfaces such as buildings or pavement. Should the use of

the facility change in the future, any proposed changes would have to be designed to the then-applicable codes and regulations and be permitted in accordance with the applicable regulations.

Description of impaired waters or waters subject to TMDLs: New Bedford Inner Harbor which is the water body which abuts the project site is listed as a Category 5 impaired water body. A Category 5 TMDL has thresholds placed on target pollutants which have exceeded the TMDL in the past and are potentially impacting the water body. The TMDL's listed for New Bedford Inner Harbor are; priority organics, metals, nutrients, organic enrichment/low dissolved oxygen, pathogens, oil & grease, taste odor color, and objectionable deposits.

6.5.2.3. Potential Sources of Pollution

Potential sources of sediment to stormwater runoff:

During the site construction potential sources of sediments would include:

- Clean stockpiled dredge material for filling behind the bulkhead
- Contaminated soils currently under an asphalt engineered barrier located at the DMF properties (MassDEP information for Release Number #4-0015490 located at 16 Blackmer Street states that the primary pollutant for this site is lead, but other contaminants include PAHs, and TPH).
- Other contaminated soils onsite.
- Clearing, grading, excavating and un-stabilized areas
- Soil transported on the construction vehicles during transport
- Dust from construction activities

- Run-off from stock piled material

Potential pollutants and sources, other than sediment, to stormwater runoff:

Stormwater Pollutants	Location
PCB's	Limited to the approximate upper two to three feet of dredged sediment (to be disposed of within the CAD Cell) and within existing soils at the site.
Heavy Metals	Limited to upper foot of dredged sediment (to be disposed of within the CAD Cell) and soils beneath the engineered barrier at 16 Blackmer Street.
Oil, Grease, Fuel	Construction vehicle washing area, vehicle maintenance area and vehicle storage area and within existing soils at the site.
Fuel	Construction vehicle re-fueling area
Paint	Structure construction area and supply storage areas
Trash & Debris	Waste storage area
Sanitary Waste	Portable bathroom facilities
Landscaping materials (fertilizers, pesticides etc.)	Supply storage area and landscape areas under construction
Building materials	Supply storage area and structure construction areas

To protect the water quality in New Bedford Harbor, the above potential stormwater pollutants will be controlled through a number of measures, including use of retention and/or detention basins (as necessary), installation of erosion and sedimentation controls, isolation of contaminated material both during construction and post-construction, protection of stockpiled sediment, control of sheet flow runoff at the site, maintenance (or appropriate alteration) of existing Activity and Use Limitations, treatment (as necessary) of detained stormwater prior to discharge, and use of Best Management Practices.

Contaminated dredged sediments will be placed within a CAD Cell. Dredged material used onsite will either be placed onsite below the water line or dewatered and allowed to dry prior to compaction above the water line (as necessary), and the water from the dredged material will either infiltrate onsite, or be directed to a temporary basin where additional settlement will occur. A dewatering fluid treatment system will be available as a contingency to capture and treat the dewatering fluids; however, it is anticipated that the majority of water will naturally infiltrate. The dredged material used within the facility will be dredged parent material, which is anticipated to be clean.

Dewatering will be conducted in accordance with the State Enhanced Remedy Performance Standards. The erosion and sediment controls associated with dewatering will include at a minimum, earth berms and/or hay bale barriers and silt fencing. The material will only remain stockpiled on-site temporarily until it can be used behind the sheet piles which will be installed. Stormwater from the handling and dewatering basins will be carefully controlled and no discharge will occur until the stormwater is monitored for turbidity.

Turbid stormwater from dredge handling and dewatering basins will be conveyed to secondary basins for additional settling. If fine-grained sediments persist in the stormwater, sand and/or geotextile filters will be employed to further reduce particulates. Stormwater on-site will either infiltrate or drain towards the sheet pile contained fill area. The construction area will be designed to ensure that any water not captured by temporary sediment basins or traveling through the site via sheet flow during stormwater events will be held behind the sheet piled area. This will allow for additional settlement of the sediments suspended in the stormwater. Water

within the stormwater basins will be monitored and can be tested for turbidity and other parameters prior to being either treated and/or discharged.

To satisfy the conditions of the existing Activity and Use Limitation ("AUL") imposed on the property at 16 Blackmer Street, pursuant to the Department's Massachusetts Contingency Plan (310 CMR 40.0000), the existing asphalt barrier will either need to be maintained, a 3" concrete barrier will need to be installed, or three feet of clean material will need to be placed on top of the contaminated material. Alternately, the AUL may be modified under the MCP to devise an alternate method for handling impacted soils. One of the above-mentioned strategies will be implemented to maintain a level of "No Significant Risk" from the impacted soils at this location.

6.5.2.4. Erosion and Sediment Control BMPs

6.5.2.4.1. Minimize Disturbed Area and Protect Natural Features and Soil

1. Prior to the start of any earthwork silt fences and hay bales will be installed. Temporary detention basins for handling and dewatering dredge materials or dewatering treatment systems will be installed as necessary.
2. All silt fences will be inspected weekly and after every rain event that produces runoff within a 24-hour period and will be repaired or replaced as necessary. Silt fencing will be cleaned out when sediment has reached 6 inches in depth.
3. Any environmental or historic resource areas to be protected will be surveyed and flagged to define limits of work.

4. Installation of siltation booms and water quality protection measures, as needed, will be installed prior to the driving of sheet piling or dredging, as necessary.
5. All areas to be excavated will be laid out by a surveyor prior to excavation.

6.5.2.4.2. Phase Construction Activity

The site will be constructed in several phases. Erosion control measures will be installed incrementally with each phase. After these measures are in place, the land will be cleared, stabilized, construction entrances will be constructed, and staging areas will be established. Siltation curtains and booms will be deployed prior to navigational dredging work within the water begins, as required by State Enhanced Remedy Performance Standards. The sheet piles will be placed and dredging in front of the bulk head will commence. A CAD Cell will be constructed in coordination with the development of the facility. CAD Cell construction will likely begin prior to the start of dredging, in order to allow placement of contaminated material into the CAD Cell from the site for disposal. Parent material from dredging activities (from navigational dredging) will be separated and staged on-site for dewatering (unless it is to be used below Mean High Water). Material to be placed above Mean High Water will be utilized as fill behind the bulkhead to establish additional land area. The entire site will then receive final grading and installation of the crushed aggregate surface. Prior to finish grading, the permanent stormwater controls will be installed.

6.5.2.4.3. Control Stormwater Flowing onto and through the Project

Temporary re-routing of sheet flow through the area by means of diversions and swales will be employed to control stormwater run-off traveling through the site and entering the area behind the new bulkhead area. Stormwater within the project area will similarly be controlled by

diversions and swales, routed to temporary detention basins which will allow for settling and infiltration of stormwater. The area immediately behind the bulkhead will be utilized as a final storage location for stormwater. This area will not yet have weepholes installed, and therefore, detention of the stormwater behind the sheet-pile wall will allow suspended sediment to settle out prior to its percolation or discharge (if necessary).

6.5.2.4.4. Stabilize Soils

TEMPORARY MEASURES

1. All soil excavated and stockpiled on site will be covered with pneumatically applied straw mulch with tackifiers or polymer emulsions to resist erosion if it is to be left in place for more than 48 hours without re-handling (unless it is to be covered with polyethylene sheeting).
2. All dredged material will be transferred to enclosed basins for handling and dewatering, unless they are to be utilized below Mean High Water. Materials of particular concern will be placed on polyethylene liner rated for the pollutant of concern and will be surrounded by hay bales and silt fencing to reduce or remove the possibility of migration of sediment through the site.
3. All stockpiles of topsoil and other earth materials will be contained at a minimum by continuous silt fence. All soil stockpiles on existing slopes in excess of 1:10 (10 percent) will be surrounded by berm and swale system to ensure erosion and sedimentation are minimized. Dredged sediment will be decanted within dredge scows prior to placement upland. Decant water will be treated utilizing a sand filter or similar prior to discharge into

New Bedford Harbor. Decanted sediment will either be placed below Mean High Water or will be transferred and stockpiled at an upland location. It is currently anticipated that the parent material will be granular in nature, and therefore, will likely dewater relatively quickly, potentially before it will be possible to transfer it to a bermed area; however, if found to be necessary, dredged material will be placed within dewatering basins constructed of earthen berms. Runoff from the dewatering basins (if needed) will be monitored and routed to temporary sediment basins or treated via dewatering fluid treatment systems. Once adequately dewatered, sediments will be moved to stockpiles and will have hay bales and silt fencing surrounding the piles. All runoff will be routed to temporary sediment basins.

4. During construction, those areas of exposed soil that have been graded but will not be worked for three weeks or more will be treated periodically with water containing liquid polymer emulsions as necessary or covered with pneumatically applied straw mulch.

PERMANENT MEASURES

1. As soon as weather permits after the completion of fine grading, all disturbed areas will be permanently stabilized with placement of crushed stone aggregate. Small portions of the site may be paved for access driveways, equipment pads and hardstand areas.

6.5.2.4.5. Protect Slopes

1. Erosion control matting will be used on any cut, fill or re-graded slopes steeper than 3 horizontal to 1 vertical.

6.5.2.4.6. Protect Storm Drain Inlets

1. Outlets from basins and culverts will be protected during construction activities with crushed rock and hay bales.

2. After the construction activities are competed, paved areas are to be swept and catch basins (where applicable) are to be inspected and cleaned if necessary twice annually to prevent a build up of sediment.
3. When sediments reach a depth of 6 inches, they are to be removed from the stormwater management basin.

6.5.2.4.7. Establish Perimeter Controls and Sediment Barriers

1. Prior to the start of any earthwork silt fences and hay bales will be installed. Clearing will initially be limited to the site perimeter and other areas of silt fence installation.
2. All silt fences will be inspected weekly and after every rain event that produces runoff within a 24 hour period and repaired or replace as necessary. Silt fencing will be cleaned out when sediment has reached 6 inches in depth.
3. Siltation curtains and booms will be installed as needed during work within water in accordance with the State Enhanced Remedy Performance Standards.

6.5.2.4.8. Retain Sediment On-Site

1. Temporary sediment basins will be constructed at selected locations on the lower portions of the project area to treat runoff from the construction sites. These temporary basins will be repositioned as construction progresses. Ultimately construction runoff will be routed through completed portions of the drainage system to the detention basins.
2. Dredged sediment will be decanted within dredge scows prior to placement upland. Decant water will be treated utilizing a sand filter or similar prior to discharge into New Bedford Harbor. Decanted sediment will either be placed below Mean High Water or will be transferred and stockpiled at an upland location. It is currently anticipated that the parent

material will be granular in nature, and therefore, will likely dewater relatively quickly, potentially before it will be possible to transfer it to a bermed area; however, if found to be necessary, dredged material will be deposited within dewatering basins which will allow for infiltration of the water from the stock piled material. Stormwater from within the basins will be routed to temporary sediment basins to remove additional suspended soils and reduce sediment migration through the site.

3. Silt fence and hay bales will be installed down gradient from slopes which have the potential of sediments washing away during construction.
4. Soil will be stockpiled on-site for reuse. Other than soils destined for off-site disposal, no soils will be removed from the project area.

6.5.2.4.9. Establish Stabilized Construction Exits

1. Construction entrances will be situated off of Blackmer Street.
2. Pavement will be swept periodically to limit the tracking of sediment off-site. At a minimum, sediments are to be swept on a weekly basis.
3. All soil or sediment tracked onto Blackmer Street will be removed immediately.
4. A stone stabilization pad at the site entrance will be maintained by the contractor. The maintenance will include removal and replacement, top dressing with additional stone or constructing additional length as conditions demand or as directed by the engineer.
5. The stones will be replaced whenever sediment has in-filled spaces between stones limiting the tracking pads ability to capture soil from the tires of trucks and other construction equipment.

6.5.2.5. Good Housekeeping BMPs

6.5.2.5.1. Material Handling and Waste Management

Solid waste disposal from the project site during construction or operation of the facility will be stored in portable dumpsters, removed by a private hauler and brought to municipal facilities. During the construction period, portable toilets will be placed on site for the construction workers. Sanitary waste from these toilets will be disposed of by a private company.

6.5.2.5.2. Establish Proper Building Material Staging Areas

For the duration of the construction period a staging area and a supply storage/stockpile area will be designated and established. No materials are to be stored in other locations. Materials within the staging area will be covered when not in use. No cans will be left open when not in use. It can be anticipated that the following items will likely be stored within the staging area; wood, construction material, sheet piles, lubricating oil/grease, gasoline, paint and other coating materials. Additional items such as construction equipment may be stored during the site construction.

6.5.2.5.3. Designate Washout Areas

Construction washout areas will be established near the construction entrances. Signs will be installed designating the washout area. A temporary polyethylene liner will be installed in the washout area. This will allow any solids suspended in the wash water sufficient time to settle out, concrete to harden and water to evaporate. The washout area shall be inspected daily for leaks and to determine when the contents need to be removed. Silt fence and hay bales will be installed immediately down gradient from the washout area to capture and detain any wash water which by-passes the area.

6.5.2.5.4. Establish Proper Equipment/Vehicle Fueling and Maintenance Practices

Most standard rubber tire equipment/vehicle fueling will occur off-site. By re-fueling equipment/vehicles off-site the risk of fuel spills will be reduced. Track equipment and some select rubber tired equipment/vehicles will be re-fueled on site. Personnel will stay with the equipment during re-fueling to prevent over-filling and/or spilling. Maintenance and refueling shall occur away from drainage paths. Equipment/vehicles will be inspected daily for leaks, damage and/or other service problems. Precautionary measures will be taken to prevent contamination of the ground water or surface runoff when maintenance is necessary. The ground surface will be protected with drip pans, drip clothes or absorbent pads. Spent fluids will be placed in appropriate receptacles and removed from site and recycled when possible.

6.5.2.5.5. Control Equipment/Vehicle Washing

Equipment/vehicles will be washed off-site whenever possible. On-site washing will be without detergent and the wash water shall be directed to the detention layer to allow for filtration, settling and infiltration. An area will be designated with signs as the equipment/vehicle washing area.

6.5.2.5.6. Spill Prevention and Control Plan

This site does not, and is extremely unlikely to, contain above ground oil storage over 1,350 gallons below ground storage of greater than 42,000 gallons and therefore is not subject to a Spill Prevention Control and Countermeasures Plan (SPCC).

6.5.2.5.7. Any Additional BMPs

Permanent BMPs include the detention layer which will control and filter flow from the site. In the process of detaining the stormwater runoff, some of the runoff will infiltrate into the ground and some will evaporate.

6.5.2.6. Selecting Post-Construction BMPs

The utilization of crushed aggregate for the majority of the projects' finished surface will allow for the direct storage of three or more inches of rainfall and its subsequent infiltration. It is anticipated that runoff from the site will be limited to large rain events. The site will be graded to flow via sheetflow directly toward subsurface stormwater collection piping, which will be perforated and wrapped in filter fabric. Contaminated material will be isolated from stormwater flows via three feet of clean dredge material and crushed stone. Stormwater collection piping will direct stormwater that does not infiltrate and is not stored within the crushed aggregate to the existing stormwater management system. Rip rap will be provided at outlets of the stormwater management system, where necessary, as energy dissipating devices which will reduce the erosion potential.

6.5.2.7. Final Stabilization

Upon completion of final grading in a given area of the site, that area shall be provided with final stabilization. Final stabilization may include the installation of crushed rock or pavement.

6.5.2.7.1. OVERALL SEQUENCE OF CONSTRUCTION ACTIVITY

The following is an estimate of the approximate sequence of construction for the development of

the site:

- Mobilize
- Install perimeter erosion and sedimentation controls
- Grub and clear site vegetation
- Construct dredge material handling and dewatering areas using earth berms sized to contain all stormwater inside without any uncontrolled runoff, if necessary.
- Install additional sedimentation basins and traps for treatment of stormwater from dredge material handling and dewatering areas, if necessary.
- Install additional temporary stormwater basins for sediment control for the remainder of the project areas, as necessary.
- Construct CAD Cell.
- Complete navigational dredging of contaminated material. Dredging will be accomplished using water tight buckets, tight bottom barges, sediment curtains, floating booms and other BMPs, as necessary, to control introduction of turbidity into the harbor's waters.
- Separate soft, organic and/or contaminated sediment from clean sediment for disposal within CAD Cell.
- Install sheet pile bulkheads. Bulkheads will be terminated with a tight connection at the shoreline.
- Complete navigational dredging of non-contaminated material. Dredging will be sediment curtains, floating booms and other BMPs, as necessary, to control introduction of turbidity into the harbor's waters.
- Dredge material will be utilized for backfill behind (landward of) bulkheads to dispose of

the dredged material and create usable land area; dewatering of sediment will be completed (as necessary).

