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FINAL BIOLOGICAL ASSESSMENT

for the ROSEATE TERN

NEW BEDFORD HARBOR – SOUTH TERMINAL PROJECT
NEW BEDFORD, MASSACHUSETTS

U.S. Environmental Protection Agency
Office of Ecosystem Protection (OEP05-2)) U.S. EPA New England Region
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TABLE OF CONTENTS

Subject		Page
I.	Introduction	3
II.	Description of Project and Action Area	4
	A. Project Description	4
	B. Action Area	6
III.	Environmental Setting	6
	A. Flora - Salt Marsh, Intertidal and Subtidal Resources	6
	B. Fauna – Finfish and Shellfish	7
	C. Physical Conditions – Sediments, Patterns of Circulation, Noise	11
IV.	Roseate Tern Biology	12
	A. Seasonal Distribution	12
	B. Nesting	12
	C. Staging	14
	D. Foraging	14
V.	Effects Analysis	17
	A. Direct Loss of Salt Marsh, Intertidal and Subtidal habitat	17
	B. Foraging by Nesting/Migrating Terns	18
	C. Effects on Prey Species In Shallow Water Habitat	18
	D. Dredging Impacts to Prey Fish in Sub-tidal Environment	19
	E. Noise and Traffic	20
	F. Oil Spills and Shipping Traffic	21
	G. Ecological Benefits of the Project	22
VI.	Determination of Effects on the Roseate Tern	22
VII	Conclusion	23
VIII.	References.	24
IX.	List of Contacts Made and Preparers	28

New Bedford Harbor - South Terminal Project
Endangered Species Act Biological Assessment for the Roseate Tern

I. Introduction

This Biological Assessment (BA) was prepared to comply with Section 7 of the Endangered Species Act (ESA). It assesses the potential effects of the construction and long-term operation of the proposed New Bedford Harbor (NBH) - South Terminal project in New Bedford, MA, on the roseate tern (*Sterna dougallii*), a federally listed as endangered which may occur in the area of the proposed project.[1] While New Bedford Harbor is not federally designated critical habitat for any federally endangered species, the project area provides potential habitat for nesting and foraging for the roseate tern.

Roseate terns were once abundant in Massachusetts waters, reportedly numbering in the hundreds of thousands, but a variety of threats has resulted in much-reduced populations. According to the U.S. Fish and Wildlife Service Roseate Tern Recovery Plan – Northeastern Population (USFWS, 1998), the numbers of roseate terns were severely reduced in the 1870's and 1880's by commercial hunting for the millinery trade and most colonies previously recorded colonies appear to have been eliminated at that time. The total number of remaining roseate terns was estimated to be roughly 2,000 pairs at the lowest point in about 1890 (Nisbet 1980 in USFWS, 1998). Following protection efforts in the 1890's and strengthened by the Migratory Bird Treaty Act of 1918, roseate tern populations increased to a high of about 8,500 pairs in the 1930s but declined again to a low of 2,500 pairs in 1977 due to habitat loss and gull encroachment (USFSW, 1998).

The islands in Buzzards Bay and Nantucket Sound have been among the most important nesting sites for roseate terns in the northeast. In 2011, based upon total season estimates of roseate tern pairs, approximately 90% of the population was concentrated at just 3 colonies: Great Gull Island, New York (NY) (1,500 pairs); Bird Island, Marion, Massachusetts (MA) (937); and Ram Island, Mattapoisett, MA (385). Other sites in Massachusetts included Penikese I., Gosnold (34), S. Monomoy I., Chatham (7), Monomoy I., Chatham (3), and Plymouth Beach, Plymouth (≥1). Roseate terns were observed carrying fish into the Plymouth colony in 2007, 2008, and 2010 and presumably nested in those years; in 2011, a nest and young were confirmed.

The total nesting area available to roseate terns is limited, which increases the terns' vulnerability to potential catastrophic events, such as oil spills or disease. The gradual loss of breeding sites in the northeast and the roseate tern's reluctance to colonize new sites are serious obstacles to the recovery of the northeast population.

[1] EPA's draft biological assessment dated October 2010 also discussed the piping plover (*Charadrius melodus*), listed as threatened; and the Northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*), listed as threatened. Since that time, the Region has determined that those two species are not present in the project area, and the U.S. Fish and Wildlife Service has confirmed this determination (EPA Memorandum to file July 10, 2012.)

II. Description of Project and Action Area

A. Project Description

The Commonwealth of Massachusetts proposes to construct an approximately 28-acre marine terminal (South Terminal) within the Designated Port Area of the New Bedford Harbor at a site north of and proximate to the Harbor's Hurricane Barrier (action area). The terminal will be capable of supporting offshore renewable energy development and other future maritime uses. The proposal is described in detail in the document entitled "State Enhanced Remedy in New Bedford, South Terminal" and its appendices, dated January 18, 2012 and prepared by the Massachusetts Department of Environmental Protection, "MassDEP"(MassDEP 2012**)**. The Commonwealth has updated and supplemented its January 18, 2012 submission with 2 additional submissions (including attachments), dated June 18, 2012 (hereafter MassDEP 2012a) and June 29, 2012 (hereafter MassDEP 2012b).

As discussed in more detail below, the project will involve, among other things, navigational dredging to accommodate vessels' access to the terminal and the construction of a solid fill structure in waters of the U.S. to provide sufficient acreage and load bearing capacity at the terminal site. Temporary and permanent impacts to the roseate tern may occur as a result of the dredging and filling of aquatic habitat, and noise from pile driving and blasting (if it becomes necessary).

EPA's Superfund ("CERCLA") regulations provide for a state to petition EPA to expand its remedial action to include additional activities as an enhancement of the remedy (i.e., State Enhanced Remedy or "SER"). In the case of the New Bedford Harbor remediation, the State Enhanced Remedy involves additional navigational dredging as well as disposal of the sediments into confined aquatic disposal ("CAD") cells (below the ocean floor) or into confined disposal facilities ("CDFs") (above the ocean floor).

The proposed NBH - South Terminal would include construction of a 6.85 acre CDF adjacent to the shoreline. It would be bounded by sheet piling, and capped by Dense Graded Aggregate, which includes a mixture of gradations of aggregates. The majority of the upland that will be incorporated into the proposed terminal was once occupied by a former textile manufacturing complex and has been heavily disturbed. The total estimated size of the facility, including ancillary southern properties, is currently anticipated to be approximately 28.25 acres. The main portion of the terminal will support staging of additional dredged material for beneficial reuse during operation of the facility.

To complete the project as proposed, a total of approximately 22.33 acres of intertidal, subtidal and salt marsh resource areas would be altered and temporary impacts from dredging would affect up to 38.22 acres of near-shore sub-tidal and sub-tidal areas. (see Section III or V. Environmental Setting, below, for further discussion of resource areas).