- Grade upland portion of the site to design contours and elevations
- Establish crushed aggregate surface in laydown areas
- Construct paved areas, hardstand, utility corridors, equipment pads and building foundations and building structures and/or renovation of existing building structures (as stated earlier, asphalt areas are projected to be very minimal).
- Install permanent soil stabilization

Avoidance, minimization and/or mitigation for secondary effects are noted within **Section 7**.

6.5.3. Lighting

It is anticipated that artificial lighting will be employed during the development of the project site. The use of temporary lighting will contribute to local light pollution, and could affect residents as well as local wildlife. This artificial lighting, when used after dusk, will obscure the night sky for residents and disturb biological rhythms for local wildlife. Nocturnal birds will be affected most notably because they rely on the moon and stars for navigation and they rely on darkness for hunting. The International Dark-Sky Association notes that millions of birds a year collide with artificially lighted fixtures during the night because they are drawn to the light beams. For other wildlife, such as mammals, reptiles, and insects, a decrease in both reproduction and appetite, along with an overall sense of confusion, are all negative effects from

artificial lighting. Avoidance, minimization and/or mitigation for secondary effects are noted within **Section 7**.

6.5.4. Bilge and Ballast Water Management

During operation of the proposed facility, vessels will be arriving and departing from the site. These vessels will all undoubtedly be carrying quantities of bilge water and ballast water. The following sections describe the anticipated handling of these two fluids at the proposed facility:

6.5.4.1. Bilge Water

Handling bilge water is a routine task for licensed merchant ships. Section 311 of the Clean Water Act, as amended by the Oil Pollution Act of 1990 (33 U.S.C. 2701-2720), applies to ships and prohibits discharge of oil or hazardous substances in harmful quantities into or upon U.S. navigable waters, or into or upon the waters of the contiguous zone, or which may affect natural resources in the U.S. EEZ (extending 200 miles (320 km) offshore). Coast Guard regulations (33 CFR §151.10) prohibit discharge of oil within 12 miles (19 km) from shore, unless passed through a 15-ppm oil water separator, and unless the discharge does not cause a visible sheen. Beyond 12 miles (19 km), oil or oily mixtures can be discharged while a vessel is proceeding en route and if the oil content without dilution is less than 100 ppm. Vessels are required to maintain an Oil Record Book to record disposal of oily residues and discharges overboard or disposal of bilge water.

In addition to Section 311 requirements, the Act to Prevent Pollution from Ships (APPS) implements MARPOL Annex I concerning oil pollution. APPS applies to all U.S. flagged ships

anywhere in the world and to all foreign flagged vessels operating in the navigable waters of the United States, or while at a port under U.S. jurisdiction. To implement APPS, the Coast Guard has promulgated regulations prohibiting the discharge of oil or oily mixtures into the sea within 12 nautical miles (22 km) of the nearest land, except under limited conditions.

Coast Guard regulations are very specific, inspections are frequent, and federal penalties and fines for noncompliance are stiff. A No Discharge Zone has been created for Buzzards Bay which includes New Bedford Harbor. Non-compliance also can result in significant fines from State regulators. No discharge of bilge water into the harbor will be permitted from vessels while at the South Terminal CDF or while transiting through inland waters to or from New Bedford Harbor. The Coast Guard Marine Safety Detachment in New Bedford enforces compliance, boarding each large international merchant vessel prior to their entering port to ensure all their systems are functioning properly and they are fully compliant with all applicable safety, environmental and port security regulations. The Coast Guard also responds to all reports of observed discharges or oily sheens on the water (that would likely result if bilge water were improperly discharged).

Please note that large merchant ships do routinely have contaminated bilge water of varying quantities. The principle contaminant of bilge water is almost exclusively hydrocarbons or cleaning solvents from products used to clean, fuel or lubricate onboard machinery. Most, if not all, of these ships will have oil-water separators that collect the waste oil and some other contaminants in bilge water. The cleaned water is often discharged at sea. The concentrated oil waste collected from the bilges is pumped off in port for disposal at licensed facilities, usually to

tanker trucks specifically designed, licensed, and exclusively used for this purpose. This waste is then taken to approved disposal sites. No bilge water will be pumped into the POTW.

In the event oily bilge water needs to be pumped and disposed of, there are many experienced commercial contractors located in Eastern Mass that provide this service (existing maritime cargo support facilities within New Bedford Harbor utilize these contractors). The contractors listed below are some that have vacuum trucks and disposal facilities available:

- Clean Harbors
- General Chemical
- Maxymilliam Technologies
- Cyn Environmental
- Moran Environmental
- Triumvirate Environmental

6.5.4.2. Ballast Water

Vessels involved in offshore wind renewable energy construction projects will most likely not have a need to carry any ballast water. The freighters carrying the renewable energy components from international destinations will be fully laden, and thus unlikely to need ballast except possibly a small amount for vessel trim. This will also apply to international cargo vessels. Vessels transiting from over-seas are required to flush out their ballast tanks (if in use) several times enroute to minimize the risk of carrying an invasive/non-indigenous species into U.S. waters.

The jack up barges and support vessels for wind farm construction, and the smaller short-seas shipping vessels will most likely not need any ballast, both due to the construction of the vessels and the type of loading (i.e., similar to the international vessels, these vessels will be fully loaded and will likely not require ballast). No discharge of ballast water will be allowed in port or in transit while these vessels are operating in inland waters. In the unlikely event that ballast water has to be dealt with, the water will be profiled appropriately and collected and disposed of in accordance with all requisite regulations. No discharges of contaminated ballast water will be intentionally made into New Bedford Harbor or the Buzzards Bay No Discharge Zone by vessels operating out of the South Terminal CDF.

Avoidance, minimization and/or mitigation for secondary effects are noted within **Section 7**.

6.5.5. Sloughing of Slopes

The dredging at the proposed site will create slopes below the waterline that may have the ability to slough. The angles of these slopes must be calculated precisely and the sediments that make up these slopes must be researched in detail before construction in order to minimize the chance of this happening. Sloughing slopes could cause the aquatic life on the ocean floor to be smothered by the falling sediment. Avoidance, minimization and/or mitigation for secondary effects are noted within **Section 7**.

6.5.6. Boat Traffic Secondary Impacts

The analysis of boat traffic secondary impacts is broken down into four sub-sections:

1). An analysis of the increased risk due to oil spills due to operation of the new facility.

2). An analysis of the increased vessel traffic due to operation at the new facility.

3). An analysis of the potential for increased turbidity associated with increased prop wash due to increased vessel traffic.

4). An analysis of potential conflicts with the Commercial Fishing Industry.

6.5.6.1. Oil Spill Analysis

The following is an analysis that was conducted in order to determine the increased risk in oil spills due to the South Terminal CDF construction. In order to conduct this analysis, existing research into the vessel traffic and the risk of associated oil spills was reviewed. The most up-to-date analysis of the risk posed to coastal communities in Massachusetts by oil spills was prepared by Nuka Research & Planning Group, LLC for the Massachusetts Department of Environmental Protection, titled "Evaluation of Marine Oil Spill Threat to Massachusetts Coastal Communities", dated December 2009 (included as **Appendix 69**).

As stipulated within this report, the main risk of spills in many harbors and ports (not to mention navigable waterways) is the possibility that a vessel will accidentally discharge petroleum through a vessel sinking, grounding, collision, fire or through accidental or illegal discharges from vessel operations, such as bilge pumping, changing engine oil, or refueling. For the purposes of this section, the assumption is made that the larger the size of the fleet of vessels servicing a harbor, the larger the threat of an oil spill from any of these possible sources. To estimate the magnitude of each oil spill threat for the purpose of comparison, a gallons of petroleum exposure measure (GPE) is calculated for each threat within each harbor in Massachusetts. For vessels permanently stationed within a harbor, the total GPE is the volume of petroleum product that could be released at any one point in time (usually the volume of the

fuel tank of the vessel); for vessels in transit, the total GPE is the volume of petroleum product times the number of visits that the vessel makes to that port.

There are two categories of potential risk from vessels that are evaluated below: oil spill risk from vessels within and/or transiting to and from New Bedford Harbor, oil spill risk from increases in bulk oil storage within New Bedford Harbor, and the potential increased risk for oil spills from regional vessel transits. The following outlines the existing Oil Spill Threat in these three categories:

Existing Oil Spill Threat For New Bedford Harbor

The following is a summary of the existing oil spill threat based upon existing traffic (based upon data gathered from 2006) in Gallons of Petroleum Exposure (GPE) for the City of New Bedford, based upon the category of vessel:

- Oil Tanker or Tank Barge Activity – 43,250,000 GPE
- Large Nontank Vessels – 1,725,000,000 GPE
- Recreational and Charter Vessels – 300,000 GPE
- Commercial Fishing Vessel Fleet – 7,500,000 GPE
- Ferry Terminals – 5,500 GPE
- Other Large Vessels (Tugs, Training Vessels) – 84,000 GPE
- Vessels Associated with Shipyard Activity – 900,000 GPE

Total Existing Oil Spill Threat in GPE for Vessels, New Bedford Harbor: **1,777,039,500 GPE**

Existing Oil Spill Threat for Vessel Activity Within Shipping Lanes

The following is a summary of the existing oil spill threat for existing shipping lanes based upon existing traffic (based upon data gathered from 2006) in Gallons of Petroleum Exposure (GPE) for the following areas:

- Regional Transit Vessels (South Coastal/New Bedford) – 1,517,636,000 GPE
- Regional Transit Vessels (Dartmouth/Fairhaven/Marion/Mattapoisett/Wareham/ Westport) – 1,562,611,000 GPE
- Cape and Islands – 1,562,611,000 GPE

Increased Vessel Traffic Due to South Terminal CDF Construction and Operation

Increased traffic at the South Terminal CDF site is anticipated to include the following vessels during the first year:

- An international vessel (similar to a traditional non-tank vessel), between 140 - 150 meters (460 – 490 feet) in length. The international vessel can only carry components for 6 turbines at one time. Therefore, for constructing an offshore wind energy facility for 130 turbines, 22 separate shipments from international vessels would need to be received at the support facility. These shipments would be anticipated to be receive within the first year of operation of the facility.
- Two installation vessels would be also required at the facility. Offshore renewable energy facility installation ships would consist of jack-up barges that would be approximately 91 meters (300 feet) in length and 30 meters (100 feet) in width. The vessels would not be powered on their own, and would require a tug to maneuver them out of dock and out to the construction site. It is currently anticipated that each barge would require one tug (each tug is estimated to be approximately 30 meters, or 100 feet

in length) to maneuver the vessel out to sea; however, the facility would employ two tugs (one for each installation vessel). Each installation vessel would be capable of delivering components for installation of 2 wind turbines for each trip, resulting in a total of 65 total trips for the vessels during the first year.

In accordance with the categorization system created by Nuka Research & Planning Group, LLC within their report, the anticipated increased oil spill threat for the additional vessels is as follows:

- International Vessels: Nontank Vessels within New Bedford area anticipated to have an average fuel capacity of 75,000 gallons. 22 annual non-tank vessels X 75,000 gallons per vessel equates to 1,650,000 GPE for the international vessels.
- Installation Vessels (and tugs) Within the Port of New Bedford: For commercial tugs between 65 and 100 feet in length, the average fuel capacity is 17,500 gallons. There are anticipated to be two tugs in port at any one time in order to assist in tendering the installation vessels in and out of port. Therefore, the increased oil spill threat due to the additional tugs is: 2 tugs X 17,500 gallons per tug, which equates to an increase of 35,000 GPE.
- Installation Vessels (and tugs) In Transit to the Construction Site: There are anticipated to be one tug that accompanies each installation vessel to the construction site. There are anticipated to be approximately 65 trips to the construction site. Therefore, the increased oil spill threat in transit to the construction site due to the installation vessels is: 65 tugs X 17,500 gallons per tug, which equates to an increase of 1,137,500 GPE.

The total increase in oil spill threat for New Bedford Harbor is: 1,650,000 GPE + 35,000 GPE = **1,685,000 GPE.** As stated earlier, the total existing oil spill risk for the Port of New Bedford is: 1,777,039,500 GPE. Therefore, the construction of the South Terminal CDF will result in a 1,685,000/1,777,039,500 = **0.095%** increase in oil spill risk for the Port of New Bedford, an extremely small increase over current existing conditions.

The total increase in oil spill threat for areas within which the international vessels and installation vessels/tugs will transit is: 1,650,000 GPE + 1,137,500 GPE = **2,787,500 GPE** over the course of a year of installation. As stated earlier, the total existing oil spill risk for areas surrounding the south coast as well as Cape Cod and the Island is:

- Regional Transit Vessels (South Coastal/New Bedford) – 1,517,636,000 GPE
- Regional Transit Vessels (Dartmouth/Fairhaven/Marion/Mattapoisett/Wareham/ Westport) – 1,562,611,000 GPE
- Cape and Islands – 1,562,611,000 GPE

Therefore, the relative increase in oil spill risk due to the addition of international vessels and the transit of installation vessels is:

- Regional Transit Vessels (South Coastal/New Bedford) – 2,787,500/1,517,636,000 = **0.18%**
- Regional Transit Vessels (Dartmouth/Fairhaven/Marion/Mattapoisett/Wareham/ Westport) – 2,787,500/1,562,611,000 = **0.18%**
- Cape and Islands – 2,787,500/1,562,611,000 = **0.18%**

All of which represent an extremely small increase in oil spill risk over current existing conditions.

Maritime Terminal Operation

After the initial use of the facility as an offshore renewable energy support facility, the facility will serve as a maritime terminal. Increased traffic at the South Terminal CDF site (subsequent to the first year) is anticipated to include the following vessels:

- An average of one cargo vessel per week is currently anticipated at the facility subsequent to the first year. This vessel would likely be similar in size to the above-mentioned international vessel (similar to a traditional non-tank vessel), between 140 - 150 meters (460 – 490 feet) in length. Alternately, several smaller, short-seas shipping barges may service the site, (transmitting a similar quantity of cargo) which could result in an average of approximately four smaller barges (similar in size to the installation vessels) per week. Therefore, the total anticipated traffic increase is an average of 3 vessels per week (approximately 156 vessels per year).

In accordance with the categorization system created by Nuka Research & Planning Group, LLC within their report, the anticipated increased oil spill threat for the additional vessels is as follows:

- Non-Tank Cargo Vessels within New Bedford area anticipated to have an average fuel capacity of 75,000 gallons. 156 annual non-tank vessels X 75,000 gallons per vessel equates to **11,700,000 GPE** for the oil spill threat (after the first year) for cargo vessels. This value would be the same for both vessels within New Bedford Harbor and Vessels in transit to the site.

The total increase in oil spill threat for New Bedford Harbor is: **11,700,000 GPE.** As stated earlier, the total existing oil spill threat for the Port of New Bedford is: 1,777,039,500 GPE.

Therefore, the oil spill threat (after the first year) will result in a 11,700,000/1,777,039,500 = **0.65%** increase in oil spill threat for the Port of New Bedford, an extremely small increase over current existing conditions.

The total increase in oil spill threat for areas within which the cargo vessels will transit is: **11,700,000 GPE** over the course of a year. As stated earlier, the total existing oil spill risk for areas surrounding the south coast as well as Cape Cod and the Island is:

- Regional Transit Vessels (South Coastal/New Bedford) – 1,517,636,000 GPE
- Regional Transit Vessels (Dartmouth/Fairhaven/Marion/Mattapoisett/Wareham/ Westport) – 1,562,611,000 GPE
- Cape and Islands – 1,562,611,000 GPE

Therefore, the relative increase in oil spill threat after the first year of operation of the new terminal is:

- Regional Transit Vessels (South Coastal/New Bedford) – 11,700,000/1,517,636,000 = **0.77%**
- Regional Transit Vessels (Dartmouth/Fairhaven/Marion/Mattapoisett/Wareham/ Westport) – 11,700,000/1,562,611,000 = **0.75%**
- Cape and Islands – 11,700,000/1,562,611,000 = **0.75%**

All of which represent an extremely small increase in oil spill risk over current existing conditions.

6.5.6.2. Vessel Traffic Analysis

Another potential secondary impact is the potential for increased vessel traffic to result in resulting restrictions to the usage of the harbor (due to limited Harbor accessibility and resources) or resulting in increased ecological impacts (due to the potential for prop wash to res-suspend sediments and cause turbidity that would affect avian wildlife or essential fish within New Bedford Harbor). In order to conduct this analysis, existing research into vessel traffic was reviewed. The most up-to-date analysis of vessel traffic in coastal communities in Massachusetts was formulated in order to assess oil spill risks within a document prepared by Nuka Research & Planning Group, LLC for the Massachusetts Department of Environmental Protection, titled "Evaluation of Marine Oil Spill Threat to Massachusetts Coastal Communities", dated December 2009 (included as **Appendix 69**). To help translate some of these numbers into vessel trips (from the GPE oil risk metric utilized within the report) information on vessel types and traffic was utilized from the New Bedford/Fairhaven Harbor Plan.

For the purposes of this section, the assumption is made that the larger number of vessels transiting in and out of a port, the larger the potential impact of interference to other vessels and from prop wash or disturbance of bottom sediments. To estimate the traffic within New Bedford Harbor, vessel numbers and usage are extrapolated from a gallon of petroleum exposure measure (GPE) metric calculated within Nuka Research & Planning Group, LLC report.

There are two categories of potential risk from vessels that are evaluated below: the potential for additional vessels to restrict usage of the harbor for existing vessels (particularly restrictions at the New Bedford Hurricane Barrier), and the potential increased ecological risk posed by increased prop wash or disturbance of bottom sediments. The following outlines the existing vessel traffic impacts in these two categories:

Existing Maritime Traffic Within New Bedford Harbor

The following is a summary of the existing marine traffic (based upon data gathered from 2006) for the City of New Bedford, based upon the category of vessel:

- Oil Tanker or Tank Barge Activity – Total traffic within New Bedford Harbor is formulated at 43,250,000 GPE. Typical general purpose tankers that transport bulk fuel within New Bedford Harbor are approximately 10,000 Dead Weight Tons, which equates to an approximate average capacity of 4,375,000 gallons per tanker. Therefore the average number of trips per year for oil tankers within New Bedford Harbor is 10 trips/year for Oil Tankers or Tank Barges.
- Large Nontank Vessels – Information within the Nuka Research & Planning Group, LLC report specifically states that there are currently approximately 23 trips per year of Non-Tank Vessels.
- Recreational and Charter Vessels – Total recreational and charter vessel traffic is formulated at 300,000 GPE. Typical recreational vessels have an average capacity of approximately 200 gallons per vessel, which equates to approximately 1,500 recreational vessels. Assuming each vessel on average takes a trip once every other week between May and October of each year, there are 12 trips per year per vessel = 18,000 trips per year.
- Cruise Ships - American Cruise Lines makes weekly port calls to the New Bedford State Pier from late Spring to early Fall for a total of between 20 and 24 visits = approximately 22 trips per year.

- Vessel Maintenance and Repair - There are two major facilities in Fairhaven that service commercial and recreational vessels and there are several other smaller repair facilities scattered around the harbor. These facilities account for approximately 200 trips per year within New Bedford Harbor.
- Government vessels - A variety of government boats regularly operate in the Harbor including law enforcement boats (US Coast Guard, Mass Environmental Police, State Police Marine Unit, New Bedford Police Marine Unit, Harbormasters (New Bedford and Fairhaven)), EPA, Army Corps of Engineering, research vessels, and visiting vessels. These vessels account for approximately 1,500 trips per year.
- Harbor Work Boats - These include harbor tugs, pilot boats, commercial assist vessels (e.g. SeaTow), marina launches, or marine contractor vessels working on infrastructure projects ranging from dredging to pier repair. These vessels account for approximately 2,000 trips per year.
- Commercial Fishing Vessel Fleet – According to the New Bedford Harbor Development Commission, the New Bedford Commercial Fishing Fleet currently is comprised of approximately 500 vessels, 120 of which are transient vessels. Due to current fishing restrictions, over the course of a year, an average fishing vessel spends 226 days in port. Every extended commercial fishing trip lasts one to two weeks. Therefore there are (on average) 15 trips per year per vessel, which is a total of 7,500 trips per year for the commercial fishing fleet.
- Ferry Terminals – There is currently one ferry terminal within New Bedford Harbor (The New Bedford-Martha's Vineyard Fast Ferry). According to the New Bedford Fast Ferry Website, the ferry makes approximately (approximately 1,300 trips per year).

Therefore, the total estimated number of trips in and out of New Bedford Harbor each year is 30,555 trips per year or approximately 84 trips per day.

According to the New Bedford Harbor Development Commission and Port Security personnel, the existing level of traffic is quite low compared to the existing capacity of traffic that the New Bedford Hurricane Barrier can accommodate; in fact, New Bedford Harbor is generally considered to be severely under-utilized. New Bedford Harbor is a relatively low-traffic harbor, and significant expansion of vessel traffic would be extremely unlikely to hinder the demands on traffic. Waits for entrance into New Bedford Harbor are currently extremely infrequent, and often there is no traffic transiting the Hurricane Barrier opening, nor are there typically lines to enter or exit the harbor. Therefore, the existing traffic numbers calculated above indicate relatively low quantity of traffic, and relatively small increases or decreases in traffic would have a relatively small change in either the operational or environmental impact to New Bedford Harbor.

Increased Vessel Traffic Due to South Terminal CDF Construction

Increased traffic at the South Terminal CDF site is anticipated to include the following vessels during the first year:

- An international vessel (similar to a traditional non-tank vessel), between 140 - 150 meters (460 – 490 feet) in length. The international vessel can only carry components for 6 turbines at one time. Therefore, for constructing an offshore wind energy facility for 130 turbines, 22 separate shipments from international vessels would need to be

received at the support facility. These shipments would be anticipated to be receive within the first year of operation of the facility.

- Two installation vessels would be also required at the facility. Offshore renewable energy facility installation ships would consist of jack-up barges that would be approximately 91 meters (300 feet) in width and 30 meters (100 feet) in width. The vessels would not be powered on their own, and would require a tug to maneuver them out of dock and out to the construction site. It is currently anticipated that each barge would require one tug (each tug is estimated to be approximately 30 meters, or 100 feet in length) to maneuver the vessel out to sea; however, the facility would employ two tugs (one for each installation vessel). Each installation vessel would be capable of delivering components for installation of 2 wind turbines for each trip, resulting in a total of 65 total trips for the vessels during the first year.

Increased traffic at the South Terminal CDF site (subsequent to the first year) is anticipated to include the following vessels:

- An average of one cargo vessel per week is currently anticipated at the facility subsequent to the first year. This vessel would likely be similar in size to the above-mentioned international vessel (similar to a traditional non-tank vessel), between 140 - 150 meters (460 – 490 feet) in length. Alternately, several smaller, short-seas shipping barges may service the site, (transmitting a similar quantity of cargo) which could result in an average of approximately four smaller barges (similar in size to the installation vessels) per week. Therefore, the total anticipated traffic increase is an average of 3 vessels per week (approximately 156 vessels per year).

Proportional Increase in Marine Traffic

- *First Year Traffic Increase:* The increase in traffic for the first year is anticipated to be (22 + 65 = 87) 87 total trips. This represents an increase of 87/30,555 = 0.28% increase in marine traffic.
- *Post-First Year Traffic Increase:* The increase in traffic for subsequent years is anticipated to be 156 total trips. This represents an increase in 156/30,555 = 0.5% increase in marine traffic.

Both of the above scenarios represent very small increases in marine traffic for the Port of New Bedford, and are extremely unlikely to cause any major disruption to marine traffic.

6.5.6.3. Operational Prop Wash and Proportional Increase In Operational Turbidity

After the site construction has been completed, and terminal operations begin, the temporary construction related turbidity sources will end. The elimination of the construction equipment and processes which generated additional turbidity, will reduce the frequency and severity of sediment suspension events in the area, but will not end the process. Operations at the completed facility utilize international shipping vessels and mobile barges. Both of these vessels will either use tug or push boats to maneuver into and away from the new bulkhead, and will scour the bottom sediments with the wash of their propellers. This wash can suspend portions of the bottom sediments and contribute to a long term increase in suspended sediment within the harbor.

In most areas within New Bedford Harbor, a proportional increase in prop wash (caused by a proportional increase in vessel traffic) could be linked to a representative corresponding increase in suspended sediment caused by prop wash (however, this is anticipated not to be the

case at the South Terminal CDF location, see discussion below). Prop wash from marine vessels increases turbidity by mixing sediment below the prop into the water column via turbulence. The suspended sediment becomes entrained within the water column, and is subsequently more bio-available to marine life via ingestion or respiration. Bottom sediment within New Bedford Harbor is impacted with PCBs and heavy metals; therefore, entrainment of this sediment within New Bedford Harbor, while not adding to contaminants within New Bedford Harbor, re-suspends contaminants, increasing their bio-availability to marine life.

The greatest risk for increased turbidity lies at each vessel's docking location. This is because each dock location is dredged to the approximate depth that vessels berthing at that facility require. Therefore, although a vessel may draft only 6 feet, that vessel typically is moored within an area that can accommodate at most 7 to 8 feet; therefore, the vessel has the most risk of entraining sediment when it is berthing and leaving its dockage, due to the proximity of its prop to the harbor bottom (channels and fairways are typically deeper than the deepest draft vessel that will transit the Harbor, and therefore there is much less of a risk from entrained sediment within these areas).

Although there are mitigating factors that will likely result in significantly less (or perhaps no) additional turbidity to be added to New Bedford Harbor as a result of the new facility (see discussion below), the worst-case scenario is that, as stated above, turbidity would increase proportionally with harbor traffic. Existing traffic within New Bedford Harbor can be utilized as a relative measure of the existing level of turbulence caused by prop wash within New Bedford Harbor from marine operations (see **Section 6.5.6.2** for a detailed vessel traffic analysis). The relative increase in marine traffic due to the South Terminal CDF can then be

compared to the existing level of marine traffic to determine the relative increase in turbidity and therefore suspended sediment and water quality impact, as follows.

- *First Year Traffic Increase:* The increase in traffic for the first year is anticipated to be (22 + 65 = 87) 87 total trips. This represents an increase of 87/30,555 = 0.28% increase in marine traffic.
- *Post-First Year Traffic Increase:* The increase in traffic for subsequent years is anticipated to be 156 total trips. This represents an increase in 156/30,555 = 0.5% increase in marine traffic.

It is assumed in this worst-case analysis, that all vessels, regardless of draft, generate increased turbidity due to prop wash: vessels with smaller draft tend to berth or moor in shallower areas and vessels with deeper drafts tend to berth in deeper areas. In both cases, the props for the vessels will be relatively close to the bottom of the harbor, and will therefore have impacts on turbidity within the Harbor. Therefore, in the worst case analysis, the relative increase in entrained sediment within New Bedford Harbor from creation of the South Terminal CDF will range from 0.28% to 0.5%, a very small increase, relative to existing conditions.

It is very likely that operations at the South Terminal CDF will result in significantly less increased suspended sediment than the worst-case scenario described above. The greatest risk of entrained sediment occurs from fine-grained organic material that accumulates at the bottom of the harbor. Specifically within New Bedford Harbor, fine-grained organic material that is impacted by metals and PCBs would generate the largest potential impact to marine organisms; however, this material will be removed from the South Terminal CDF dredge footprint prior to the start of operations at the facility. It is anticipated that, due to the dredge depth within the

footprint of the proposed facility (-14 to -30 MLLW, as stated previously), that the geologic material that will be present below the props within the South Terminal CDF dredge footprint will be glacial till material. Glacial till is tightly-packed combination of sand, silt and gravel that was left after passage of the glaciers. This material will be free of anthropogenic contaminants as a result of the date of its formation (the glaciers retreated from this region 13,000 years ago). Due to the density of this material, it is often very difficult to remove even with heavy equipment. Therefore, it is highly unlikely that prop wash could dislodge it. As a result, prop wash from the new vessels is unlikely to be a significant concern. Therefore, although the worst-case scenario indicates an increase in turbidity of 0.28% to 0.5%, the actual increase in turbidity is anticipated to be significantly less than this number.

Avoidance, minimization and/or mitigation for secondary effects are noted within **Section 7**.

6.5.6.4. Potential for Traffic Interference With Commercial Fishing Industry

Conflict with commercial fishing vessels is not anticipated, particularly considering the professional skills/experience of both the fishing vessel crews and the merchant mariners operating the large freighters and tugs. This is confirmed by long (literally centuries of) experience with the operation of both merchant ships and commercial fishing vessels in the Harbor.

South Terminal itself serves as a temporary berth for commercial fishing vessels for off-loading of catches at fish processing facilities. Long-term berthing for vessels is generally not permitted. Cargo vessels transiting to the South Terminal CDF location will not disrupt

operations at the fish processing facilities, as the cargo vessels will transit sufficiently far from the bulkhead to allow unloading operations at the facilities to proceed unhindered. Interference with arrivals and departures at the fish processing facilities due to the additional vessel traffic will also be relatively minor, as unloading at the facilities typically takes up to an hour or more and transiting vessels will likely only pass through the channel in front of the existing South Terminal bulkhead for 10-15 minutes or so. Once the vessels have passed the fish processing facilities, no further interference is anticipated during berthing operations of the cargo vessels.

A similar sharing of the water sheet currently exists in the area north of the Route 6 Bridge at Bridge Terminal on Fish Island and at Maritime Terminal and North Terminal. North Terminal currently harbors existing fish processing facilities, and also allows berthing of fishing vessels. Maritime Terminal and Bridge Terminal load and unload cargo vessels. The mixture of commercial fishing vessels and cargo vessels has not proved burdensome to existing commercial fishing traffic in this location; similarly, it is not anticipated to be burdensome at South Terminal.

Should unexpected conflicts arise regarding vessel traffic at either the Hurricane Barrier or at South Terminal, it may prove necessary to implement various traffic management practices to ensure that vessels can continue to operate safely, efficiently, and with minimal impact on the environment. Although not currently anticipated, if required, these considerations will be included in the design and in evaluation of the proposed future operation of the South Terminal CDF.

6.5.7. Environmental Justice, Truck Traffic, Noise, and Air Impacts

6.5.7.1. Environmental Justice

U.S. Executive Order 12898 (Federal Actions to Address Environmental Justice (EJ) in Minority Populations and Low-Income Populations) directs federal agencies to assess proposed actions or alternatives for disproportionately high and adverse human health or environmental impacts on minority and low-income populations. Identification of health and environmental issues is accomplished through public involvement and the scoping process. Environmental justice has been an important consideration in the NEPA process since the issuance of Executive Order 12898 in 1994, which required all federal agencies, including the U.S. EPA, to identify and address "disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority populations and low-income populations in the United States."

The Commonwealth also has a formal Environmental Justice Policy, promulgated by the Executive Office of Environmental Affairs (Environmental Justice Policy of the Executive Office of Environmental Affairs, October 2002 or the Policy). The Commonwealth's policy identifies Environmental Justice populations as "those segments of the population that EOEA has determined to be most at risk of being unaware of, or unable to participate in, environmental decision-making or to gain access to state environmental resources". In order to facilitate inclusion of these communities into the public decision-making process, the Policy requires consideration of the following outreach efforts:

1). Scheduling public meetings or hearings at locations and times convenient for neighborhood stakeholders;

2). Translating public notices into other languages;

3). Offering interpreters and translated documents at public meetings;

4). Providing notices as early as possible to all neighborhoods potentially impacted by a decision; and

5). Assisting Environmental Justice populations with grant applications and questions about environmental regulations to assist them with compliance and sustainability.

As a Draft Decision has not yet been issued by US EPA, the Commonwealth has not yet conducted community outreach under its Environmental Justice Policy. It is currently anticipated that the Commonwealth will implement these outreach efforts during the Public Notification phase of the project, after a Draft Decision has been issued by US EPA. At that time, the Commonwealth will initiate a dialogue with effected Environmental Justice Communities, and make an effort to address any concerns that arise.