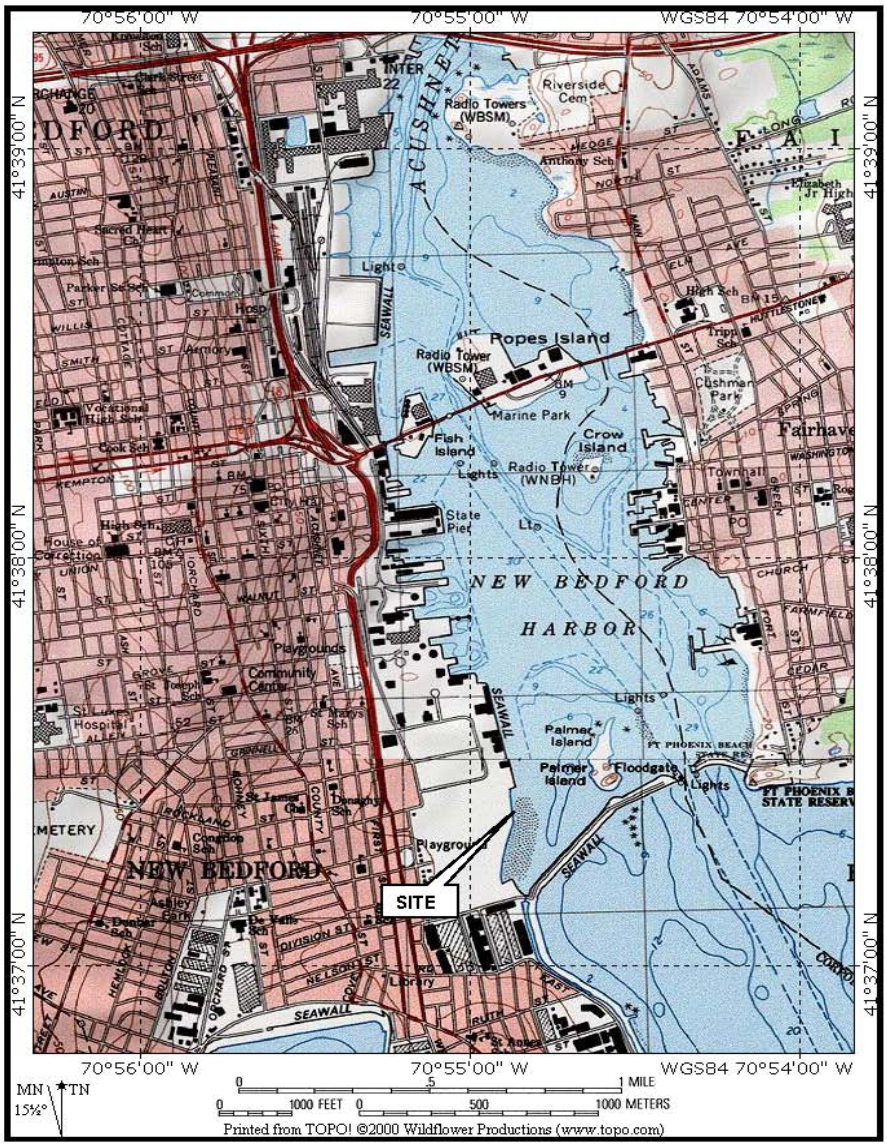


Figure 1: Site Location Map
South Terminal CDF Proposed Location
City of New Bedford, New Bedford, Massachusetts

Source: Expanded Avian Assessment Appendices (MassDEP, 2012)

B. Action Area

New Bedford Harbor is located on the northern shore of Buzzards Bay and borders the communities of Fairhaven to the east, and New Bedford to the west. The New Bedford Hurricane Barrier seawall and floodgates (immediately south of Palmer Island) demarcates the outer harbor from the inner harbor. There is also a federal navigation channel which leads into the inner harbor (see Figure 1 - Site Location Map, above). The Acushnet River flows into the northernmost part of the upper estuary and is the most significant freshwater inflow into the harbor. The inner harbor contains several marinas, a recreational fleet, historical attractions, commercial fishing fleet, and fish processing/cold storage facilities. Land usage along the shore is a mixture of residential, commercial and industrial uses (MassDEP, 2012).

New Bedford Harbor is contaminated with polychlorinated biphenyls (PCBs) and heavy metals from manufacturing discharges that occurred from 1940 to the late 1970s. The harbor sediments are contaminated in varying degrees from the upper Acushnet River into Buzzards Bay. Bioaccumulation of PCBs within the marine food chain has resulted in closing the area to lobstering and fishing, and recreational activities and harbor development has been limited by the widespread PCB problem. The source of the contamination has been attributed to two electrical capacitor manufacturing facilities that operated between the 1940s and 1970s. One facility, Aerovox Corporation was located near the northern boundary of the site and the other facility, Cornell-Dubilier Electronics, Inc., is located just south of the New Bedford Hurricane Barrier. Based on the health concerns from the site, the Environmental Protection Agency (EPA) added the site to the National Priorities List in 1983 as a designated Superfund Site (USACE 2010). EPA's selected remedy for site contamination involves sediment removal by dredging and the containment of contaminated sediments. Full scale dredging began in 2004, and to date approximately 200,000 cubic yards of contaminated sediments and soils have been remediated (EPA, 2010a).

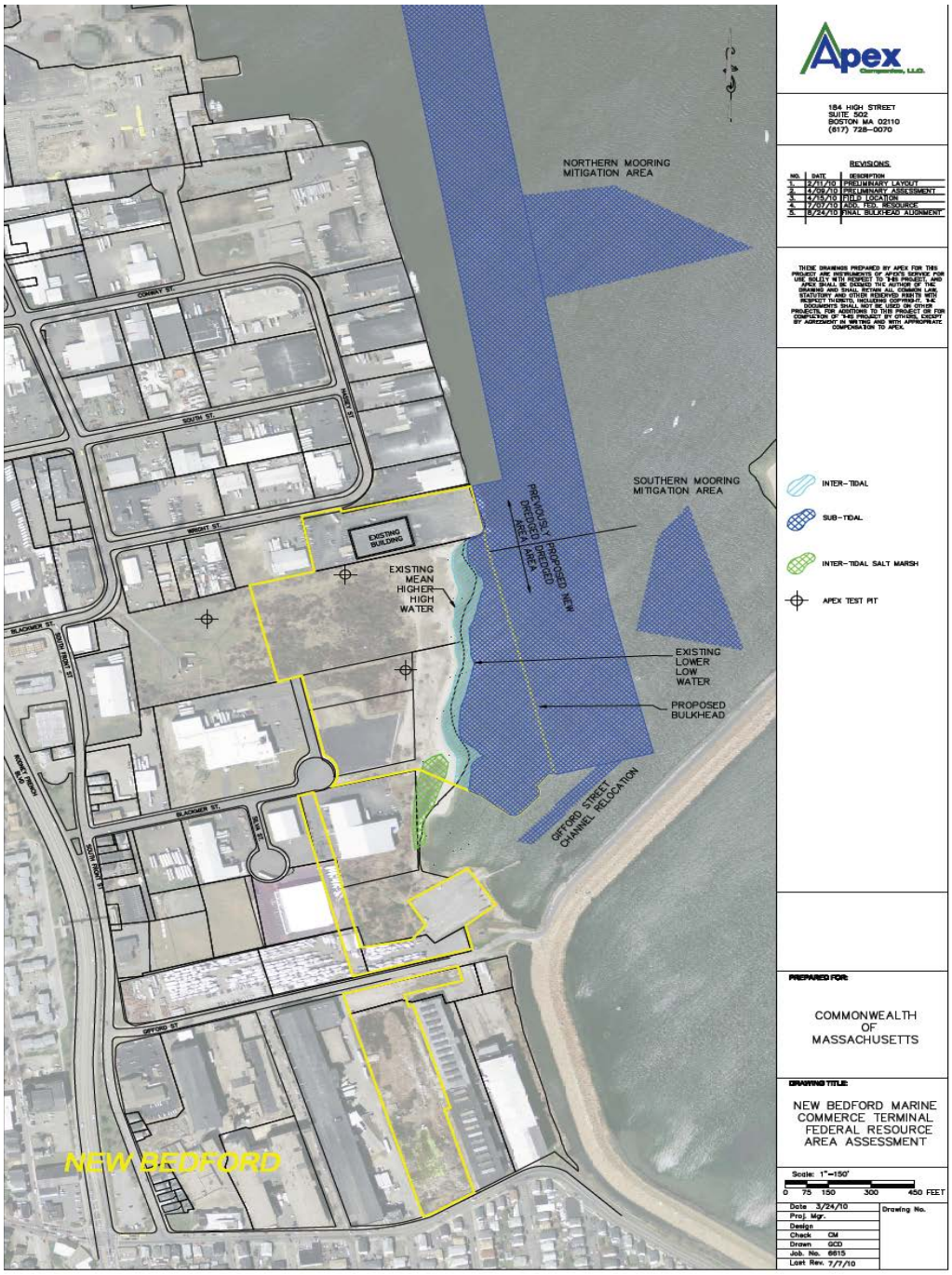
III. Environmental Setting

A. Flora - Salt Marsh, Intertidal and Subtidal Resources

New Bedford Harbor is a coastal embayment with a mean tidal range of approximately 3.3 feet or 1 meter (Howes and Goehringer, 1996 in MADEP, 2010a). The primary resource areas in the NBH- South Terminal project area include; intertidal, near-shore subtidal (existing elevation of between -1 and -6 MLLW), deeper subtidal (existing elevation between -20 and -25 MLLW), and salt marsh (MassDEP, 2012). Although the proposed site is surrounded by industrial properties, the salt marsh, intertidal and sub-tidal areas provide feeding locations and potential nesting habitat for shore birds; serve as finfish foraging and spawning habitat; and supports a benthic and shellfish invertebrate community (see Figure 2 – Salt Marsh, Intertidal and Subtidal Resources). The sediments within the resource area are, however, contaminated with PCBs (MassDEP 2010a) and as such, fishing, shellfishing, and lobstering are banned within New Bedford Harbor (EPA 2010a).

B. Fauna – Finfish and Shellfish

New Bedford Harbor is home to a wide variety of marine life. Fisheries include both commercial and recreational bottom dwelling and free-swimming water column resident and migratory species. The intertidal and subtidal areas were found to support abundant benthic and pelagic resources, including horseshoe crabs, and provide spawning and nursery habitat for various species of fish. Ecologically, the harbor functions both as an ocean embayment and estuarine environment (MADEP, 2010a). Roseate terns eat almost exclusively small marine fish and very rarely small crustaceans such as shrimp. (Gochfeld et al., 1998) The Massachusetts Department of Public Health (MDPH) promulgated state regulations in 1979 prohibiting the consumption of any fish/shellfish within designated areas of NBH due to high levels of contamination (EPA 2010b), but for wildlife utilizing these resources, the consumption of shellfish or fish is still an avenue for bioaccumulation of PCBs in fish and wildlife utilizing these resources. A shellfish survey was conducted in May 2010 under the guidance of Mr. David Whittaker, South Shore Section Leader of the MA Department of Marine Fisheries (MADMF), in order to determine potential impacts to the local shellfish population due to the NBH-South Terminal project construction (MADEP, 2010a). Approximately 9,817,121 quahogs, oysters and clams are estimated to be impacted from the direct impacts of filling and dredging in the proposed project area. (Mass DEP, 2012a)


Apex
184 HIGH STREET
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REVISIONS
NO. DATE DESCRIPTION
1. 2/11/10 PRELIMINARY LAYOUT
2. 4/09/2010 PRELIMINARY ASSESSMENT
3. 4/15/10 FIELD LOCATIONS
4. 7/07/10 ADD. TEST RESOURCE
5. 8/24/10 FINAL BULKHEAD ALIGNMENT
NORTHERN MOORING MITIGATION AREA
SOUTHERN MOORING MITIGATION AREA
PREVIOUSLY PROPOSED NEW DREDGED AREA
PROPOSED NEW DREDGED AREA
EXISTING BUILDING
EXISTING MEAN HIGHER HIGH WATER
EXISTING LOWER LOW WATER
PROPOSED BULKHEAD
GIFFORD STREET CHANNEL RELOCATION
COMMERCIAL
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An Essential Fish Habitat (EFH) assessment was prepared by the MassDEP for the NBH - South Terminal project in conformance with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) for managed fish species listed in the project vicinity. There are twenty EFH species listed for the NBH area; three species of which are considered potential forage for roseate terns. These include bluefish *(Pomatomus saltatrix)* (listed for the presence of juveniles and adults), king mackerel (*Scomberomorus cavalla*) (listed for all life stages; eggs, larvae, juvenile and adults) and Spanish mackerel (*S. maculatus*) (listed for all life stages) (MADEP, 2010a). Roseate terns generally feed on the young of these larger fish species.

A fisheries study was conducted by Normandeau Associates Inc. (NAI) in New Bedford Harbor from June 1998 to May 1999 which consisted of three near shore seine sampling stations (two in the outer harbor and one in the inner harbor) and trawl samples along five transects (three in the outer harbor and two in the inner harbor) in deeper waters (from 6.5 to 33 feet). As noted above in Section II. Project Description, the demarcation between the inner harbor and the outer harbor is the New Bedford Hurricane Barrier. (MassDEP,2012). No inner harbor sampling sites were located in the NBH–South Terminal project area; however, the fisheries data would be characteristic of the typical fish community in the inner and outer harbor area.

The most numerous fish species found in the NAI study at the three near shore seine sampling stations were Atlantic silversides (*Menidia menidia*) (44 %), striped killifish (*Fundulus majalis*) (16%), mummichog (*Fundulus heteroclitus*) (9%), cunner (*Tautogolabrus adspersus*) (7%), and winter flounder (*Psuedopleuronectes americanus*) (6%). The most numerous fish found in trawl catches (standardized for length of tow and catch for comparison purposes) were scup (*Stenotomus chysops*) (23%), cunner (21%), winter flounder (13%), black sea bass (*Centropristus striata*) (9%), and northern pipefish (*Syngnathus fuscus*) (6%). Alewife (*Alosa pseudoharengus*) appeared in trawl samples in September in lesser numbers but was absent in other months. Atlantic silversides, bay anchovy (*Anchoa mitchilli*) and Atlantic herring (*Clupea harengus*) were also found in the trawling sampling in lesser numbers. Bluefish represented 9.3% of catch at one seine sampling station in the outer harbor area. Although known to utilize Buzzards Bay, blueback herring, sand lance and mackerel were not found in abundance in either the seine or trawling sampling data, most likely being tallied as part of the category of “other species” (MADEP, 2010a).

The bluefish is a wide ranging pelagic species (Robins et al. 1986 in NOAA, 2006) that travels in schools of like-sized individuals and undertakes seasonal migrations. They spawn off the Atlantic coast and juveniles and adults eat whatever taxa are locally abundant. The bluefish diet includes fish, crustaceans and polychaetes (Friedland et al. 1988 in NOAA, 2006). Mackerel is another pelagic schooling fish; they spawn in a wide ranging area off the Atlantic coast. They have a diet of copepod larvae and eggs, the smaller adult copepods, various other minute crustacea, and small fish larvae. Various other planktonic animals also enter regularly into the diet of the mackerel. Juveniles often enter estuaries and harbors in search of food (Bigelow et al., 2002).

The bay anchovy, because of its abundance and widespread distribution in the mid-Atlantic Region, is a very important component food source for many sport and commercial fish (Derickson and Price, 1973; Richards, 1976 in Morton, 1989 in USFWS, 1989) as well as sea

birds. Bay anchovy feed primarily on macrozooplankton, small benthic crustaceans, small mollusks and detritus (Darnell, 1958, 1961 and Odum, 1971 in USFWS, 1989). In the mid-Atlantic region, spawning generally occurs in estuarine waters where salinities are usually over 10 parts per thousand (ppt) (Dovel 1981 in USFWS, 1989). Heinemann (1992) found that anchovy accounted for 6% of the roseate tern diet in 1990 and 4% in 1991.

Alewives and blueback herring (*Alosa aestivalis*) are anadromous species which return to freshwater in the Acushnet River to spawn in the April/May timeframe. Alewife and blueback herring are plankton feeders, subsisting primarily on copepods and pelagic shrimp, as well as on young sand lance and other small fish fry (Bigelow et al., 2002). Herring are an important prey source for many EFH species that occur in the New Bedford Harbor vicinity, such as bluefish (Bowman et al., 2000 in MADEP, 2010a). Heinemann (1992) found that herring-type fish accounted for 8% of the roseate tern diet in 1990 and 11% in 1991.

The sand lance (*Ammodytes americanus*) is an eel-like fish which grows to an average of 25 centimeters (cm) in length, and is widespread in estuarine, open coastal and off shore habitats along the northeastern coast of the United States (Sherman et al. 1981; Morse 1982 in Auster et al. 1986). Sand lances are important in the diet of piscivorous species of fish and birds and it is the primary prey species for the roseate tern. Heinemann (1992) found that sand lance was the most important prey species for roseate terns over the entire season, representing 71% of the diet. Sand lance prey primarily on copepods, but also eat fish eggs and larvae and. Sand lances rely on sandy bottoms for habitat and are found in somewhat patchy distributions. Strong evidence exists that Stellwagen Bank provides spawning habitat for the sand lance (NOAA, 2010). The sand lance was not specifically identified in abundance in the NAI seine and trawl sampling, however, and any sand lance were most likely being tallied as part of the category of "other species" (MassDEP, 2010a).

The Atlantic silverside is a resident fish species of New Bedford Harbor, inhabiting the salt marsh and shallow intertidal areas. Atlantic silversides spawn in the intertidal zone of nearly all major estuaries and tributaries (USFWS, 1983). Heinemann (1992) found that Atlantic silversides represented approximately 10% of the roseate tern diet in 1990 and 11% in 1991 with the tern capture rate more prevalent in the mid-July to early August timeframe. Atlantic silversides grow to about 12 cm and are common in near shore waters, usually on sand or gravel shores and in salt marshes at high tide. Swimming in schools of similarly sized fish, they prey upon zooplankton, shrimp, young squid, worms and algae. They serve as food for other predators such as birds, mackerel and bluefish (URI 2010). Exposure to contaminated sediment during larval and juvenile development may have health implications for this species during later life stages (MADEP, 2010a).

The foraging behavior of the fish species preferred by roseate terns increases the opportunity for these fish to be exposed to PCBs and to bioaccumulate, either because of a longer duration of exposure to contaminated sediment or because of a greater consumption of contaminated forage. These prey species may, in turn, expose roseate terns to PCBs. The potential impacts of the proposed NBH–South Terminal project on the fish species used by foraging roseate terns likely to be found in New Bedford Harbor are discussed in Section V., Effects Analysis, below. As discussed above, the primary prey species for the roseate tern, the sand lance, are widespread and

are not solely confined to New Bedford Harbor. Indeed as also discussed above, sand lance were not found in large numbers in New Bedford Harbor.