To determine the potential impacts on EJ populations, the U.S. EPA provides guidelines for conducting an analysis of the area, and including the following steps:

- Encourage meaningful community representation in the permitting process through the use of effective public participation strategies and special efforts to reach out to communities of color and low income populations;
- Identify the area impacted by the proposed facility or activity and assessing whether there is the potential for a disproportionately high and adverse human health or environmental effect on low-income or minority populations from the Proposed Action;
- If a disproportionate impact is found, considering alternatives that have a less disproportionate effect on low-income and minority populations; and
- Identifying mitigation measures that address and needs of affected low-income and minority populations.

6.5.7.2. Determination of the Environmental Justice Areas

STUDY AREA

The community of concern (CoC) or study area for EJ includes ten U.S. Census block groups along or adjacent to the truck route for vehicles that would service the proposed South Terminal in New Bedford (see **Appendix 70**, Block Groups along the Proposed Truck Access Route). The proposed truck access and egress route is expected to be along Route 18, which extends approximately 2.6 miles from Interstate 195 on the north side to Gifford Street on the south side. Route 18 runs approximately through the middle of these block groups. Most of the land use on the east side of the route is industrial, supporting the waterfront businesses as well as the city. Most of the land use on the west side of the route is residential with some commercial uses.

MINORITY COMMUNITY OR POPULATION

EPA's Office of Environmental Justice has defined the term "minority" to include Hispanics, Asian-Americans and Pacific Islander, African-Americans, and American Indians and Alaskan Natives. If an area is found to be at or above 50 percent minority, then it is flagged as an EJ area.

LOW INCOME COMMUNITY OR POPULATION

Although the U.S. Census Bureau does not provide a specific definition for "low income," it is used interchangeably with "poverty." The Census determines poverty by comparing the total income of each family against it corresponding threshold.

The 2000 Census data will be used to determine whether an area along the truck route meets the low-income and/or minority criteria. The U.S. Census Bureau tracts located wholly or partially within or along the truck access route (Route 18) will be analyzed.

Statistical Reference Area

As part of this analysis, a statistical reference area was chosen to compare the results of the CoC area, described above. Data was derived from the U.S. Census 2000 for the New Bedford Urbanized Area, Central Place statistical area.

Results and Analysis

Minority and low income data for the statistical reference area and the CoC areas are shown in Table 1. Two block groups (tract 6519 BG 2 and Tract 6526 BG 1) were determined to be EJ areas since their minority percentages were greater than 50 percent (in bold). All but one block group had low-income percentages at or above 25 percent (in bold).

Table 1. Demographics of Truck Route Access Areas

U.S. Census Location		Total Population	Minority Population	% Minority	Low-Income Population	% Low-Income
Census Tract 6511	Block Group 1	960	394	41.0	457	**48.2**
Census Tract 6512	Block Group 2	877	307	35.0	360	**41.1**
Census Tract 6513	Block Group 1	1,178	273	23.2	328	**27.8**
Census Tract 6513	Block Group 2	1,065	386	36.2	290	**27.6**
Census Tract 6518	Block Group 1	1,091	255	23.4	384	**35.6**
Census Tract 6518	Block Group 4	757	300	39.6	291	**40.3**
Census Tract 6519	Block Group 1	802	373	46.5	179	24.2
Census Tract 6519	Block Group 2	1,063	822	**77.3**	397	**37.8**
Census Tract 6526	Block Group 1	513	309	**60.2**	198	**38.6**
Census Tract 6526	Block Group 2	1,042	427	41.0	473	**45.4**
Census Tract Average		9,358	385	42.4	336	36.6
New Bedford	Urbanized Area, City (part)	93,465	19,622	21.0	18,468	20.2

Source: U.S. Census 2000, SF-3 data, Tables P7 and P87.

The average percent of minorities and low-income populations for the ten block groups are 42.4% and 36.6%, respectively. These percentages are significantly higher than those of the New Bedford Urbanized Area, Central Plan geographic area. In fact, all the census tract block groups for minority and poverty populations are significantly higher than the statistical reference area. Therefore, all of the block groups along the proposed truck access route are considered as EJ areas.

SUMMARY OF EJ CRITERIA

The EJ CoC Area contains neighborhoods with highly diverse populations in terms of minority and income characteristics.

Minority EJ populations greater than 50 percent exist in two block groups within the CoC. Low income populations at or above 25% exist in the entire within the CoC area except for one block group.

All of the block groups have higher percentages of minority and low income populations greater than the New Bedford Urbanized Area, Central Place statistical area.

6.5.7.3. Existing and proposed vehicle Traffic

The project proposes to construct the South Terminal within a Designated Port area along the New Bedford industrial waterfront (see **Appendix 70**). Vehicular access to the proposed terminal will be along Route 18. The route runs approximately 2.6 miles from I-195 on the north side to one of the main roads, Potomska Street, that lead to the terminal on the south side.

This route currently serves hundreds of businesses within the industrial port on the east side as well as hundreds of residences and some commercial operations on the west side. See **Appendix 70** for the primary land uses along this route.

EXISTING VEHICULAR TRAFFIC ALONG ROUTE 18

Available traffic data from MassDOT was collected for this route. Annual average daily traffic (AADT) ranged between 48,600 and 23,700 with the high volumes being in the north and the lowest numbers being in the south. The average of all the AADT traffic counts is 33,330.

Existing truck traffic along Route 18 has been estimated to generate approximately 1,370 trips, which represents 4.0 percent of the average AADT for the traffic route based on MassDOT data for 2007.

PROPOSED VEHICULAR TRAFFIC ALONG ROUTE 18

The proposed South Terminal project at the southern end of Route 18 will generate different amounts of traffic during the three main stages of its construction and use:

1. Construction of the South Terminal (9 months),
2. Use of the Terminal as a staging area for wind turbines (second year), and
3. Use of the Terminal for port shipping operations (third year and beyond).

Each of these uses will generate a different level of truck activity along Route 18 as shown in the following table:

Table 2. Vehicle and Truck Trips Along Route 18

	AADT(1)	Cumulative	% Increase	Trucks	Cumulative	% Increase
Existing	34,240 (2)			1,370 (3)		
Stage 1	168	34,408	0.5	168	1,538	12.3
Stage 2	0	34,240	0.0	0	1,370	0.0
Stage 3	42	34,282	0.1	42	1,412	3.1

1. AADT: Average Annual Daily Traffic
2. Source: MassDOT, Average of Route 18 AADT, 2004 – 2005.
3. Source: MassDOT, Truck Peak Hour and Average Day History, 2007.

Truck traffic will generate only a half percent increase over existing traffic and increase 12.3 percent over existing truck traffic during Stage 1, the construction of the South Terminal. When the terminal is used for wind turbine lay down area during Stage 2, there will not be any additional vehicular traffic over the current amounts. During Stage 3, there will be a 0.1 percent increase in AADT counts or 3.1 percent increase over existing truck counts.

6.5.7.4. Environmental Justice Effects

6.5.7.4.1. Direct and Indirect Effects

PROPOSED ACTION AND COMMUNITY RESPONSE

As discussed above, the CoC impact area is considered to have Environmental Justice (EJ) areas because significant portions of its population are made up of minorities and low income people.

The proposed South Terminal expansion is a compatible land use with the surrounding community and similar to existing industrial port uses that are located along New Bedford's waterfront. The South Terminal expansion has been proposed for some type of waterfront industrial use as part of the development of the New Bedford Fairhaven Municipal Harbor Plan, which was approved by the State and City in June 2010. During the review and approval process, there were a considerable number of community meetings that identified this project as well as other port development projects. Fort Point Associates, Inc (FPA) led the consultant team and was responsible for overall project planning and public participation. According to FPA, there were no concerns or objections raised about this project during the public review process. The following is a summary of the public process associated with the preparation of the harbor plan:

The Harbor Plan Renewal Committee had thirteen (13) members - seven from New Bedford and six from Fairhaven. Six New Bedford members were named by the Mayor and the seventh by the President of the City Council. The Fairhaven Town Selectmen named the six

Fairhaven members. The Committee met approximately monthly over the period of Plan development, commencing in February 2008 until August 2008 and then during review and approval of the draft plan in the spring of 2009. All Committee meetings were open to the public. The Committee reviewed the consultants' analyses and findings and provided overall policy direction and guidance in shaping the Harbor Plan.

Four public workshops and two general public meetings were held. The workshops focused on the commercial fishing industry, dredging, recreational boating, and tourism/public access/environmental issues. A general public meeting was held near the beginning of the process to inform the public about the goals and objectives of the renewal, to obtain preliminary input and an update on the planning process, and to offer an opportunity for the public to contribute to shaping overall project direction. A second public meeting was in May 2009 to review the draft plan with interested individuals and organizations. Notices were placed on the Harbor Development Commission website and in the local newspaper, emails sent out and flyers posted to advertise workshops and public meetings. Over 45 individual interviews were held with key waterfront harbor stakeholders who offered a broad range of perspectives on harbor issues and activities.

Furthermore, the project will bring in significant benefits to the surround community, including enhancing the local economy and bringing increased employment opportunities and tax revenues to the area.

As a result of the proposed South Terminal project, there will be a slight increase in truck traffic over existing traffic due to the trucking needs during its construction and operation after it is constructed.

6.5.7.4.2. Analysis of the Potential for Disproportionate Effects

Stage 1 Construction Impacts – Traffic, Air, and Noise

During the construction (Stage 1) of the project, all the EJ communities along Route 18, which include the project site, may experience a temporary increase in traffic, air, and noise impacts from construction vehicles because of their location and proximity. The average annual daily traffic (AADT) during this nine-month construction period will increase less than one half percent over existing traffic. Noise levels, in general, do not increase proportionally with increases in traffic due to the existing noise levels and any increases are expected to be minimal. Air quality impacts are expected to be minor since the construction truck use of Route 18 will be spread over the course of the day and will not be concentrated at any one time or place. Furthermore, the Project will develop a Construction Management Plan (CMP) to minimize construction-related transportation impacts. The CMP will include measures to control time of route use, methods to control fugitive dust, wash down controls, measures to reduce potential emissions, and related best management practices to reduce traffic and construction impacts. Therefore, no disproportionately high and adverse health or environmental effects due to traffic, air, or noise impacts are expected within the EJ communities along Route 18.

Stage 2 Impacts – Traffic, Air, and Noise

During the use of the project area for wind turbine assembly, which will be approximately one year, no additional trucks are expected since the wind turbine components

will be brought to and taken from the site by ocean going vessels. No traffic, air, or noise impacts are expected within the EJ communities along Route 18. Therefore, the use of the terminal during this stage does not create disproportionately high and adverse human health effects on EJ populations.

Stage 3 Impacts – Traffic, Air, and Noise

During Stage 3, the project site is expected to be used for break bulk operations and generate relatively small amount of truck traffic. Due to the relatively minor amount of traffic (approximately 0.1 percent increase) over existing traffic, traffic, air, and noise impacts are expected to be minimal. Therefore, no disproportionately high and adverse health or environmental effects due to traffic, air, or noise impacts are expected within the EJ communities along Route 18.

6.5.7.4.3. Cumulative Impacts – Traffic, Air, and Noise

The primary sources of air quality and noise impacts to the EJ communities to the west of Route 18 arise directly or indirectly from port activities, including vessel activities, seafood processing and cargo activities. Over the past several decades there have been significant year to year variations in the number of fishing vessels in the harbor, the pounds of seafood landed and processed and the tons of freight handled at local port facilities. These year to year variations are part of the normal functioning of the port and relate to economic conditions and natural resource cycles.

Fishing vessels as a source of noise and air quality impacts from idling engines has diminished in recent years with increased restrictions on the number of days at sea allowed for

each vessel and by retirement of older fishing vessels in the fleet. The City of New Bedford is working to provide shoreside power at City owned fishing vessel docks to further minimize the need to run engines and generators while at the dock. Further, fishing vessels are located generally 1500 feet or more from EJ communities and thus would have little to no impact.

Truck traffic volume, and related noise and air quality impacts, derives directly from the volume of products shipped in and out of the port. While these volumes vary over time, the number of trucks involved in supporting existing conditions in New Bedford Harbor is so much greater than those from the proposed project that the change in impacts would be minimal. In the context of the Route 18 reconstruction project now under design, the levels of service (LOS) along Route 18 are at or above LOS D, suggesting that air quality impacts from idling vehicles will be minimal. In fact, the project will include signal timing to improve traffic flow, while making the highway more pedestrian friendly. Cumulative impacts from noise are similarly expected to be minimal as the overall increase in traffic in the long term is expected to be a 0.1 percent increase in average daily vehicular traffic or a 3.1 percent increase over average daily truck traffic. Using the inverse square law of calculating sound levels, such a small increase in noise generation would not produce a noticeable change in overall levels of sound as measured in dBA. For example, a doubling of traffic would result in only a 3 dBA increase in noise levels.

Given that the impacts of proposed project alone are insignificant, the cumulative impacts of continued port operations and the proposed project are expected to be insignificant as well.

6.5.7.5. Mitigation Measures

The proposed South Terminal project, which is still going through its approval process, will have additional public input. This input will inform the residents of the adjacent EJ communities with descriptive information on flyers and notices in the appropriate language (Portuguese, Spanish, etc.). One or more community meetings will be held in the affected neighborhoods.

During this process, traffic concerns identified by the public will be addressed. For example, the state is currently improving intersections along Route 18 near the State Pier to allow better access to the industrial waterfront. Community concerns about other intersections may improve their use and reduce impacts.

A construction management plan will be required as part of the development. As explained above, this will ensure that the measures are implemented to reduce traffic and air quality impacts as a result of the project.

6.6. Similar Habitats Within New Bedford Harbor

The habitat provided by the project site as it now exists is not unique within New Bedford Harbor. The subtidal and intertidal areas found the project area consist of subtidal areas, which provide habitat and spawning grounds for both finfish and shellfish, intertidal areas including beach and salt marsh which provide habitat for shellfish and habitat and spawning ground for finfish as well as species upon which finfish depend and habitat and nesting areas for avian

wildlife. These habitats and habitat functions are duplicated in several other areas within the harbor including: the shallow-water areas, intertidal areas, and salt marshes at Marsh Island, the marsh west of Cherry Street in Fairhaven, the beach west of South Street in Fairhaven, the Beaches west of Fort Street in Fairhaven, the beaches at Fort Phoenix in Fairhaven, the beaches at Fort Taber in New Bedford, the shallow water habitat, beaches and salt marshes of Palmer's Island, and the shallow-water habitat, marshes and intertidal area of Crow Island.

The intertidal area of the project site consists of coastal beach (1.43 acres) and an area of salt marsh (approximately 0.18 acres). The shellfish survey performed at the site revealed that these areas provide habitat for Quahogs, Oysters, Soft-Shelled Clams, Periwinkles, and Hermit Crabs, as well as some species of polycheates. The intertidal areas also provide foraging habitat for shore birds, and spawning habitat for horseshoe crabs. The salt marsh provides foraging habitat for both juvenile fishes, and predators which prey on them. A comprehensive listing of the species of birds which are found in the area is included earlier within this document and includes likely avian predators which would use this area for foraging. Likewise the finfish species expected to utilize the intertidal areas of the project site are included in the Essential Fish Habitat Assessment section.

The subtidal portion of the project site consists of a shallow sandy bottom with portions of greater and lesser amounts of pebble to cobble sized stones, and sparse intermittent areas of vegetation. Depths in this area range from Mean Lower Low Water (MLLW) to 6 feet below MLLW, before dropping off steeply to the navigational channel at the existing terminal bullkhead. In addition to the habitat provided for the shellfish found in the shellfish survey, the

subtidal portion of the project site provides foraging and spawning habitat for juvenile and adult finfishes respectively. The total area of shallow (less than 16 feet below MLLW) subtidal area anticipated to be lost by the construction of the terminal and associated dredging is equal to 3.68 acres.

Although the resources described above provide the habitat and values discussed; they are not unique to this one location within the harbor. There are many locations within which shallow subtidal areas and intertidal areas both within New Bedford Harbor and outside of New Bedford Harbor also provide these same habitats and functions and values. The following sections describe large areas within the Hurricane Gates of New Bedford Harbor where similar habitats exist. A figure showing areas with similar habitat within New Bedford Harbor is included as **Figure 8**.