C. Physical Conditions – Sediments, Patterns of Circulation, Noise

Sediments – For descriptive purposes, the New Bedford Inner and Outer Harbor have been divided into three areas: upper, lower (also referred to as the inner harbor) and outer harbor based upon geographic features, basin morphology and gradients of contamination. The upper harbor, the area north of the Coggeshall Street Bridge, has PCB contaminant levels ranging from below detection to approximately 4,000 parts per million (ppm). The upper harbor initially had PCB "hot spots" in the range of 100,000 ppm which were removed in 1994 and 1995 as part of EPA's first clean up phase. The lower harbor, which lies between the Coggeshall Street Bridge and the New Bedford Hurricane Barrier, has PCB contamination ranging from below detection to approximately 190 ppm. The outer harbor area is defined as the area lying outside the hurricane barrier (which was constructed in the mid-1960s) and extends out covering approximately 17,000 acres. The outer harbor has sediment PCB levels averaging approximately 1 ppm, with localized areas approaching 50 ppm (USACE, 2010).

Long-term sediment and toxicity monitoring has been conducted in New Bedford Harbor as part of the long term monitoring program for the New Bedford Harbor Superfund site. One of the monitoring stations (Station 253) is located within the proposed dredging area for the NBH – South Terminal project. The long-term sediment monitoring data for Station 253, conducted five times between 1993 and 2009, showed an average PCB concentration of 5.7 ppm and the grain size analysis showed an average 46.9% silt/clay component. Sediment samples were collected in 2010 and 2011 using vibracores and Russian Peat Cores within the footprint for both the proposed dredging area and the proposed facility. (MA DEP, 2012, Section 5). Surface samples from within the proposed dredging areas and the filled facility footprint were collected and analyzed for PCBs (22 NOAA Congeners by Modified EPA Method 8270C). Surface samples (samples collected from 0 to 1 foot) and fifteen 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).

Patterns of Circulation - Although general data regarding circulation conditions and sediment transport within the harbor have been collected, no data exist describing the actual site-specific sediment transport and circulation patterns within the NBH - South Terminal site. Circulation patterns within New Bedford Harbor are primarily driven by meteorological events and mixed semi-diurnal tidal currents (EBASCO, 1991; Howes and Goerhinger, 1996; NBHTC, 1996 in MADEP, 2010a). Flushing of the harbor was determined to take 2 days under winter conditions, and 8 days under summer conditions (Bellmer, 1988 in MADEP, 2010a). 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 located in the upper harbor. 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) in MADEP, 2010a). In the New Bedford Harbor PCB Flux Study conducted by Woods Hole Group (WHG) on behalf of the USACE for EPA, NBH

sediments and water were identified as a source of PCB contamination to the area outside of the hurricane barrier (outer harbor area) (Woods Hole Group, 2010.)

Noise and Traffic - The NBH- South Terminal 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 and interfaces with the Waterfront Industrial and "Industrial B" zoning districts (MADEP, 2010a). The inner harbor contains several marinas, a recreational fleet, historical attractions, commercial fishing fleets, and fish processing/cold storage facilities. Land usage along the shore is a mixture of residential, commercial and industrial uses (MADEP, 2010a). Dredging activities in the harbor for both navigation and remediation of the New Bedford Superfund site adds additional human disturbance to the harbor area. The current level of human disturbance, noise and traffic undoubtedly deters the foraging of shorebirds to some extent.

IV. Roseate Tern Biology

A. Seasonal Distribution

In North America, the roseate tern breeds in two discrete populations; from Nova Scotia south to New York (the Northeast Population) and in the Caribbean. Roseate terns arrive in Massachusetts from late-April to mid-May to nest at just a handful of coastal locations. Massachusetts birds depart from breeding colonies in late-July and August and concentrate in "staging areas" around Cape Cod and the Islands, before departure for wintering grounds in September. Most have departed staging areas and have begun migrating southward (principally to South America) by mid- to late-September (MA NHESP, 2007).

B. Nesting

In Massachusetts, the roseate tern generally nests on sandy, gravelly, or rocky islands. Roseate terns have very specialized habitat requirements; however, they are always found nesting in close association with the common tern (*Sterna hirundo*). Roseate terns, being less aggressive than the common tern, seem to rely on the common terns aggressive tendencies to protect their own nests. Roseate terns usually place their nests under cover in dense vegetation, such as seaside goldenrod *(Solidago sempervirens)* or beach pea *(Lathyrus maritima)*, or under boulders or other structures (e.g. nestboxes or wooden boards). Roseate terns appear to enjoy the security of crevices and structural backing to their nesting sites. Common terns tend to nest in open sandy areas with limited vegetation (Nisbet, 2002 in USACE, 2006).

In Buzzards Bay, terns start arriving at the nesting islands in late-April. Common terns usually begin laying eggs the second week of May and roseate terns begin a few days later. Peak egg-laying takes place from mid-May to mid-June, but eggs may be laid into mid-August. Incubation lasts about three weeks, and after three to four weeks chicks can fly. Fledglings of both species are dependent on their parents for at least several weeks post-fledging. Most terns begin moving in July to pre-migration staging areas in the region (especially on Cape Cod) where they feed and roost before starting migration a few weeks later. By early September, essentially all terns have departed the nesting islands for the pre-migration staging areas. By mid-September, most have

departed the staging areas for the wintering grounds (principally in South America), but some linger at staging areas until mid-October (USACE, 2006).

The islands in Buzzards Bay and Nantucket Sound have been among the most important nesting sites for roseate terns in the northeast. In the most recent inventory of terns prepared by Massachusetts Division of Fisheries and Wildlife (MA DF&W the following results are presented:

> Roseate terns were confirmed to have nested at six sites in 2011. The largest colony was at Bird I., Marion (937 vs. 735 in 2010); productivity was very good, 1.23 fledglings/nest. Ram I., Mattapoisett was the second largest site at 385 pairs (vs. 584 in 2010); productivity also was very good, 1.10 fledglings/nest. Repeated Peregrine Falcon (*Falco peregrinus*) disturbance in May and early June was probably responsible for roseate terns shifting from Ram to Bird. Other sites included Penikese I., Gosnold (34 vs. 37 in 2010; fair to good productivity), S. Monomoy I., Chatham (7 vs. 8 in 2010; 0.29 fledglings/pair), Monomoy I., Chatham (3 vs. 1in 2010; 1.67 fledglings/pair), and Plymouth Beach, Plymouth (≥1 vs. 2 in 2010). Roseate terns were observed carrying fish into the Plymouth colony in 2007, 2008, and 2010 and presumably nested in those years; however, in 2011, a nest and young were confirmed. Roseate terns preparing to nest at Norton Beach, Edgartown before the peak census window were disrupted by a Peregrine Falcon and did not nest (0 vs. 26 in 2010). At Gray's Beach, Yarmouth, three roseate terns (two adults and one sub-adult) consistently were observed flying over the colony together over the course of the breeding season, but they did not land and there was there was no indication of nesting. At a sandbar off Muskeget I., Nantucket in July, a roseate tern pair was courting, scraping, and bringing nesting material to a scrape, but nesting was not confirmed. (MDF&W, 2012)

Bird Island and Ram Island (located approximately 17 km and 9.2 km “as the crow flies,” respectively) are the two closest colonies to the NBH- South Terminal project area that are within the typical foraging range (25 km) of the roseate tern.

Bird Island is a 3-acre island located in Buzzards Bay in Marion, MA, southwest of Butler’s Point at the entrance of Outer Sippican Harbor. Bird Island is subject to wave action and submergence during storm events, which has eroded the island over time. Sand and gravel areas have given way to the establishment of some areas of salt marsh and two salt pannes. The island is also the location of a historic light house. In 2011, Bird Island supported 937 nesting pairs of roseate terns (MDF&W, 2012).

Ram Island, a 2.5-acre island located 0.8 km southeast of Mattapoisett Neck, Mattapoisett, MA, is composed of eroded glacial till, surrounded by scattered boulders. There is a tidal pond in the center with a small area of low-grade salt marsh, and a storm beach of gravel and shell. Common and roseate terns have been known to breed on the island since the 1930s (Mass Audubon 2010) but the island was eventually overrun with gulls. Suitable conditions for nesting roseate terns were restored in the 1990’s by the MDF&W Natural Heritage and Endangered Species Program (MA NHESP; and as of 2011, the island supported 385 nesting pairs of roseate terns (MDF&W, 2012).

In Massachusetts in 2011, the roseate tern population decreased slightly (2.4%) to 1,359 pairs (vs. 1,393 pairs in 2010). The U.S. (or "Northeast") population as a whole increased slightly to 3,042 pairs (vs. 2,970 in 2010). The population declined steeply after 2000, but essentially has been stationary since 2008 – this is close to the 1987 level, when it was first listed as Endangered in the U.S. Since 1985, roseate tern numbers in the Commonwealth e have fluctuated between 1,339 and 2,124 pairs, averaging 1,587 pairs during this time period. (MDF&W, 2012)

C. Staging

Roseate tern staging areas in the New Bedford Harbor general vicinity (within 50 miles) include Monomoy Island and Nauset Beach on Cape Cod, Nantucket Island, and Napatree Point on the Connecticut/Rhode Island border (USFWS, 1998). There were twenty areas of open beach or sand flat sites around Cape Cod identified where roseate terns (and common terns) staged between 24 July and 22 September. Birds from eight different breeding sites were identified among staging flocks (Trull et al., 1999, in USFWS, 2010).

D. Foraging

Roseate terns feed almost exclusively on small and/or juvenile fish, occasionally including crustaceans and insects in its diet. Its feeding habits are fairly specialized, consuming primarily sand lance. Heinemann (1992) found that the roseate terns from Bird Island foraged primarily (95%) on sand lance prior to mid-June (71% over the season). After mid-June, the breadth of the diet increased to include herring, anchovy, silversides, mackerel and bluefish. Roseate terns capture food mainly by plunge-diving (diving from heights of 1-12 meters (m) and often submerging to ≥ 50 centimeters (cm), but also by surface-dipping and contact-dipping (MA NHESP, 2007).

Roseate terns feed in bays, tidal inlets, or between islands in Massachusetts. They are known to fly up to 25 km to feed over reliable feeding areas (Nisbet, 1991, Duffy, 1986, Safina, 1990, Heinemann, 1992 in USFWS, 1998). Rock et al., 2007 found an average foraging distance of 7 km from a colony in Country Island, Nova Scotia, Canada. Roseate terns forage in highly specialized situations such as shallow sand bars (less than 3 meters (m) deep) or rip tides where prey fish are swept close to the surface. They will also feed in shallow water (less than 2 m deep) where prey fish cannot stay below the plunge depth. Roseate terns will also take advantage of school feeding of predatory fish or feeding close to double-crested cormorants when smaller fish are driven to the surface. Some roseate terns specialize in stealing fish from other terns Heinemann (1992). Rock et al. (2007) found in a telemetry study in Canada that 90% of foraging was in water less than 5 m deep.

In 1990 and 1991, a study was conducted to assess the foraging locations and ecology of roseate terns breeding on Bird Island in Massachusetts (Heinemann, 1992). Eight survey transects were established in the Buzzards Bay and Vineyard Sound area and roseate tern observation surveys were conducted during the months of June and July in 1990 and 1991. Five of the eight transects went into the New Bedford outer harbor, of which two of these transects went into the inner harbor (north of the Hurricane Barrier). Of the five transects that included the New Bedford outer harbor area, the most southern foraging location in three transects was the West Island area

and, in one transect, a small number of terns (1 to 9 birds) were observed foraging on the west side of Sconticut Neck (outer New Bedford Harbor) (for the location of these areas see Figure 3 – Roseate Tern Foraging Habitat Within 25 km). No roseate terns were identified foraging in the inner harbor area.

The MassDEP (conducted an expanded avian assessment for potential usage in the vicinity of the NBH - South Terminal project for avian nesting and foraging by reviewing existing data. The assessment included a review of a bird survey conducted by the USEPA in 1987, bird observations within Bristol County made via the Massachusetts Audubon Society's online "eBird" system, the species prioritization list associated with Bird Conservation Region 30 (Southern New England Data), information from the Paskamansett Bird Club's 2007 Christmas Bird Count, identifications made by an individual within New Bedford from 2005-2008, and observations made for the Mass Audubon Society's Breeding Bird Atlas 2. The conclusion of this assessment was that "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." (MassDEP, 2010b).

Of the roseate tern nesting colonies in Massachusetts, only Bird Island and Ram Island are within the foraging range for roseate terns (approximately 25 km) to the New Bedford Harbor. Bird Island is located approximately 17 km from New Bedford Harbor but terns would most likely follow a water route during foraging which extends the flying distance from Bird Island to New Bedford Harbor to the outer-most foraging range. Heinemann (1992) stated that "Roseate Terns from the Bird Island do not forage in the immediate vicinity of New Bedford Harbor, although they can be found in significant numbers near West Island and Ram Island 6-9 km away." Therefore, it is unlikely that Bird Island roseate terns forage in the New Bedford Harbor area during nesting season. However, Ram Island is located 9.2 km from New Bedford Harbor. The Heinemann (1992) tern foraging study was conducted prior to the restoration of Ram Island and as such, may not account for Ram Island roseate terns foraging in the New Bedford Harbor area during nesting season since the mid-1990's.

Little information is known about the movements or ecology of the terns during migration to and from wintering areas or moving from nesting and staging areas. Theoretically, they may use New Bedford Harbor for foraging during this time. Potential risks to migrating roseate terns related to NBH – South Terminal project could include effects from increased shipping traffic, noise, oil spills, etc. The potential impact to foraging roseate terns from Ram Island and migrating roseate terns is discussed in the Section V., Effects Analysis.

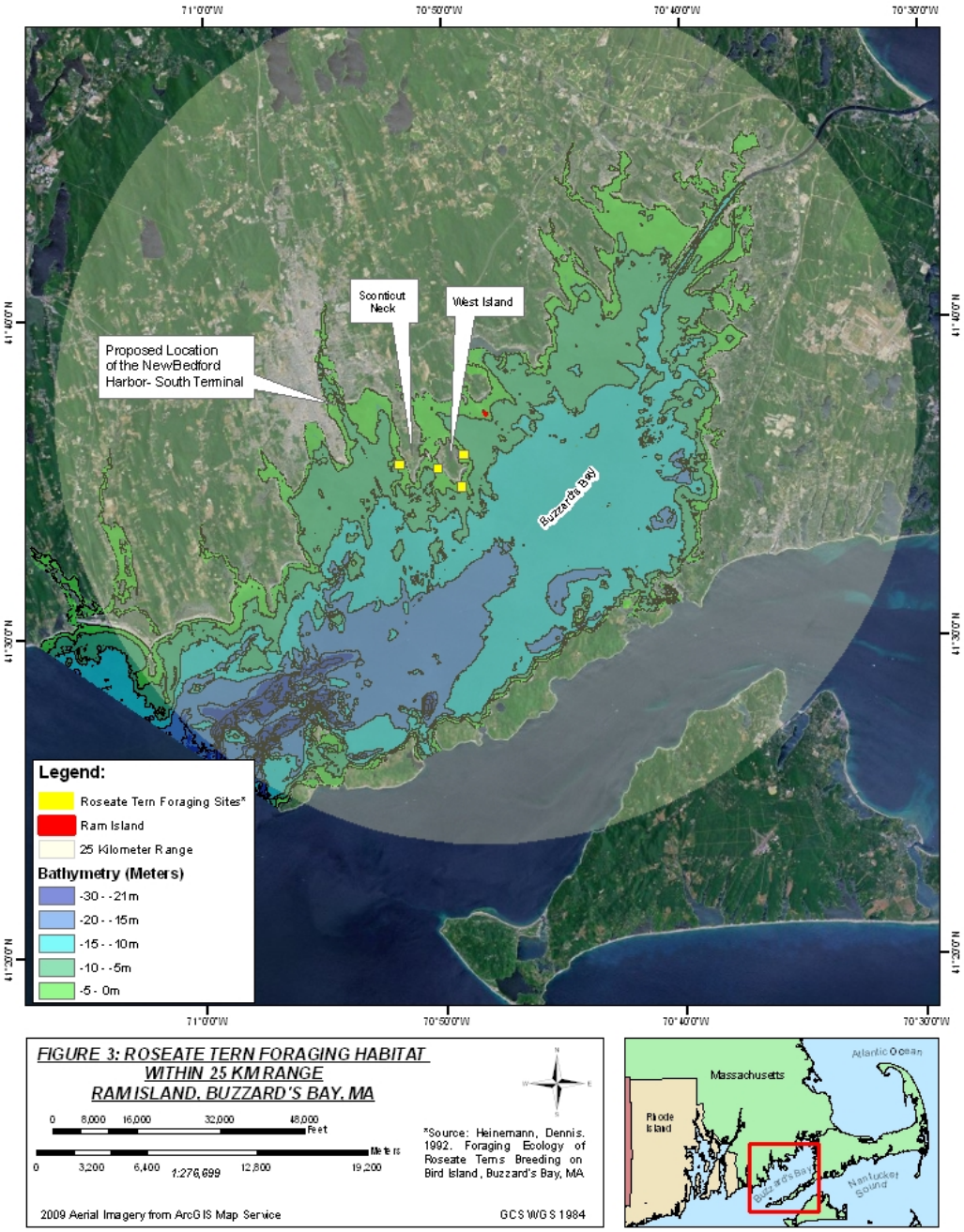

FIGURE 3: ROSEATE TERN FORAGING HABITAT WITHIN 25 KM RANGE RAM ISLAND, BUZZARD'S BAY, MA

0 8,000 16,000 32,000 48,000 Feet

0 3,200 6,400 12,800 19,200 Meters

1:276,699

*Source: Heinemann, Dennis. 1992. Foraging Ecology of Roseate Terns Breeding on Bird Island, Buzzard's Bay, MA