Marsh Island

Marsh Island is located north of Route 6 and south of Coggshall Street, on the shore of Fairhaven. The Island is a peninsula of land extending out into the harbor, and is currently utilized as the site of a pair of radio towers. Along this portion of the harbor are some 2700 linear feet of intertidal habitat ranging from rocky to sandy to muddy shoreline. Directly adjacent to these areas are shallow subtidal areas ranging in depths between 1 foot and 20 feet below MLLW. The shallow water habitat here extends from Marsh Island to the northern shore of Popes Island and to the east to Fairhaven. Within these boundaries exists approximately 126 acres of subtidal area. The substrate in this area varies broadly between medium sand to fine organic silts and provides habitat for shellfish, foraging area for juvenile fishes and spawning

area for adult fin fish species. Although a portion of this area is to be used for the construction of CAD cells for the disposition of sediment generated during navigational dredging projects, the anticipated final grades of the constructed cells will remain within the shallow subtidal range (less than 16 feet). On the north shore there is approximately one acre of salt marsh and mudflat providing habitat to shorebirds and for shellfish, as well as foraging area and nursery habitat for juvenile fin fish species. The southern intertidal beaches are predominantly sandy, containing varying amounts of pebble to cobble to boulder sized stones, and provide sheltered breeding habitat for horseshoe crabs.

Marsh East of Cherry Street in Fairhaven

Contiguous with the subtidal area south of Marsh Island is an undeveloped intertidal area west of Cherry Street in Fairhaven. The site is approximately one and a half acres, and appears to contain approximately three tenths of an acre of intertidal saltmarsh. The intertidal beach which lies between the marsh and the harbor extends for 500 feet between developed residential properties. The Marsh is accessed by the same 135 acres of shallow subtidal habitat which lies to the south of Marsh Island. As is typical for salt marshes in this area, the marsh east of Cheery Street provides foraging habitat for shore birds, and nursery and foraging habitat for juvenile fin fish. The west intertidal beach is fine grained, containing varying amounts of pebble to cobble to boulder sized stones, and provides breeding habitat for horseshoe crabs, as well as foraging habitat for shore birds, and habitat for shellfish

Beach East of South Street

South of the Nantucket and Martha's Vineyard Steamship Authority pier near to South Street in Fairhaven is a beach which extends south from the pier around a residential seawall to Church Street. The area provides approximately 300 feet of mostly contiguous intertidal sandy beach, connected to approximately 23 acres of shallow subtidal habitat. The intertidal beach is sandy, containing varying amounts of pebble to cobble to boulder sized stones, and provides breeding habitat for horseshoe crabs, as well as foraging habitat for shore birds, and habitat for shellfish. Directly adjacent to these areas are shallow subtidal areas ranging in depths between 1 foot and 20 feet below MLLW. The substrate in the subtidal area varies broadly between medium sand to fine organic silts and provides habitat for shellfish, foraging area for juvenile fishes and spawning area for adult fin fish species.

Beach West of Fort Street

South of the Fairhaven Ship Yard pier near Cottage Street in Fairhaven is a beach which extends south from the pier to the hurricane barrier. The area provides approximately 1550 linear feet of contiguous intertidal sandy beach, connected to approximately 16 acres of shallow subtidal habitat. The intertidal beach is sandy, containing varying amounts of pebble to cobble to boulder sized stones, and provides breeding habitat for horseshoe crabs, as well as foraging habitat for shore birds, and habitat for shellfish. Although the area upland of the beach is developed as residential properties, and portions are protected by sea walls and rip rap, the residential development is relatively low density in comparison to other portions in the harbor, and the shore protection structures are low in elevation and do not present formidable barriers to all of the species which would use this area as habitat. Directly adjacent to this intertidal zone is a shallow subtidal area ranging in depths between 1 foot and 20 feet below MLLW. The substrate in the

subtidal area varies broadly between medium sand to fine organic silts and provides habitat for shellfish, foraging area for juvenile fishes and spawning area for adult fin fish species.

Fort Phoenix Beaches

To the east of the hurricane barrier, in the outer harbor (outside of the hurricane barrier) is Fort Phoenix, and more than 3000 linear feet of contiguous undeveloped intertidal beach . The beach is predominantly sandy, containing varying amounts of pebble to cobble to boulder sized stones, and provides breeding habitat for horseshoe crabs, as well as foraging habitat for shore birds, and habitat for shellfish. Notably the sandy beach is interrupted by a section of naturally rocky shoreline at a bedrock outcrop. Directly adjacent to the intertidal zone is a shallow subtidal area ranging in depths between 1 foot and 20 feet below MLLW. The substrate in the subtidal area varies between rocky and sandy, and provides habitat for shellfish, foraging area for juvenile fishes and spawning area for adult fin fish species.

Fort Taber Beaches

To the south of the hurricane barrier, in the outer harbor is Fort Taber, and more than 1200 linear feet of contiguous undeveloped intertidal beach . The beach is predominantly sandy, containing varying amounts of pebble to cobble to boulder sized stones, and provides breeding habitat for horseshoe crabs, as well as foraging habitat for shore birds, and habitat for shellfish. Directly adjacent to the intertidal zone is a shallow subtidal area ranging in depths between 1 foot and 20 feet below MLLW. The substrate in the subtidal area varies between rocky and sandy, and provides habitat for shellfish, foraging area for juvenile fishes and spawning area for adult fin fish species.

Palmer's Island

Located less than 1000 feet east of the project site, Palmer Island's shoreline is most similar to the area affected by the proposed expansion of South Terminal. Along this portion of the harbor are some 3000 linear feet of intertidal habitat ranging from rocky to sandy to muddy shoreline providing breeding habitat for horseshoe crabs, as well as foraging habitat for shore birds, and habitat for shellfish. Directly adjacent to these areas are shallow subtidal areas ranging in depths between 1 foot and 20 feet below MLLW. The shallow water habitat here extends east, north and west to the federal and state navigation channels. Within these boundaries exists approximately 42 acres of subtidal area. The substrate in this area varies broadly between medium sand to fine organic silts and provides habitat for shellfish, foraging area for juvenile fishes and spawning area for adult fin fish species. The intertidal beaches are predominantly sandy, containing varying amounts of pebble to cobble to boulder sized stones, and are broken up by intermittent bedrock outcrops. The sand spit which connects Palmer Island to the hurricane barrier is submerged for portions of the tide limiting the pedestrian access to the island, sheltering breeding habitat for horseshoe crabs.

Crow Island

Crow Island's shoreline consists of approximately 1500 linear feet of intertidal sandy beach providing breeding habitat for horseshoe crabs, as well as foraging habitat for shore birds, and habitat for shellfish. Directly adjacent to these areas are shallow subtidal areas ranging in depths between 1 foot and 20 feet below MLLW. The shallow water habitat here extends west, south and east to the federal navigation channels, and to the north to Popes Island and Route 6.

Within these boundaries exists approximately 60 acres of subtidal area. The substrate in this area varies broadly between medium sand to fine organic silts and provides habitat for shellfish, foraging area for juvenile fishes and spawning area for adult fin fish species. The intertidal beaches are predominantly sandy, containing varying amounts of pebble to cobble to boulder sized stones. Although the Island is developed as a residential property, there is only a single home on the island and pedestrian traffic along the intertidal area is limited, providing protection to this area as habitat.

6.7. Summary of Existing Resource Area Assessment and Anticipated Direct and Secondary Impacts

The project as planned will result in the following *Direct Impacts* to existing resource areas as outlined below:

- **Areas of Proposed Filling:**
    - 1.43 acres of intertidal area,
    - 4.06 acres of shallow, near-shore sub-tidal area; and
    - 0.18 acres of salt marsh will be filled during the construction of the facility.

  These areas currently serve as:
    - Essential Fish Habitat for winter flounder, windowpane flounder, scup, and black sea bass,
    - Shellfish habitat,
    - Potential foraging habitat for avian wildlife; and
    - The intertidal area serves as horseshoe crab habitat.

- **Areas of Dredging (Existing Depth Between -1 and -6 MLLW):**
    - 3.68 acres of near-shore, subtidal area will be dredged to between -30 and -32 MLLW (Quayside Areas).
    - 4.43 acres of near-shore, subtidal area will be dredged to -14 MLLW (Quayside Areas).
    - 8.01 acres of near-shore, subtidal area will be dredged to between -6 and -7 MLLW (Gifford Street Channel Re-Alignment and Mooring Mitigation Areas).
    - 8.76 acres of near-shore, subtidal area will be dredged to -45 MLLW, filled and capped (CAD Cell).

  These areas currently serve as:

    - Essential Fish Habitat for winter flounder, windowpane flounder, scup, and black sea bass,
    - Shellfish habitat, and
    - Potential foraging habitat for avian wildlife.
- **Areas of Dredging (Existing Depth Between -5 and -14 MLLW):**
    - 4.03 acres of near-shore, subtidal area will be dredged to -14 MLLW (Tug Channel).

  These areas currently serve as:

    - Essential Fish Habitat for winter flounder, windowpane flounder, scup, and black sea bass,
    - Shellfish habitat, and
    - Potential foraging habitat for avian wildlife.
- **Areas of Dredging (Existing Depth between -20 and -30 MLLW):**

- 7.01 acres of subtidal area will be dredged to -30 MLLW (South Terminal Channel).
- 19.6 acres of subtidal area will be dredged to -30 MLLW (Maintenance Dredging of Federal Navigation Project).

These areas currently serve as:

- Essential Fish Habitat for winter flounder, windowpane flounder, scup, and black sea bass, and
- Shellfish habitat.

- **Shellfish Impacts**:
  - It is estimated that approximately 9,285,300 shellfish will be lost during construction of the facility and associated dredging.

The project as planned will also result in the following *Secondary Impacts* to existing resource areas as outlined in previous sections:

- Dredging and Other Construction Related Turbidity and Re-Suspension/Bioavailability Impacts;
- Stormwater Runoff;
- Lighting;
- Bilge and Ballast Water Management;
- Sloughing of Slopes;
- Boat Traffic Secondary Impacts; and
- Environmental Justice, Truck Traffic, Noise, and Air Impacts.

As noted above, these existing resources that will be impacted via construction and dredging are not unique to New Bedford Harbor; many areas within New Bedford Harbor, including some areas very nearby the proposed construction location (for example, Palmer's Island), provide similar functions and values that will remain in place.

The existing resources at the proposed construction site are impacted by existing PCB concentrations; thus, capping of these impacted resource areas will have an environmental benefit by removing the PCB impacted sediment from contact with the environment. The flood storage loss created by the completion of the South Terminal CDF would have a minimal overall impact on New Bedford harbor, as noted within the document entitled Hydrology of Floods, New Bedford Massachusetts, produced by the Hydrologic Engineering Section of the U.S. Army Corps of Engineers in September 1987, due to the enormous flux of harbor water that is able to flush in and out of New Bedford Harbor as it is adjacent to Buzzard's Bay.

As sections of New Bedford Harbor are designated as a Designated Port Area, the land in question has historically been utilized for industrial purposes. Much of the land consists of fill material that has been transported to this location. Use of the site for water-dependent industrial activity would be in compliance with Commonwealth of Massachusetts Waterways Regulations. Additionally, a CDF would create positive economic benefits to the area by facilitating new water-dependent industrial activity. Although CDF creation represents a change of portions of the shoreline of New Bedford Harbor, CDF creation has already been vetted through a public process within the New Bedford/Fairhaven Harbor Plan process during 2009.

7. AVOIDANCE, MINIMIZATION, AND MITIGATION OF PROJECT IMPACTS

7.1. Summary of Evaluation of Opportunities to Avoid or Minimize Impacts Through Project Design

The minimum criteria for construction of the South Terminal CDF are outlined within Section 4.0 of this document. The criteria outlined within that section illustrated that:

- South Terminal in New Bedford has been determined to be the only practicable location for siting of an offshore renewable energy support facility; and
- The only practicable design of South Terminal in New Bedford has been determined to be a filled structure, as a pile-supported structure has been determined to not be a practicable alternative.

Nevertheless, the proposed CDF was evaluated for opportunities to avoid or minimize environmental impact, wherever possible, by modifying the structural and decking design, and/or the overall configuration of the facility. While the marine terminal is intended to serve multiple purposes, one of the purposes is to support offshore wind facilities. Thus, the size and shape of the proposed South Terminal extension CDF takes into account the size and space requirements of the Offshore Wind Energy industry. The following is a list of basic guidelines that drive the configuration of the facility, based upon the current status and anticipated future direction of the off-shore wind industry. In **Section 3** above, we identified the essential size and space requirements as 1,200 linear feet of waterfront, and approximately 28 acres of total space. However, as shown in the next several paragraphs, this represents a significant reduction in the ideal size of a terminal of this nature.

Offshore wind developments involve the shipment, staging, and assembly of wind turbines. Wind turbines are broken down into several base component parts for shipment: Wind Blades, Nacelle, Tower Section, and Hub. Generally, each wind turbine has three wind blades, one nacelle, one hub, and at least three tower sections. One potential wind turbine type that meets the anticipated power and size requirements for the Offshore Wind Energy Industry in the New England area is Vestas V112-3.0MW (many different types of manufacturers produce wind turbines of this size and power structure; this brand is presented only for guidance purposes). The following is a summary of important information associated with the portions of this wind turbine:

Part	**Length**	**Width/Diameter**	**Number/Turbine**
Wind Blade	180 feet	13 feet	3
Nacelle	46 feet	13 feet	1
Hub	13 feet	11 feet	1
Tower Length	107 feet	14 feet	3

Based on discussions with representatives from the Offshore Wind Energy industry, for a large scale offshore wind project, it is currently anticipated that parts for approximately 130 wind turbines will need to be stored onsite at least temporarily in order to stage the project. The maximum amount of storage space required simply for raw storage of each part is calculated by taking the dimensions of the parts (length times width) times the number of parts required for each turbine, times one hundred thirty turbines. The raw value for the space required for storage of the total number of wind turbines is 1,593,150 square feet (36.57 acres), which does not

include space for foundation components, sea cables, frames utilized to hold semi-constructed towers erect, hubs, gear boxes, aviation equipment, power/converter units and transformer units. It is unlikely that delays in construction will require storage of 100% of the parts onsite at any one time; additionally, there are stacking procedures for wind blades and some other parts that allow more efficient storage of the materials; for both of these reasons, it is clear that there are opportunities to minimize impacts by using less than 36.57 acres for raw storage space.

In addition to raw storage space, the facility will need space for facility operations, which includes: space for turbine assembly, loading and unloading space for cranes, space for an operational building (for office space and for interior work space), and parking for the facility. Additionally, space will be required between the parts themselves in order to allow space for machinery (mobile cranes) to operate within the storage area, moving parts to organize and sort them, as well as space to load and unload the parts onto trucks, trains or marine vessels and to allow for space between the parts to prevent damage. This extra required space could demand up to an additional 12-16 acres.

Discussions with representatives from the Offshore Wind Energy industry have made it clear that an ideal facility would have as much storage space as possible (the above calculations make plain that even a 50 acre facility would be well utilized by the Offshore Wind Energy Industry; however, in an effort to minimize impacts, we were able to design a footprint of approximately 28.25 acres. This footprint is the minimum necessary and has been minimized to the maximum extent practicable to allow the project to move forward.

When outlining a plan for determining the exact configuration for the Proposed South Terminal Extension CDF, historic research was conducted in order to determine what the previous proposals have been for a CDF in this location. Early configurations of a South

Terminal Extension CDF were proposed during the 2002 New Bedford/Fairhaven Harbor Planning process. **Figure 9** is an excerpt from the final 2002 Harbor Plan that shows the configuration of a proposed CDF that extended far into New Bedford Harbor. This CDF would extend the South Terminal footprint to the south to the Hurricane Barrier, and would extend it over to Palmer's Island.

The 2002 proposed South Terminal CDF was anticipated to encompass 70 acres. This proposal would create an ideal location for the Offshore Wind Energy Industry; however, a number of existing businesses would need to be permanently relocated and existing facilities, including fish processing equipment of significant value, would need to be destroyed or relocated, which would result in a significant loss of economic activity and jobs for the City of New Bedford. If the footprint were revised to allow existing businesses within the footprint to remain, the footprint would encompass 50 acres, still large enough to create an ideal facility for the Offshore Wind Energy Industry; however, 31 acres of the 50 acre facility would be wetland resource areas that would need to be capped and permanently impacted from the construction of the facility.