2009 Aerial Imagery from ArcGIS Map Service

GCS WGS 1984

V. Effects Analysis

A. Direct Loss of Salt Marsh, Intertidal and Subtidal Habitat

Permanent direct adverse impacts to aquatic resources from constructing the NBH-South Terminal project would include the filling of 1.94 acres of intertidal area; 4.06 acres of shallow, near-shore sub-tidal area; 0.18 acres of salt marsh, and 0.67 acres of shallow sub-tidal area that will be dredged and partially filled with piles and a concrete blanket. This 0.67 acre area will also be shaded with a concrete platform. These aquatic resource areas were found to support abundant benthic and shellfish resources and are used as fisheries spawning and nursery habitats.

Permanent impacts from dredging associated with the proposed project includes 7.02 acres of near-shore, sub-tidal land which will be dredged in feet from between -1 and -6 Mean Lower Low Water (MLLW) to between -30 and -32 MLLW[2]; and 8.46 acres of near-shore, sub-tidal land that will be dredged in feet from -1 and -6 MLLW to -14 MLLW.

Temporary impacts associated with the proposed project include 8.76 acres of near-shore sub-tidal area that will be dredged from between -1 and -6 MLLW to -45 MLLW to create a Confined Aquatic Disposal cell which will later be filled and capped; 6.17 acres of near-shore, sub-tidal areas that will be dredged from -4 to -6 MLLW to between -6 and -7 MLLW (Gifford Street Channel Realignment and Mooring Mitigation Areas); 8.29 acres of sub-tidal area will be dredged from -20 to -20 MLLW to -30 MLLW (South Terminal Channel)[3]; and 15 acres of sub-tidal area that will be dredged from -20 to -30 MLLW for -30 MLLW (Maintenance Dredging of Federal Navigation Project).

A total of approximately 22.33 acres of intertidal and subtidal resource areas would be permanently altered due to filling and dredging during the construction process. The direct effect to marine resources caused by filling and dredging intertidal and subtidal areas include permanent loss of spawning and foraging habitat, reduction in the availability of food supply, and loss of refuge areas from predators.

A total of 38.22 acres of near shore subtidal and subtidal would be temporarily impacted during dredging. Temporary impacts would include elevated turbidity, the resuspension and mobilization of contaminants during the construction process, and human disturbance (vessel traffic, noise, etc.) associated with the post-construction operation of the terminal (MassDEP 2012). Temporary impacts from construction noise will potentially occur as the project involves the insertion of piles into substrate to provide a foundation for the terminal bulkhead and may involve blasting to remove rock in the area of the terminal and in shipping channels.

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[2] This figure represents 3.68 acres that will definitely be dredged, and an additional 3.34 acres that are associated with a potential extension of the deep-draft quayside dredging area to the south and potential additional widening of the deep-draft channel. See MassDEP 2012a at pp. 2-4 and 9.

[3] This figure represents 7.01 acres that will definitely be dredged, and an additional 1.28 acres that are associated with a potential extension of the deep-draft quayside dredging area to the north. See MassDEP 2012a at pp. 3 and 10.

B. Foraging by Nesting and/or Migrating Roseate Terns

Ram Island is located 9.2 km from New Bedford Harbor which is within the 25 km foraging distance for roseate terns and as such there is some potential for Ram Island roseate terns to forage in the New Bedford Harbor area during nesting season. In 2009, Ram Island supported 645 roseate tern pairs; 20.6% of the northeast population in 2009. Of that number, only a portion would be expected to forage at any one time in the direction of New Bedford Harbor. In addition, roseate terns forage in highly specialized situations such as shallow sand bars or rip tides where prey fish are swept close to the surface. New Bedford Harbor does not exhibit these habitat characteristics. The southernmost foraging areas, located around West Island and the west side of Sconticut Neck (outer New Bedford Harbor), could also be used by Ram Island roseate terns, and Heinemann (1992) identified many other better suited foraging sites in Buzzards Bay that are also within the range of foraging Ram Island terns. No roseate terns were identified foraging in the inner harbor area by Heinemann (1992), though, as mentioned above, this survey predated the restoration of suitable nesting conditions on Ram Island.

In addition, the MassDEP conducted an assessment for potential avian usage of the NBH – South Terminal area by reviewing a wide variety of existing avian survey data. The conclusion of this assessment was that "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." (MassDEP 2012).

While terns migrating to and from wintering, nesting and staging areas also have the potential to forage in New Bedford Harbor, it is not considered to provide high quality foraging and does not provide nesting habitat for the roseate tern. Trull et al. (1999) in USFWS, 2010, suggested that at least half of the entire northeast population of roseate terns was concentrated around Cape Cod at the time of staging. These staging areas are located 40 miles or more from New Bedford Harbor, which is beyond the foraging range for roseate terns. Therefore, it would be expected, based upon existing survey data, that only occasional or transient birds would attempt to use New Bedford Harbor for foraging during migration and staging based upon existing survey data.

There are areas of roseate tern foraging habitat identified around West Island and the east side of Sconticut Neck (Heinmann, 1992), which are within the foraging range of Ram Island roseate terns and would likely be preferred over foraging in the inner NBH project area because they are closer to Ram Island. In addition, because roseate terns forage in waters up to approximately 5 meters in depth and as such, there is a large amount of potential foraging habitat in areas external to the New Bedford Harbor area (see Figure 3 – Roseate Tern Foraging Habitat within 25 km). In addition, the significant degree of existing human related disturbance in the harbor is a deterrent for foraging birds (as discussed below). Therefore, it would be expected that only occasional transient roseate terns, if any, would use the New Bedford inner harbor for foraging during nesting, migration or staging.

C. Effects on Prey Species in Shallow Water Habitat

Project related impacts on the prey species preferred by the roseate tern are dependent on the mobility, life history, food preference and spawning behavior of the species. Non-mobile or

slow-moving benthic organisms, including slow moving invertebrates (food for prey species) may be buried or trapped by filling during construction of the NBH–South Terminal. More mobile species of fish would likely avoid the disturbance areas. Spawning habitat for the pelagic species such as mackerel and bluefish, which spawn in at sea, or for the anadromous herring which spawns in fresh water (in the Acushnet River), would be least likely to be directly affected by the filling of intertidal and subtidal habitat. Species such as the sand lance, bay anchovy which spawns in estuarine waters and bluefish, herring and mackerel, the juveniles of which, may utilize the NBH–South Terminal intertidal area for foraging could potentially be impacted by the project. However, these species were not well represented in the Normandeau Associates near shore sampling or trawl sampling and as such do not appear to utilize the area to a great extent.

The Atlantic silverside is a resident of the intertidal area, which makes it most susceptible to impacts associated with the direct filling of the 1.94 acres of intertidal resources, 0.67 acres of shallow sub-tidal area that will be dredged and partially filled with piles and a concrete blanket and 4.06 acres of shallow near-shore sub-tidal habitat. The Atlantic silverside spawns in intertidal areas, comprised 44% of the three near shore seine sampling stations, and represents approximately 10% of the roseate tern diet (Heinemann, 1992). However, the Atlantic silverside is a wide spread species, occurring from Nova Scotia to Florida and is abundant in every major estuary (USFWS, 1983).

Overall, the intertidal resources that will be affected by the proposed project represent a small portion of the total potential spawning, nursery and foraging habitat in New Bedford Harbor. Furthermore, the roseate tern prefers primarily sand lance and a range of other prey species which support its dietary requirements during the spring, summer, and fall in the northeast. It is unlikely that the potential impact of the NBH–South Terminal project on the Atlantic silverside population or other foraging juvenile prey species will affect the occasional or transient roseate terns that may use the New Bedford Harbor for foraging. Although certain areas will be eliminated as a potential foraging site for roseate terns, as explained above, 1) only occasional or transient birds would be expected to use the inner harbor area for foraging, 2) there are several more preferred feeding sites in the Buzzards Bay area (as shown on Figure 3 – Roseate Tern Foraging Habitat Within 25 km) that are anticipated to be the focus of foraging roseate terns, 3) the preferred prey base is largely absent from the New Bedford area and 4) the amount of potential preferred forage fish spawning habitat that will be eliminated will be negligible.

D. Dredging Impacts to Prey Fish in Sub-tidal Environment

Dredging effects on roseate tern foraging may include increased exposure of prey fish to elevated turbidity and higher levels of contaminants in the water column from the dredging processes. Though direct mortality to prey fish would not be expected, sub-lethal impacts could occur, such as decreased reproduction or bioaccumulation of contaminants in benthic organisms that the prey fish feed upon. Dredging will impact approximately 38.22 acres of subtidal area in order to create an adjacent deep water channel and mooring area.

The direct effects of dredging on fisheries include destruction of eggs or spawning areas, physical impairment (e.g., turbidity-induced clogged gills resulting in suffocation, or abrasion of

sensitive epithelial tissue), behavior impairment (changes in migration patterns) or physiological impairment due to acute or chronic toxicity from exposure 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 could be temporarily impacted by any sediment plume that was present as they pass through it to freshwater spawning areas.

To better understand the effects of dredging in the New Bedford Harbor Superfund site, the EPA Atlantic Ecology Division in Narragansett, RI, conducted extensive research with regard to water column contaminant accumulation in shellfish tissues. Blue mussels (*Mytilus edulis*) were selected for use in the study because they have been shown to accumulate PCBs in their tissues proportional to the concentration of PCBs in the water that they filter. Mussels were deployed at three sites; the Coggeshall St. Bridge in the upper harbor, the NBH Hurricane Barrier in the lower harbor, and approximately 1000 yards east of West Island. In order to quantify any dredging and operational related impacts, mussels were deployed at three different times; before dredging (Pre Operational), during dredging of PCB contaminated areas (Hot Spot Remediation) and after dredging (Post Operational). After the mussels were deployed for a period of 28 days, they were retrieved from the field and analyzed for PCB concentrations in their tissues (EPA, 2009, unpublished. B.J. Bergen and W.G. Nelson, U.S. EPA, Atlantic Ecology Division, Narragansett, RI).

Results of the study indicate that, over a period of twelve years (1987 to 1999), PCB bioaccumulation levels were relatively constant, which leads to the conclusion that operational dredging in the NBH had minimal impact on PCB bioaccumulation in mussels. The data showed that PCB concentrations do not increase during dredging periods in blue mussels and as such, it was reasonable to assume that dredging does not lead to increases in PCB concentrations in other biota in the harbor (EPA, unpublished. B.J. Bergen and W.G. Nelson, U.S. EPA, Atlantic Ecology Division, Narragansett, RI).

Given that only occasional or transient roseate terns would be expected to use the NBH during breeding and migration, we believe that roseate terns are unlikely to be adversely affected as a result of this project. Should a few birds choose to forage in the project area during dredging operations, the risks of exposure to PCBs resulting from the effect of dredging on their prey would be extremely low. This conclusion is supported by long term trends which show that total PCBs have declined 12% since 1972 in tern breeding colonies in Buzzards Bay, MA (EPA, 2008). This decline in PCB levels in tern eggs, though not specifically linked to the remedial activities at the NBH Superfund site, coincides with declines in sediment PCB concentrations from those activities.

E. Noise and Traffic

New Bedford Harbor is a highly industrialized area with noise levels related to 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. Although roseate tern

foraging would also be at its peak during this time (MassDEP, 2010b), the elevated activity within the harbor area is likely to deter shorebirds from foraging there.

The construction and operation of the NBH-South Terminal will involve increased truck traffic and noise impacts in the project vicinity. It is estimated that operations will be 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 NBH-South Terminal 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 and is within the Waterfront Industrial and "Industrial B" zoning districts (MassDEP, 2010a). As discussed above, the current level of human activity in the harbor is likely to be a deterrent to shorebirds foraging in the area. Increased noise and traffic from construction and operational activities at the terminal may further deter roseate terns from using the area. However, this is not likely to adversely affect the roseate tern since even apart from the NBH South Terminal Project, the use of the New Bedford inner harbor by roseate terns is expected to be limited to occasional and transient individuals and there are several and more preferred areas terns may use for foraging in Buzzards Bay.

F. Oil Spills and Shipping Traffic

Increased vessel traffic and/or the potential for uncontrolled releases of oil to surrounding waters as a result of the operation and maintenance of the NBH – South Terminal project present additional potential vulnerabilities to terns foraging in Buzzard's Bay. An oil spill in 2003, the Bouchard No. 120 (B-120) oil spill in Buzzards Bay, Massachusetts, resulted in moderate oiling of Ram Island and slight oiling of Bird and Penikese Islands. During this event, roseate terns were hazed to discourage them from settling into nesting habitat until it was cleaned of oil. As a result, many tern pairs moved to other islands, and/or delayed nesting, which resulted in reduced productivity at Ram Island by an estimated 350 chicks (USFWS, 2008).

To determine the threat to avian wildlife, the Massachusetts DEP relied upon an oil spill threat analysis of vessel traffic prepared by Nuka Research & Planning Group LLC (MADEP, 2009 cited in MADEP, 2012.) Nuka Research & Planning Group LLC considered the existing oil spill threat for New Bedford Harbor from vessel activity within shipping lanes; from increased vessel traffic due to the construction of the NBH–South Terminal project; and from use of the facility as a maritime terminal after the initial offshore renewable energy project is completed. The analysis determined the relative increase in oil spill threat after the first year of operation of the new terminal for Regional Transit Vessels is 0.77% for the South Coastal/New Bedford area, 0.75% for the Dartmouth/Fairhaven/Marion/ Mattapoisett/Wareham/Westport area, and 0.75% for the Cape and the Islands. Details of this analysis may be found in the document entitled the State Enhanced Remedy in New Bedford, South Terminal and dated August 25, 2010 (MASSDEP 2012). In addition, Spendelow et al. (2008) (in USFWS 2008) examined survival rates of roseate terns over a 19-year period and did not detect a lower survival of the birds nesting at the colonies near the Bouchard No. 120 (B-120) oil spill compared to those nesting at other study sites in New York and Connecticut. Therefore, it is unlikely that roseate terns will be adversely affected by the small increased threat of oil spills or increased traffic as a result of the NBH–South Terminal project.

G. Ecological Benefits of the Project

In its current state, New Bedford Harbor presents a limited risk to foraging transient roseate terns within the harbor and from the export to adjacent areas of PCB contaminated forage fish (e.g., sand lance, alewife, blue fish, etc.). The dredging associated with this project will reduce the levels and amounts of PCBs and other contaminants in the sediments within the harbor areas that are to be dredged. The material will be disposed/confined in the CDFs or CADs. This will reduce future potential for resident and transient fish species and other organisms to be exposed to these contaminants. The potential benefits may be illustrated in the long-term trends that show that total PCBs have declined 12% in tern breeding colonies in Buzzards Bay, MA since 1972 (EPA, 2008).

VI. Determination of Effects on the Roseate Tern

From the above analysis, EPA concludes that the proposed NBH–South Terminal project is unlikely to adversely affect the roseate tern. The project site contains neither nesting habitat nor migratory staging area habitat for roseate terns. Therefore, the project would have no direct effect on such habitat. In addition, the project is sufficiently distant from available roseate tern nesting habitat and migratory staging area habitat, that it will have no indirect effect on these habitats, either.

Furthermore, the project would be unlikely to have any effect on roseate terns foraging during nesting or migration because roseate terns are not expected to use the project area for foraging to any significant degree. Although the distance from the project location to the Ram Island and Bird Island roseate tern breeding colonies is within the estimated foraging range of roseate terns, there are foraging sites closer to these colonies that have site characteristics preferred by foraging roseate terns. Based on existing literature and known feeding habitats, roseate terns use specialized sites for feeding where currents or rip tides bring prey species to the surface, and these conditions do not exist in the project area but do exist at other locations in or around Buzzards Bay. Moreover, already existing noise and vessel traffic in the harbor are likely to deter any potential foraging in the harbor by roseate terns.

In light of the above considerations, there is, at most, only a small likelihood that a transient roseate tern might seek to use the project area for foraging during nesting and migration. If such a transient roseate tern did seek to forage in the project area, it is highly unlikely that it would encounter any contamination, or that its prey sources would have been reduced in any meaningful way, as a result of the project.