The City of New Bedford has worked with representatives from the Offshore Wind Energy industry in order to determine the minimum space requirements necessary in order to operate an Offshore Wind Energy support facility to reduce the size of the proposed facility. It is anticipated that some wind turbine components can be stacked on-site, that not all of the 130 turbines will be onsite at any one time (although some buffer is needed to account for delays in construction), and some areas can be used for multiple functions (such as pre-assembly that could take place in the loading zone). As a result of these negotiations, it currently appears that the *minimum* facility size required for the Proposed South Terminal Extension CDF is 28.25

acres. A conceptual layout of a 28.25-acre facility at South Terminal was created showing the amount of land needed by an Offshore Alternative Energy Developer that would be creating between a 100 and 130 offshore turbine wind farm (see **Figure 2**). The layout presumes that components for the wind towers will be brought in to the Port for assembly and shipping to the wind farm site. The layout shows space for components (monopoles, nacelles, blades) to assemble between 8 and 10 wind towers at a time. If a wind project were to require 130 wind towers (for example), then approximately 14-17 cycles of component staging, assembly, and shipping would be employed. Over a projected 18 month construction cycle for the offshore erection component of such a project, each assembly cycle would be approximately 1 month in duration, a reasonable (though tight) timeframe for such activity.

Figure 3 shows the available parcels of land that could be utilized to construct the Proposed South Terminal Extension CDF, as well as a projection of the extension of the bulkhead to the south from the existing South Terminal. Although multiple configurations to reach the 28.25 acre minimum area were attempted, it quickly became clear that it was not possible to create the facility without the bulkhead extending into New Bedford Harbor. In fact, multiple configurations have been considered that were significantly larger than what is currently presented. The current configuration was chosen in order to avoid dredging close to shore, which would increase the impact anticipated on intertidal and salt marsh areas. The current configuration will preserve much of the salt marsh located immediately to the south of the facility, which would have been destroyed (as a result of dredging) if berthing had been planned on the southern face of the facility.

It is currently anticipated that having the bulkhead extension parallel to the existing South Terminal bulkhead will help vessels dock more easily. The length of the bulkhead (1200 linear

feet) was chosen to keep the length of impacted coastline to a minimum. If the bulkhead were moved closer to shore or angled, it would need to extend further to the south to maintain the minimum 28.25 acre facility size.

The construction basis of the proposed South Terminal extension CDF as a filled terminal was explained in greater detail within Section 3.0 and 4.0 of this document. As stated earlier, due to the extremely heavy loadings required at the facility, a pile-supported structure would have roughly an equivalent level of impact to the environment due to the high frequency spacing of pilings necessary, and the large quantities of fill and concrete necessary to support the loadings. An evaluation of the potential for minimization of fill has resulted the following changes to the bulkhead alignment:

- The bulkhead itself was offset by approximately 7.25 feet to account for a fendering system to protect the bulkhead from vessel impacts; and
- The large cranes were pushed back from the edge of the bulkhead approximately 6.5 feet to allow for a utility trench to service berthed vessels, and also to reduce the loading at the edge of the bulkhead, which then would allow a pile-supported apron at the edge of the bulkhead.

These two changes have resulted in a net reduction of approximately 0.67 acres of fill (which reduced the amount of sub-tidal fill from 4.73 acres, before the evaluation, to 4.06 acres, after the evaluation). After further analysis, the Commonwealth has concluded that this is the maximum practicable reduction in fill that can be achieved while still meeting the Project Purpose.

A process of consultation with representatives of the offshore renewable energy industry, the shipping industry, the Northeast Marine Pilots, and local tug operators has resulted in a

facility dredge footprint that the Commonwealth has determined is the minimum practicable in order to support the industries that are intended to operate at the South Terminal CDF (more information on the process used to determine the minimum practicable facility dredge footprint is included within Section 4.0 of this document). The dredge area has been reduced to the minimum practicable in order to support the vessels at the facility.

The area must be at least as wide as two vessels (each 100 feet wide), in order to allow vessels to pass one another when berthed at the facility. To accommodate the entrance and exit of vessels a 60 foot buffer between passing vessels is needed to prevent vessels from striking each other and also to prevent overhanging wind blades from striking adjacent vessels (this is consistent with the 60 feet requested in writing by Siemens as the space between vessels when berthed at the facility).

In order to allow vessels to exit and enter the facility, a tug boat (aligned perpendicular to the vessel at its approximate middle) will be needed to pull or push the vessels from or to their berth, and then keep the vessels aligned within the channel, as they are pulled out of the harbor. Once the vessels are aligned with its exit corridor, the tug boat would stick out to the east from the vessel approximately 100 feet. The tug boat would therefore stick out into shallow waters as the vessel was entering or pulling away from the facility, and while it was travelling along the channel. To remedy this, a 100 foot wide corridor on the eastern side of the dredge area is shown.

A turning basin must be positioned to allow for both access directly from the federal channel, and for access to a corridor that leads directly from the turning basin to the boat basin for the facility; without this turning basin, the vessels would have to re-align themselves multiple times within the Harbor, increasing the chance that the vessels would run aground accidentally.

Finally, the entry channel must be wide enough to allow for some drifting of the vessel as it maneuvers into and out of the port. The drifting in question could be from tidal currents, wind forces, or errors in navigation; however, without the extra width, the potential for grounding of the vessel is high. Therefore, the channel is 175 feet wide (plus the 100 foot wide tug channel), which is the minimum width that is acceptable to allow for some.

After further analysis, the Commonwealth has concluded that this is the maximum practicable reduction in dredging that can be achieved while still meeting the Project Purpose.

7.2. Conceptual Mitigation Plan - Proposed Compensatory Mitigation for Unavoidable Direct Impacts

Unavoidable direct impacts are both permanent and temporary. Permanent impacts involve filling of existing resource areas and dredging of resource areas in such a manner as the functions and values of that area are permanently lost. Temporary impacts involve maintenance dredging of areas and/or minor changes in elevation from dredging of resource areas, such that the functions and values of that area are not permanently lost, or are anticipated recover relatively quickly. Mitigation is proposed for both temporary and permanent direct impacts.

Permanent Impacts

Permanent direct impacts to existing resource areas are as follows:

- Filling of 1.43 acres of intertidal area,
- Filling of 4.06 acres of shallow, near-shore sub-tidal area;
- Filling of 0.18 acres of salt marsh,

- Dredging of 3.68 acres of near-shore, subtidal area from -1 to -6 MLLW to between -30 and -32 MLLW (Quayside Areas).
- 4.43 acres of near-shore, subtidal area will be dredged to -14 MLLW (Quayside Areas).
- Dredging of 4.03 acres of near-shore, subtidal area from -5 to -14 MLLW -14 MLLW (Tug Channel).
- Dredging of 8.76 acres of near-shore, subtidal area from -4 to -6 MLLW to -45 MLLW, but which will be subsequently filled and capped (CAD Cell).
- Destruction of approximately 9,285,300 shellfish.

Temporary Impacts

Temporary direct impacts to existing resource areas are as follows:

- Dredging of 8.01 acres of near-shore, subtidal area from -4 to -6 MLLW to between -6 and -7 MLLW (Gifford Street Channel Re-Alignment and Mooring Mitigation Areas).
- Dredging of 7.01 acres of subtidal area from -20 to -25 MLLW to -30 MLLW (South Terminal Channel).
- Dredging of 19.6 acres of subtidal area from -26 to -30 MLLW to -30 MLLW (Maintenance Dredging of Federal Navigation Project).

In order to compensate for both Permanent and Temporary direct impacts to resource areas due to construction of the Proposed South Terminal Extension CDF, a number of potential mitigation options have been evaluated. The results of this evaluation were that the following mitigation package is proposed (see **Figure 10** for locations):

- Creation of 17.73 acres of Winter Flounder spawning habitat (see **Figures 11 and 12**), via the placement of dredged navigational dredging parent material or CAD Cell parent material into a deep area, in order to create a shallow area more suitable for Winter Flounder spawning, at a location outside of the New Bedford Hurricane Barrier. While the primary purpose of this action is to create Winter Flounder spawning habitat, this action will also enhance spawning and foraging areas for scup, black sea bass and windowpane flounder, also create shallow areas that will enhance foraging viability of the area for avian wildlife, including the Common Tern and the Roseate Tern and will also sequester PCBs in sediment. PCBs currently existing in sediment within the Winter Flounder mitigation area are below EPA superfund cleanup levels for both the upper and lower harbor.
- Creation/Enhancement of 3.47 acres of inter-tidal area and enhancement of 10.91 acres of near-shore, shallow, sub-tidal areas located in the outer harbor, immediately southwest of the Hurricane Barrier, where a PCB-contaminated area has been partially (approximately 20 acres) capped (OU-3 pilot cap) (see **Figures 12 and 13**), to enhance spawning and foraging areas for winter flounder, scup, black sea bass and windowpane flounder, and enhance foraging area for avian wildlife identified within the resource delineation, including the Common Tern and the Roseate Tern, enhancement of shellfish habitat, and enhancement of horseshoe crab habitat. PCBs currently existing in sediment within this area to be capped are below EPA superfund cleanup levels for both the upper and lower harbor.

- Creation/Enhancement of up to approximately 1.9 acres of a combination of successional marsh areas (mudflat, low marsh, high marsh, and transitional area) to enhance spawning and foraging areas for winter flounder, scup, black sea bass and windowpane flounder, and enhance foraging area for avian wildlife, enhancement of shellfish habitat, and enhancement of horseshoe crab habitat (see **Figures 14, 15, and 16**).
- Completion of a Tern Monitoring program to provide additional information on the utilization of New Bedford Harbor by terns.
- Relaying of shellfish from Fish Closure Area 1 to other locations within Fish Closure Area 1 and/or relaying of shellfish from Fish Closure Areas 2 or 3 to a location south of the City of New Bedford (but within City of New Bedford waters), under MassDMF permit, and/or seeding to compensate for shellfish lost during filling, capping and/or dredging operations. (Please note that relaying of shellfish from Fish Closure Area 1 to any other area is restricted – See letter from US EPA attached to **Appendix 52**.)
- Dredge and disposal of approximately 240,000 cubic yards of sediment impacted with PCB concentrations of up to approximately 20 mg/kg into Confined Aquatic Disposal Cells in New Bedford Harbor.

7.2.1. Winter Flounder Spawning Habitat Creation

Three locations located outside of the New Bedford Hurricane Barrier, adjacent to the Federal Channel, were proposed by USEPA as potential pilot Winter Flounder spawning mitigation locations, this proposal was based on the assumption that the locations met specific criteria associated with depth, PCB concentration in sediment, and strength of current. The three areas were screened for suitability for Winter Flounder spawning habitat creation via collection of

bathymetric data, PCB concentration in sediment, and current data (for the location of data points, and a presentation of data collected in the three screening areas, please see **Appendix 71**).

Literature indicates the winter flounder spawn at a water depth of approximately -16.4 feet MLLW and shallower, and that currents less than 0.6 knots will prevent Winter Flounder eggs from being swept out to sea. Based upon the results of the screening investigation, it was determined that the chosen location had existing bathymetry that is deeper than what is conventionally considered Winter Flounder spawning habitat, and had currents below 0.6 knots.

Samples of sediment collected from the proposed area Winter Flounder mitigation area were collected and analyzed for the presence of PCBs. The results of the testing indicated PCB concentrations in sediment between 1.3 mg/kg and 8.2 mg/kg within the proposed mitigation area, indicating PCB concentrations, although generally below EPA Superfund cleanup levels for the upper and lower Harbor, could have impacts such that capping the areas would result an environmental benefit by isolating the contaminants from the environment. (Please note that PCB concentrations in sediment are calculated by summing the 18 NOAA Congeners and multiplying by a factor of 2.0, which is a non-location specific factor used by NOAA to calculate total PCBs since 1988. Please see Appendix 1 for additional information).

Based upon the results of the suitability analysis, it was determined that an area located immediately north of the Butler Flat's Lighthouse would be suitable for a pilot test, intended to create Winter Flounder spawning habitat. The area targeted for mitigation is at least approximately 17.73 acres in area, and is located outside of the New Bedford Hurricane Barrier.

The area is approximately 1 mile south of the proposed facility in an area with a water depth of between approximately -22 feet MLLW to -18 feet MLLW. The proposed mitigation would change the elevation of the targeted area to a depth of approximately -16 MLLW or deeper, in order to create conditions suitable for Winter Flounder spawning. A figure showing the proposed mitigation area, as well as a conceptual cross-section are included as **Figures 11 and 12**.

The mitigation would have a dual purpose. The work will not only create an area that is within the elevation range for preferred Winter Flounder spawning, the work will also cap PCB contaminated sediment, and enhance the area as habitat for fish and shellfish. The mitigation will be achieved via placement of dredged parent material within the target area. The parent material will be generated from either the construction of the South Terminal Expansion (i.e. parent material from the dredge footprint of the proposed facility) or from the construction of a CAD Cell, or both. The target final elevation after fill placement will be a depth of approximately -16 feet MLLW or deeper.

The mitigation is anticipated to also have a beneficial impact upon terns, including the Common and Roseate Tern. Common Terns feed mainly on a wide variety of small fish and crustaceans; however, their primary prey in most Atlantic coast breeding areas is the American sand lance. Similarly, the Roseate Tern feeds almost exclusively on small fish (see **Appendix 65**). Both the Roseate Tern and the Common Tern forage by plunge-diving (diving from heights of between 1-12 meters and oven submerging to greater than 50 centimeters. Creating shallower water in the area of this mitigation project will make the area more attractive for the type of game fish that

both the Roseate Tern and Common Tern hunt, as many types of fish seek shallower water to escape predators. Therefore, it is likely that this mitigation project will benefit the tern population by creating a more productive foraging area.

About 70% of the Common and Roseate Tern's diet consists of Sand Lance (see **Appendix 66**). Sand Lance occur throughout the water column over sandy substrates into which they burrow. The sand lance burrows for rest and escape from predators; hence much time may be spent within the substrate, isolated from the water column. Due to this specific defense behavior, the sand lance is particularly vulnerable to become contaminated by adjacent contaminated sediment, such as the high levels of PCBs within the contaminated sediment of New Bedford Harbor. It is likely the Common Tern and Roseate Tern's preference for American sand lance is the source of high levels of PCBs found in chicks found dead at Bird Island in 1970, and increased levels of PCBs within existing Roseate and Common Tern colonies. Historical bird observations presented within **Section 6** indicate that Common and Roseate Terns have been observed outside of the Hurricane Barrier, but not in the areas north of the Hurricane Barrier. PCB concentrations outside of the Hurricane Barrier have been shown via EPA sampling to typically be less than 1 ppm, except for a few isolated areas. The proposed mitigation areas contain concentrations of PCBs above 1 ppm (in one location the concentrations are higher than 8 ppm). Capping of PCB contaminated sediment within these areas will allow sand lance to burrow without being exposed to PCB contaminated sediment. Therefore, capping of contaminated sediment will benefit the Common and Roseate Tern populations by reducing their exposure to a source of contamination shown to be detrimental to those species.

7.2.2. Intertidal Habitat Creation and Near-Shore, Shallow, Sub-tidal Enhancement

This proposed alternative would utilize parent material from the construction of South Terminal or from a CAD Cell to cap 10.91 acres of near-shore, shallow, sub-tidal environment, and create an adjacent new 3.47 acre intertidal area, in order to compensate for permanent loss of intertidal area and temporary and permanent impacts to sub-tidal areas via construction of the South Terminal CDF. The location of the proposed intertidal creation and sub-tidal enhancement is located immediately outside of the New Bedford Hurricane Barrier, east and slightly south of the end of Gifford Street.

The proposed intertidal creation and sub-tidal enhancement areas would be created outside the Hurricane Barrier on the New Bedford side of the Bay (see **Figures 10 and 13** for the location of the proposed intertidal creation area). The location of the intertidal creation was selected because it was previously an intertidal area (prior to the construction of the New Bedford Hurricane Barrier) that was formerly affected by an anthropogenic structure (the Hurricane Barrier), and would significantly benefit from new intertidal habitat. A cross-sectional diagram of an example beach profile for the proposed created intertidal area is included in **Figure 12**. The profile created will include a large proportion of intertidal sandy (silt/sand/gravel mixture) area, representing creation of preferential habitat.