Finally, as mentioned above, current noise and vessel traffic in the harbor are likely deterrents to the use of the harbor by roseate terns for foraging. As such, additional noise from the project is not expected to cause an adverse effect. However, in the unlikely event that roseate terns enter the inner harbor to forage, noise and vessel traffic would likely serve to drive the birds away from the South Terminal site. Therefore, injury as a result of foraging during dredging is highly unlikely. In addition, the increased threat over existing conditions to migrating roseate terns due to increased vessel traffic and potential oil spills would be minimal.

VII. Conclusion

EPA concludes that, though the proposed NBH-South Terminal project may affect the roseate tern, the project is unlikely to adversely affect the species.

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Figure 4 Hurricane Barrier Swale Mitigation – Existing Conditions

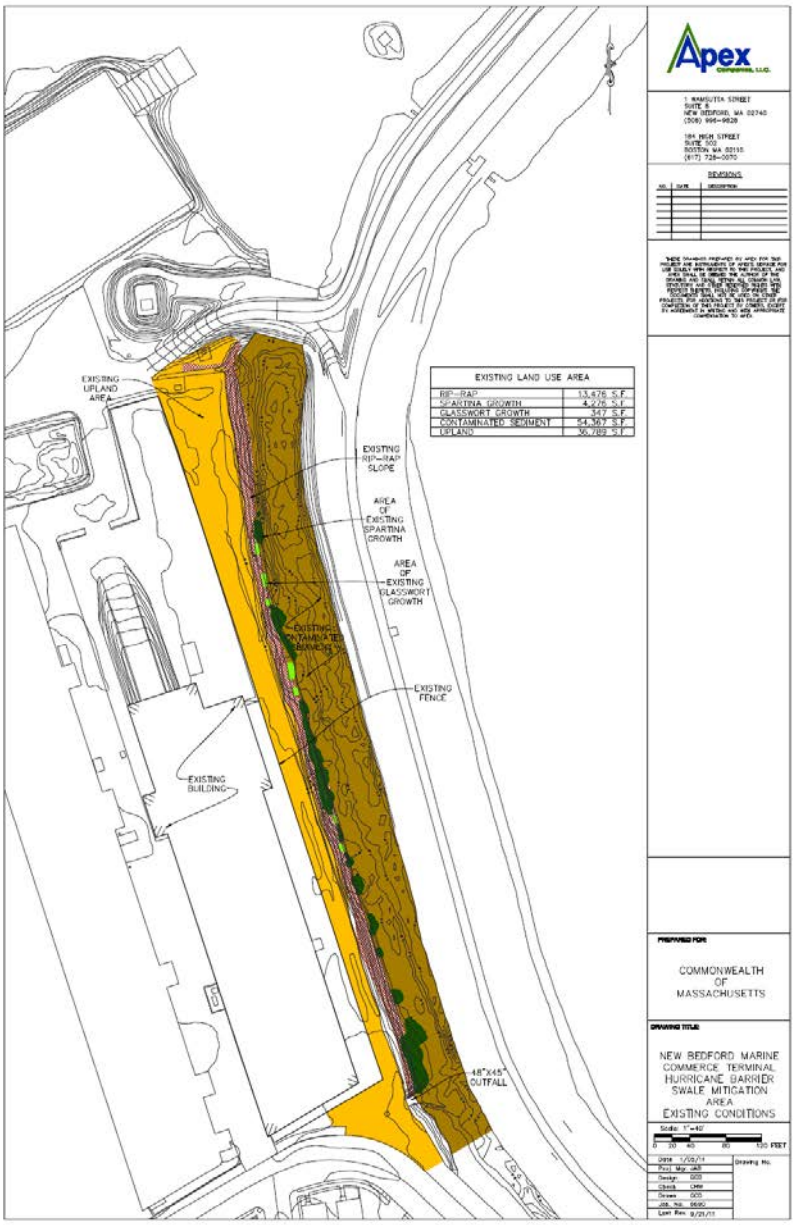
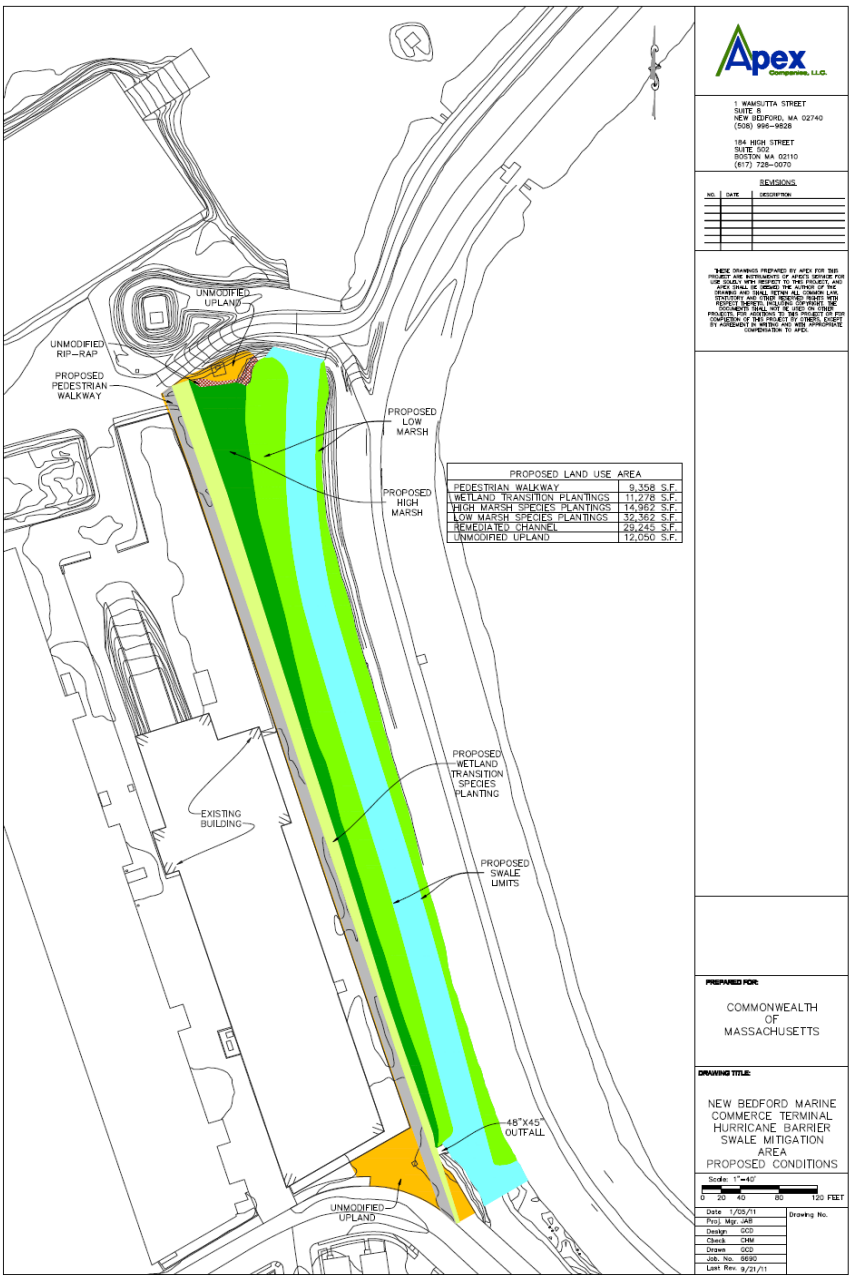


Figure 5 Hurricane Barrier Swale Mitigation Area Proposed Conditions



PROPOSED LAND USE AREA	
PEDESTRIAN WALKWAY	9,358 S.F.
WETLAND TRANSITION PLANTINGS	11,278 S.F.
HIGH MARSH SPECIES PLANTINGS	14,962 S.F.
LOW MARSH SPECIES PLANTINGS	32,362 S.F.
REMEDIATED CHANNEL	29,245 S.F.
UNMODIFIED UPLAND	12,050 S.F.

Apex Companies, LLC.

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(508) 996-9828

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REVISIONS

NO.	DATE	DESCRIPTION

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PREPARED FOR:

COMMONWEALTH OF MASSACHUSETTS

DRAWING TITLE:

NEW BEDFORD MARINE COMMERCE TERMINAL HURRICANE BARRIER SWALE MITIGATION AREA PROPOSED CONDITIONS

Scale: 1"=40'
0 20 40 80 120 FEET

Date: 1/05/11
Proj. Mgr. JAB
Design: GCD
Check: CHM
Drawn: GCD
Job. No. 8690
Last Rev. 9/21/11
Drawing No.