The proposed mitigation location is not accessible from the shore and is rarely travelled by recreational vessels. As a result, the critical area would be relatively isolated from human impacts, and would provide a prime location to enhance spawning and foraging areas for winter flounder, scup, black sea bass and windowpane flounder, and enhance foraging area for avian

wildlife identified within the resource delineation, including the Common Tern and the Roseate Tern, and create horseshoe crab spawning habitat.

Both the inter-tidal creation area and the sub-tidal enhancement areas were also chosen due to the presence of PCB impacted sediment in the area. The placement of the parent material will also cap PCB contaminated sediment associated with a portion of the New Bedford Harbor superfund project called "OU-3". The mitigation is located within a near-shore, shallow, sub-tidal area located in the outer harbor, immediately southwest of the Hurricane Barrier, where a PCB-contaminated area has been partially (approximately 20 acres) capped (OU-3 pilot cap) (see **Figure 13)**, OU-3 is a 17,000 acre area outside of the Hurricane Barrier. A hotspot area was located in the vicinity of the proposed mitigation that was partially capped in 2005 (OU-3 pilot cap). The OU-3 pilot cap area was identified for remediation under the New Bedford Harbor Superfund project; however, the OU-3 pilot cap area is not within the area slated for intertidal creation. The OU-3 pilot cap project was a "pilot study"; a remedy decision has not been issued for OU-3. The mitigation project would have the dual purpose of creating intertidal area while simultaneously capping and isolating from the environment sediments with a high level (but likely lower than 10 mg/kg) of PCB contamination within them.

Through bioaccumulation and uptake, PCBs impact a variety of types of marine life, and also have subsequent effects on avian wildlife. The effects of PCBs on Common and Roseate terns via their ingestion of sand lance were discussed in the previous section; it is anticipated that the isolation of PCB contaminated sediment in the location of the proposed intertidal creation area will also benefit both terns and other avian wildlife. A summary of available literature

presenting some evidence of the impact of PCBs on the reproductive cycle of Winter Flounder is attached as **Appendix 72**. The literature search consists of one study noting the link between PCB contamination and a reduction in Winter Flounder larval length and body weight. The other study notes that reduced larval length and body weight results in significant decreased survival potential. The two studies taken together indicate that PCBs in sediment have a significant impact on the ability for Winter Flounder to produce viable offspring that ultimately contribute to propagation of the species. As a result, it is likely that eliminating direct contact from PCB impacted sediment would result in a positive impact to the Winter Flounder population. Therefore, isolation of PCB sediments would be beneficial to Winter Flounder.

It is suspected that PCB impacted sediment affects many species, in addition to Winter Flounder, and that capping PCB impacted sediment will create an area that will be relatively more productive as a shallow near-shore subtidal environment for spawning and foraging areas for many species, including Winter Flounder, Scup, Black Sea Bass and Windowpane Flounder. The areas will also therefore be more productive as foraging areas for avian wildlife, including the Common Tern and the Roseate Tern.

7.2.3. Successional Marsh Area Restoration/Enhancement

In addition to the intertidal area creation, the project proposes restoration/enhancement of a 1.9 acre Salt Marsh and successionary sequence in the drainage swale situated westerly of the Hurricane Barrier, just to the south of the Gifford Street Boat-ramp parking area. The area currently serves as a stormwater runoff channel that runs behind the Hurricane Barrier. The sediment within the stormwater runoff channel is currently impacted with PCBs, SVOCs, and

some metals (see **Appendix 73**). The maximum PCB concentration detected within the sediment of the channel is 55 mg/kg, from a sample collected in 2007. Additional sampling of sediment and adjacent upland material was also conducted in the Fall of 2011.

The western side of the channel is currently a rip-rap slope that has little ecological value. By removing PCB contaminated sediment and capping the residual impacted sediment, creating drainage channels, removing the rip-rap slope, and grading into the upland behind the rip-rap slope, the Commonwealth will create and enhance approximately 1.9 acres of mudflat, low marsh, high marsh, and transitional salt marsh area. This area is owned by the City of New Bedford, which supports the project, as it will not only revitalize a degraded wetland area, but will also extend a public walkway along this area, which has been planned by the City for some time. **Figure 10** shows the location of the drainage ditch, with relation to the footprint of the proposed terminal.

The project will enhance the hydraulic capacity of the drainage ditch to transport stormwater from behind the Hurricane Barrier by removing fill from the western side of the channel. A central drainage channel would run through the re-graded benthic substrate, allowing for stormwater drainage through the area, unimpeded. The restored area and the new salt marsh habitat will replicate the functions and values of salt marsh that will be lost during construction of the South Terminal CDF. **Figure 14** shows the existing resource areas within the drainage ditch. **Figure 15** shows the current conceptual plan for mitigation within the drainage ditch. A cross-section of the proposed work is attached as **Figure 16**.

Currently, the drainage swale in this location is tidally influenced (it is subtidal), however the quality of the resource is degraded mudflat/drainage ditch. The area of the proposed mitigation is currently characterized by the growth of invasive species and has a large amount of trash evident. The sediments in the drainage swale are contaminated (with PCBs, see **Appendix 73**).

The goal of the restoration project at this location is to create a functioning marsh area in a publically visible area, so as to have both an ecological and educational benefit. The mitigation project at this location would include four primary elements:

- Removal of PCB and metals contaminated sediments;
- Re-grading of the swale profile to allow for the creation of a successionary sequence of marsh vegetation;
- Planting of high, low, and transitional marsh species within the regraded swale; and
- Installation of a public access walkway/bike path adjacent to the created marsh area.

The proposed marsh restoration/creation includes the following characteristics:

- Sampling to determine the extent and depth of PCB and metals contaminated sediments;
- Excavation and removal of those sediments and placement of those sediments in a CAD Cell;
- Installation of a layer of parent material across the bottom of swale (within areas that were below Mean High Water prior to excavation of the PCB impacted sediment), while shallowing some areas in order to create a suitable environment for low-marsh plants, while including a deeper flow channel through the middle of the swale for transport of tidal flows.

- Excavation of fill on the western side of the drainage swale and grading of the area with benched sides that will promote high and low marsh vegetation growth as well as transitional vegetation growth.
- Planting of Low Marsh vegetation (such as sp. *spartina alternaflora*) on the lower created benched steps;
- Planting of High Marsh vegetation (such as sp. s*partina patens, sp. solidago sempervirens, sp. iva frutescens, sp. morella (myrica) pensylvanica* and sp. *hibiscus moschuetos*; and
- Planting of Transition Zone vegetation (such as sp. *panicum virgatum*, sp. *iva frutescens*, and some sp. *ammophila brevigulata and prunus maritima*);
- Installation of an adjacent public access walkway/bike path and bordering ornamental fence (such as a split-rail fence).

To keep trash from entering the mitigated area, a local stormwater outfall (located at the corner of Cove Street and Rodney French Boulevard) will be retro-fitted with a hooded catch basin, or trash screen to catch trash prior to its discharge to the drainage ditch. This screen or catch basin will be maintained by the Commonwealth (although responsibility for maintenance of the structure may be transferred to the City of New Bedford Department of Public Infrastructure).

7.2.4. Tern Survey Plan

Although it is not currently anticipated that Common Tern and Roseate Tern habitat will be substantially impacted by completion of the South Terminal CDF project, elements of the proposed project mitigation related to creation of intertidal and shallow water subtidal habitat, in

conjunction with the removal of PCB-contaminated sediment, is intended to compensate for the impacts to tern foraging habitat that may occur. In addition, a tern survey plan will be implemented in Spring/Summer 2012 to determine the extent of the foraging habitat for the Terns as well as Tern use of the area. Based on consultation with the Massachusetts Natural Heritage and Endangered Species Program (NHESP) (Mostello, pers. comm.), the survey will entail weekly surveys from May through mid-July, peak tern nesting season, to acquire data on the density and abundance of terns using the area on both an east/west and north/south gradient to determine tern abundance and density as a function of proximity to shoreline and distance up the estuary. Outside the hurricane barrier, transects would be roughly east/west (shoreline to shoreline); inside the hurricane barrier one north/south transect would extend from the hurricane barrier as far north as navigability allows. At the recommendation of the NHESP, the surveys will be conducted using methodology consistent with guidance provided in the document titled Towards standardized seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the U.K. (http://www.offshorewindfarms.co.uk/Assets/1352_bird_survey_phase1_final_04_05_06.pdf), and in consultation with the NHESP and the U.S. Fish and Wildlife Service.

7.2.5. Shellfish Mitigation

In order to provide compensatory mitigation for impact to shellfish organisms, MassDMF has proposed either, or a combination of, the following:

7.2.5.1. Relay of Existing Shellfish

Relay of shellfish from the proposed facility footprint to a location north of the New Bedford Hurricane Barrier (the shellfish would remain within Fish Closure Area 1 and would not be transported outside of Fish Closure Area 1). Relay of shellfish from the mitigation measures outside of the New Bedford Hurricane Barrier (shellfish from Fish Closure Areas 2 or 3) to a location south of the City of New Bedford (but within City of New Bedford waters) for depuration. The shellfish would be relayed under a MassDMF permit, and would be transported to a location that would then be suspended from shellfishing for a period of time to be determined based on monitoring (but likely between one and three years). Shellfish would be harvested utilizing standard shellfish dredging equipment and/or bullrakes. The work would be overseen by an independent third party.

The City of New Bedford has stated that they would like the relayed shellfish to stay within City of New Bedford waters. **Figure 17** shows the municipal boundaries associated with jurisdictional waters for the City of New Bedford, superimposed on sub-catchments of shellfishing areas designated by MassDMF (labeled BB13, BB14 and BB15). Based upon preliminary discussions, it is likely that the shellfish would be placed within City of New Bedford waters within sub-catchment Area BB14, significantly south of the southern tip of New Bedford, and south of any restricted areas.

Please note that relaying of shellfish from Fish Closure Area 1 to any other area is not proposed by the Commonwealth and is, in fact, restricted – See letter from US EPA attached to **Appendix 52**.

7.2.5.2. Shellfish Seeding

MassDMF has also indicated that it would like to see the purchase and planting of 2.5 large seed for every one (1) shellfish impacted by the project. MassDMF considers large seed to range from approximately 21-25 mm in size. MassDMF has stated that seeded areas will need to be shut down for shellfishing for approximately 3 years, in order to allow the seed to grow to a sufficient size for future shellfishing. If we proceed with this approach, it is anticipated that approximately up to 23,213,250 seed may be planted, requiring large areas to be closed while the seed grow. Rather than seed at one time (which would result in large areas to be shut down for 3 years), it is likely that the seeding will need to be distributed over a relatively large time period (at least over 5 years). Seeding will not take place within Fish Closure Area 1.

As relaying of shellfish will already result in significant closures of City of New Bedford shellfishing areas (to allow for depuration), and as seeding will require at least one year (if not more) of closure to allow the seed to grow to a size suitable for harvesting, the City of New Bedford has requested that the first seeding not begin until at least 2013, but possibly 2014. The purpose of delaying the shellfish seeding is to prevent too many shellfish beds (either for depuration or for seed to grow) from being closed at once. **Figures 18 and 19** note the potential areas for seeding in the City of New Bedford. Red cross-hatched areas are prohibited for shellfishing and would not be seeded. Blue striped areas are restricted and would not be seeded. Tan areas are conditionally approved for shellfishing and may be seeded. Green areas are approved with no restriction and may be seeded. Seed stock would be provided to the New Bedford Shellfish Constable for distribution in accordance with the City shellfish program.

The project proponent will continue its discussions with MassDMF to determine the appropriate amount of Relaying of Existing Shellfish and Shellfish seeding would be suitable for this project.

7.2.6. Removal and Disposal of PCB Contaminated Sediment

The Commonwealth plans to dredged, remove, and sequester approximately 240,000 cubic yards of PCB and heavy metal contaminated sediment from New Bedford Harbor during completion of the South Terminal CDF project. Characterization of that material is detailed within **Section 5** of this document; however, the concentrations of PCBs within this material are known to range from approximately 0.2 mg/kg to approximately 20 mg/kg. It will result in a reduction in the bioavailability of PCBs within Essential Fish, horseshoe crabs and shellfish within New Bedford Harbor, which will subsequently reduce the quantity of PCBs available to avian wildlife when foraging within New Bedford Harbor.

7.3. General Construction Sequence

The following section highlights the construction sequence and timing of construction activities:

7.3.1. Mitigation Construction

Construction techniques will vary based upon the type of mitigation being constructed. To enhance/create the 3.47 acre intertidal area outside of the Hurricane Barrier, as well as to enhance the 10.91 acre sub-tidal area outside of the Hurricane Barrier, parent material from either the dredge site or from the construction of a CAD Cell would be placed hydraulically.

Hydraulic placement of the material would result in a relatively uniform thickness of material to be placed. Particular care will be utilized to ensure that the final grades are correct, as small variations in elevation could result in significant variations in the size if the inter-tidal area. Short-term settlement of hydraulically placed material will be addressed during the post-construction survey period (contract documents will mandate specific elevation and areal requirements for the cap); long-term settlement (depending upon the severity), which will be observed via periodic surveys of the capped area, may or may not be addressed, depending on the speed of the resultant re-colonization of the capped area.

Creation of the 17.73 acre Winter Flounder spawning habitat will likely be achieved by placement of parent material from either the dredge area or from a CAD Cell, likely via bottom-dump scow. The bottom-dump scow placement would result in variations of the final surface, which will allow for a more complex benthic habitat. The variations would consist of small rises and falls within the finished surface. It is anticipated that these variations would further reduce bottom currents and to act as sheltered areas for fish to hide from predators.

Creation of the marsh mitigation area will involve re-grading, and may involve the placement of erosion control mat (likely of a biodegradable material, such as coir or jute) and the re-graded slope may utilize one or more erosion control rolls (also made of coir or jute) to help to stabilize the slope temporarily while vegetation is replanted. Post-excavation samples, which represent concentrations of PCBs that will be capped and left in place, have already been collected and analyzed (see **Appendix 73**). Requirements for transportation of waste regulated by TSCA will be met, as required. Planting of wetlands plants will foster the permanent

stabilization of the area. Invasive species removal will also be completed while re-planting occurs.

The successional salt marsh restoration work would be constructed utilizing standard earthwork equipment and techniques. It is likely that a temporary dam would be constructed adjacent to the box culverts in New Bedford Harbor to allow construction work to be completed in relatively dry conditions. Although a specific design for this dam has not yet been conceptualized, it is clear that, in order to maintain functionality of the stormwater drainage ditch, that a bypass or pump system would need to be in place to allow the ditch to perform its hydraulic function during storm events. It is possible that an additional coffer dam would be constructed to the south of the restoration area so stormwater runoff could be captured prior to entering the work area. The site would therefore be dewatered and dewatering fluid would be treated prior to being discharged to the harbor or the local POTW.

Heavy construction equipment would remove contaminated sediment. Parent material will then be utilized to cap the residual impacted material. The contaminated material will be either hauled to the South Terminal CDF construction site, where it will be allowed to dewater prior to disposal within a CAD Cell, or transported to a scow for disposal within a CAD Cell. Parent material dredged from either the South Terminal CDF dredge footprint or from construction of a CAD Cell will be utilized to cap the remaining sediment within the drainage channel. The parent material will either be mechanically dredged and transferred to the ditch for placement, or will be hydraulically dredged and placed within the ditch.

To minimize future input of trash and other debris to the restored area, a retro-fit of the nearest stormwater outfall (located on the southern end of the mitigation area) will be installed. It is currently anticipated that a structure will be constructed at the discharge point located directly south of the mitigation area. The structure will likely be a hooded catch basin or trash screen or similar device. The structure will minimize the input of trash, grit, oil, and other floating debris to the wetland.

Slope stabilization structures, likely bio-degradable structures such as coir rolls, coir logs or coir blankets will be utilized to stabilize any slopes. The existing bike path will be extended along the top of the re-graded slope. The completed channel will be planted with high marsh and low marsh plants as detailed earlier in the document. Plantings will likely be completed in either the late fall or the early spring in keeping with typical wetland restoration practices.

7.3.2. Timing

Implementation of selected mitigation alternatives will take place during the dredging of the main channel to the South Terminal Marine Park Expansion. Each of the three selected mitigation alternatives rely on a supply of parent material. As a result, each option has a portion of the construction linked to either the construction of a CAD Cell (if a CAD Cell is constructed in conjunction with construction of the South Terminal CDF) or to the dredging of parent material from the South Terminal CDF dredge footprint.

Creation of the Winter Flounder spawning area will begin after parent material is either generated from construction of the South Terminal CDF or from construction of a CAD Cell.

Dredge material will be loaded into dump scows or split hull barges and positioned at the site. Parent material will be placed in accordance with the plans established for the site. Parent material can be safely transported to the site and placed 24 hours a day, except in extreme marine conditions.

Capping of the inter-tidal and sub-tidal areas immediately outside of the Hurricane Barrier will begin after parent material is either generated from construction of the South Terminal CDF or from construction of a CAD Cell. Placement of parent material during fish runs (anticipated to occur between January 15th and May 31st) will be minimized unless suitable precautions to minimize water quality impacts and protect migrating fish are implemented (such as the use of silt curtains). Capping of the inter-tidal and subtidal areas immediately outside of the Hurricane Barrier may take up to approximately 3 to 4 months. This time period may vary due to the potential inter-relationships of other portions of construction of the South Terminal CDF.

The construction within the drainage swale adjacent to the Hurricane Barrier can begin immediately; however, availability of capping material will drive the timing of construction of this portion of the work. This mitigation alternative relies on the reuse of material generated during the dredging of the channel to the facility or dredging of a CAD Cell (should a CAD Cell be constructed in conjunction with construction of the South Terminal CDF). Additionally, the drainage swale mitigation will be planned in order to time the wetlands plantings to either the late fall or early spring in order to allow for maximum growth during the first full growing season.

7.3.3. Oversight

Oversight of mitigation will be undertaken by MassDEP through the State Enhanced Remedy process. Meetings will be held on a regular basis to present data collected in the field, and review status reports on the progress of construction or the completion. MassDEP will conduct periodic inspections of field activities. In keeping with the Commonwealth's engagement with Tribal Representatives, the Tribal Representatives will also participate in project oversight.

Creation of the Winter Flounder spawning habitat as well as the creation of intertidal and enhancement of the sub-tidal areas immediately outside of the Hurricane Barrier will be observed by field personnel. Bathymetric and land surveys will be conducted as necessary both before and after placement of material to confirm that the material has been placed appropriately. Clean-up areas will be designated around the mitigation areas; if material is inadvertently placed outside of the designated areas, it will be removed and replaced in the appropriate area. Vertical tolerances will also be set; should material exceed those vertical tolerances, the material exceeding the vertical tolerance will be removed and re-positioned.

For salt marsh restoration work, a wetland scientist shall be on-site to monitor construction of the wetland mitigation area(s) to ensure compliance with the mitigation plan and to make adjustments when appropriate to meet mitigation goals.

To reduce the immediate threat and minimize the long-term potential of degradation, the species included on the "Invasive and Other Unacceptable Plant Species" list in Table 4 of the US Army Corps of Engineers New England District Mitigation Plan Guidance will not be

included as planting stock in the overall project. Only plant materials native and indigenous to the region will be used.

7.3.4. Monitoring and Maintenance Plan

A long term monitoring program will be implemented to determine the effectiveness of the mitigation. A comprehensive Operation and Maintenance Plan will be prepared during preparation of a Final Mitigation Plan. The Commonwealth will be responsible for long term monitoring and maintenance of each mitigation project, including after the five year milestone. The following section provides guidance regarding monitoring and maintenance that will be conducted to confirm success of planned mitigation efforts:

7.3.4.1. Winter Flounder Spawning Habitat and Intertidal and Sub-tidal Areas Outside Hurricane Barrier

Mechanical Monitoring (Winter Flounder Spawning Habitat and Intertidal and Sub-Tidal Areas Outside Hurricane Barrier)

In order to monitor that capping material has remained in place, the Winter Flounder spawning habitat and intertidal and sub-tidal areas outside of the Hurricane Barrier will be surveyed annually for the first five years after construction to confirm that material placed within these areas has not inadvertently moved to another area, and that excessive erosion is not taking place. Yearly bathymetric data will be compared to the post cap placement survey to assess migration of capping material away from the designated area.

Biological Monitoring (Winter Flounder Spawning Habitat Only)

In order to judge the effectiveness associated with Winter Flounder Spawning Habitat creation area, we have consulted with academic researchers Professor Steve Cadrin and Professor Kevin Stokesbury of the University of Massachusetts Dartmouth's School for Marine Science and Technology (SMAST). The two professors have formed a joint academic team with relevant professionals drawn from both SMAST and the Woods Hole Oceanographic Institute (WHOI), to create a team with broad-based experience that will effectively investigate the potential impact of the proposed mitigation measure. As needed, individual members of this team will be utilized to both collect and analyze relevant data over the period of this study.

The initial proposal, which currently focuses on the resources available to SMAST, involves collecting data prior to mitigation being completed, in order to establish background or "baseline" conditions prior to mitigation. The proposal includes a plan to quickly initiate baseline sampling and to develop a conceptual design for long-term monitoring, with the goal of evaluating the effectiveness of the mitigation plan for winter flounder spawning habitat.

The analytical design involves before-after/control-impact sampling and statistical comparisons. Egg sampling will be conducted by using an epibenthic sled to test for the presence of winter flounder eggs in both the mitigation site and adjacent control sites. The sled will be dragged behind a marine vessel, and is intended to capture demersal Winter Flounder eggs along the bottom of the harbor (if present). A control site was defined that is adjacent to the habitat mitigation site north of Butler Flats, with the same area and similar bathymetry as the habitat mitigation site. An additional control site is located in shallower habitat (more likely to be Winter Flounder habitat) across the Federal Channel from the mitigation site. Baseline

sampling (before the mitigation plan begins) of the mitigation and control sites is critical for evaluating effectiveness of the plan.

A hybrid bi-weekly/weekly baseline sampling protocol will be utilized (with weekly sampling being conducted early in the spawning season, and bi-weekly later in the season). Both baseline sampling and long-term sampling will involve surveys of winter flounder eggs in the mitigation and control sites.

For sampling methodology, SMAST plans to follow the protocols that Scultz et al. (2007) used to sample winter flounder eggs in New Haven and Milford Harbors. The epibenthic sled will be towed in a straight line, into the direction of the prevailing current. The sled will be towed on the bottom at a speed of approximately 2 knots, for 4-5 minutes. Towing the net in a straight line will ensure that it maintains solid contact with the bottom throughout the tow. During each tow, approximately 800'-1000' of the area will be sampled by the sled. The tow duration is limited, due to the small size of the study area. SMAST plans to conduct 4 standard tows each in the mitigation site and the control sites during each sampling event. Following each tow, the contents of the net will be rinsed into the collection jar at the end of the net, and preserved in a labeled 500mL bottle with 10% formalin for subsequent analysis.

It is anticipated that long-term monitoring will be similar in scope to the baseline sampling, and that statistical analysis of baseline and long-term monitoring data will test for increased presence of winter flounder eggs in the mitigation area.

The relevant personnel associated with the project (some of which may be very actively involved in the project and others of which may or may not):

- Professor Kevin Stokesbury, Associate Professor, Chair of the Department of Fisheries Oceanography, University of Massachusetts Dartmouth, School for Marine Science and Technology.
- Professor Steve Cadrin – Associate Professor, Department of Fisheries Oceanography, University of Massachusetts Dartmouth, School for Marine Science and Technology.
- Professor John Stegeman – Senior Scientist at the Woods Hole Oceanographic Institute; and
- Professor Mark Hahn – Senior Scientist at the Woods Hole Oceanographic Institute.

A copy of the SMAST Baseline Proposal is attached as **Appendix 74**. Please note that biological monitoring program is being completed for the Winter Flounder Spawning Habitat Area only.

7.3.4.2. Drainage Swale Mitigation Area

The drainage swale mitigation area will be inspected on a monthly basis during the period from April through October for the first 3 years after construction. Subsequent to the first 3 years, the mitigation areas will be inspected in May and September of each year for an additional 2 years.

Inspections will be completed by a wetland scientist. The wetland scientist will monitor and document the presence and species diversity of plants that have been installed at the site, and will monitor for the presence of invasive species. The wetland scientist will hand pull invasive species as necessary and will evaluate other control methods, if necessary.

The general health of the plants within the marsh area shall be determined during each inspection. Invasive species found within the areas will be removed. The entire area will also be inspected for excessive erosion or siltation.

If plants are found to be dead or stressed, they will be replaced. If the erosion control blankets (which may be used with discretion to stabilize planting areas within the marsh restoration area) are found to have been torn or show evidence of tears, eroded material will be replaced and tears in the blanket will be sewn shut. If the coir rolls (which may be utilized to stabilize slopes within the salt mash restoration area) or other slope stabilization measures become dislodged, additional tie-downs will be added to secure the coir rolls. If excessive erosion or siltation is noted, grades within the area will be restored to match the final elevations. The coir rolls or other slope stabilization measures will be replaced or repaired if plant growth has not been well established before the coir roll has decayed.

7.3.4.3. Monitoring Reports

The results of the mitigation activities and subsequent inspections will be documented in annual reports that will be submitted to USEPA by December 15th of each year following the completion of the first growing season subsequent to planting.

7.4. Proposed Avoidance, Minimization, and Mitigation For Secondary Impacts

7.4.1. Dredging or Other Construction Related Turbidity and Re-Suspension/Bioavailability Impacts

The increase in turbidity during the construction of the CDF and CAD Cell will be monitored utilizing existing Performance Standards the Navigational Dredge – Phase III, Part A version of which are attached as **Appendix 75**. The Performance Standards within **Appendix 75** have been developed through the State Enhanced Remedy process at the New Bedford Superfund Site. The Performance Standards have been developed over two phases of navigational dredging (Phase II, which began in January 2005 and was completed in January 2006 and Phase III, which began in September 2006 and was completed in September 2009). The Performance Standards were developed with the coordination with a number of Federal, State and Local authorities who are represented at the State Enhanced Remedy meetings, including MassDEP, USACE, USEPA, the National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Division of Marine Fisheries (DMF), Massachusetts Coastal Zone Management (MACZM), EOEA, Tribe Representatives and the Coalition for Buzzards Bay.

In addition to conformance with the Performance Standards, certain Time of Year Restrictions will be observed. Work will be minimized from January 15 to June 15; if unavoidable, work will be completed with the use of silt curtains areas with water depths greater than -5 MLLW. If additional Time of Year restrictions are identified, work will be minimized at those times of year, or silt curtains will be utilized during those times of year, as outlined above. Environmental dredge buckets will be utilized, as applicable, to contain impacted sediment

completely, and reduce turbidity during dredging activities. There will be turbidity monitoring during the deployment of silt curtains. Written contingency plans will be required from the marine contractors working at the facility. Should turbidity monitoring indicate exceedances of Performance Standards, the contractor will be required to implement its contingency plans to reduce the turbidity levels. Possible contingency options include: decrease in the speed of work, the halt of work, fixes to equipment, use of an environmental bucket, use of silt curtains or other potential measures.

7.4.2. Stormwater Runoff

Mitigation for Stormwater Runoff impacts will be handled as noted within **Section 6**. Stormwater management as a part of the construction will be in accordance with standard construction means and methods. Best management practices (use of vegetated swales, stormwater detention basins (where possible), storm-ceptors (where possible), or other methods will be utilized to reduce sediment within stormwater prior to discharge to New Bedford Harbor. The site will be designed to manage stormwater in compliance with the Massachusetts Stormwater Handbook.

Erosion and sedimentation controls will be present at the site during the construction process. A Licensed Site Professional will review the presence of impacts to soil and/or groundwater located within the parcels that are anticipated to be incorporated within the proposed project, evaluate the health and environmental risk posed by the impacted soil and/or groundwater, and

will determine how the project can be designed to prevent and/or minimize erosion of impacted sediment that could be transported into New Bedford Harbor during the design process.

7.4.3. Lighting

The newly constructed marine terminal in New Bedford will have security lighting as the rest of the City has street lights. When international vessels are at the facility and work is to be completed 24-hours a day temporary lighting will be utilized. Other than prudent management to ensure unnecessary use of lighting, it is unlikely that lighting can be controlled at the site due to the anticipated demand for 24-hour site usage.

7.4.4. Bilge and Ballast Water Management

Bilge and ballast water management will be undertaken in conformance with the guidelines noted within **Section 6**. It not currently anticipated that any additional actions will be necessary associated with these secondary impacts.

7.4.5. Sloughing Slopes

To limit slope failures associated with propeller wash in the newly constructed channels a full geotechnical evaluation of the in-situ soils will be completed. Generally speaking native soils, including those recently dredged in the vicinity of the South Terminal CDF, and those dredged in past years that have been observed to retain their angle of repose over time, in New Bedford

Harbor have been shown to have an angle of repose of approximately 3 feet horizontal per 1 foot vertical. Therefore, it is currently anticipated that side-slopes of 3 feet horizontal per 1 foot vertical will be applicable for this project.

7.4.6. Boat Traffic Secondary Impacts

The impacts associated with Boat Traffic Secondary Impacts were analyzed in **Section 6** and found to not be significant. Increases in vessel traffic with in New Bedford Harbor are not anticipated to greatly impact the current operations of the Port. During the construction of the CAD Cell, material being shipped to the South Terminal CDF will likely be incorporated into the normal Port traffic pattern without a major disturbance. During previous dredging project barges would move through the Route 6 swing bridge during its normal openings; additional openings were not required and a similar pattern is anticipated for the construction of the South Terminal CDF. There should be very little commercial vessel traffic through the CAD Cell area or through the South Terminal CDF area. Recreational boat traffic will need to be redirected around the work area, however this has been normal practice during previous navigational dredging projects completed within the port.

Please note that the analysis on operational turbidity conducted within **Section 6** indicated that, although the worst-case scenario indicates an increase in turbidity of 0.28% to 0.5%, the actual increase in turbidity is anticipated to be significantly less than this number. Nevertheless, in order to manage turbidity that may be generated from prop wash during operation of the facility, low speeds will be utilized by international vessels and installation vessels when approaching, maneuvering at the facility, or leaving the facility. This will also be

necessary as there will be a limited amount of available room for the vessels to maneuver. Tugs with relatively shallow drafts will likely be utilized to transport installation vessels in and out of the harbor, which should minimize prop-wash turbidity. Additionally, tugs with shallower drafts than the larger vessels will likely be needed to maneuver the larger, international vessels into berthing at the facility.

It not currently anticipated that any additional actions will be necessary associated with these secondary impacts.

7.4.7. Environmental Justice, Truck Traffic, Noise, and Air Impacts

As stated within the analysis presented within **Section 6**, the proposed South Terminal project, which is still going through its approval process, will have additional public input. This input will inform the residents of the adjacent Environmental Justice communities with descriptive information on flyers and notices in the appropriate language (Portuguese, Spanish, etc.). One or more community meetings will be held in the affected neighborhoods.

During this process, traffic concerns identified by the public will be addressed. For example, the state is currently improving intersections along Route 18 near the State Pier to allow better access to the industrial waterfront. Community concerns about other intersections may improve their use and reduce impacts.

A construction management plan will be required as part of the development. As explained above, this will ensure that the measures are implemented to reduce traffic and air quality impacts as a result of the project.

Noise from construction of the expansion at South Terminal will be minimized to the extent practical. Work will be completed during permitted work hours. However, the area

around the site is within the Designated Port Area of New Bedford Harbor, and fishing vessels enter, offload, and exit New Bedford Harbor at all hours of the day. Navigational dredging (which can be a noisy process) has taken place within the Harbor for multiple events.

As stated earlier within the Neighborhood Analysis (**Section 6**), Map Number 21, Lot Number 45 is adjacent to the residential neighborhood at Cove Street; however, this area would be utilized with much less frequency than other portions of the terminal. This property (as well as the other, southern ancillary properties) will be utilized primarily for wind blade lay-down. Although 24/7 access is required for the facility, this is anticipated to be required mainly due to issues associated with loading and unloading of vessels and assembly of wind turbines, activities that will not be occurring at the Map Number 21, Lot Number 45; therefore, although some access to the southern portion of that property may occur within a 24/7 timeframe, it will likely be very infrequent. Additionally, due to the anticipated use of the property (lay down of wind blades is anticipated to take place at the far southern end first, and subsequent wind blades are anticipated to be subsequently laid down in a south-to-north fashion as they arrive onsite, and then utilized in a north-to-south fashion), it is currently anticipated that noise caused by operations (when utilized) at this property will be relatively minimal.